Investigating the potential for new media and new technologies in design and technology undergraduate education

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INVESTIGATING THE
POTENTIAL FOR NEW
MEDIA AND NEW
TECHNOLOGIES IN DESIGN
AND TECHNOLOGY
UNDERGRADUATE
EDUCATION

BY

Marian Hepburn

Doctoral Thesis

March 2012

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Abstract: Investigating Potential for New Media & New Technologies in Design & Technology Undergraduate Education

This research explores potential for New Media and New Technology (NM & NT) in the Design School at Loughborough University. Using action research to investigate potential, this research develops a new way of managing inquiry based on Susman and Evered’s five cycles of action research (Susman and Evered, 1978). In particular, it extends the “double-helix metaphor” (Dick, 2000) for action research. This new way of conducting action research looks at educational and IT-based aspects; in particular, developing strategies, guidelines and materials for implementing video podcasting (Vodcasting) and Really Simple Syndication (RSS) into Design School undergraduate modules.

In looking at potential, the research involved 6 lecturer’s interviews and thematic analysis. Findings suggest that limitations to the current uses of NM & NT related to lecturers’ lack of skills in NM & NT and scepticism about what the benefits might be. Some recognised potential for NM & NT to manage module administration. One lecturer wanted to stop students using dubious sources from the Internet for assessment on a Sustainable Design module. This led to using RSS to resolve this problem in a mobile learning scenario. In this research, 98 D and T students were surveyed to identify current uses of mobile technology. Results suggested that students would like module content streamed to their mobile device. Lecturers too could see benefits for NM & NT, if they stopped lecturers from having to repeat themselves to students. This led to using Vodcasting to resolve this problem in a mobile learning scenario.

Video observational data was collected from 6 students using RSS to perform mobile learning tasks for a Sustainable Design module. The findings suggested that the technology at the time of study was not quite up to the task, although some NM & NT learning resources relating to Sustainable Design were found by students using RSS. Similarly, video observation data was collected from 4 students using Vodcasts to design electronic circuits. Findings showed more technological competence with this technology and students suggested future modules where this type of NM & NT would have further educational potential. Through exploring potential, this research develops new strategies, guidelines and materials for design and technology educators. This research reveals the educational benefits of Vodcasting and RSS in labs and workshops, and concludes that there is potential for NM & NT in D and T education.


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Chapter 1: Introduction – Outline of Research

This chapter introduces the research, exploring the potential for new media and new technologies in design and technology undergraduate education at Loughborough University. It covers the research question and definitions, aims, objectives and limitations concluding with a thesis overview. It also explores the educational context and some of the benefits and challenges for this research.

1.0 Introduction to Research Problem

The problem definition; exciting new communication, learning and research tools, New Media and New Technologies (hereafter NM & NT) have yet to be fully exploited for undergraduate students’ studying design and technology (hereafter D and T), in the Design School (formerly the Department of Design and Technology) at Loughborough University. Examples of these new communication tools include mobile devices, computers and software. This research explores how to link NM & NT to D and T undergraduate education, and what the benefits of doing so may be.

Exploring the potential of NM & NT in D and T education has occurs within the fields of e-learning and m-learning (mobile learning). Challenges exist for assessing the potential of NM & NT to undergraduate D and T education, as many of the degree modules involve “learning-by-doing” (Kimbell, 2005); design workshop activities may not to be suited to NM & NT, or sitting in front of a computer. This research problem will be undertaken within the fields of information technology research and educational research.

1.1 Highlighting the Benefits/Challenges of Research

This section highlights the benefits and challenges for this research.

In looking at potential, this research problem looks for benefits for NM & NT in D and T undergraduate pedagogy. Pedagogy in universities involves the administration of learning resources through scheduled laboratory, workshop, lecture or tutorial times. Using NM & NT will require encouragement to change education habits for all stakeholders. In The Educator’s Manifesto (1999), McClintock asserts that digital technologies drastically alter what is pedagogically possible. This research aims to find out in what way.
1.1.1 Educational Benefits of New Media and New Technologies for Learning

JISC (2005), review innovative practice with e-learning in further and higher education within the UK, outlining three educational benefits of mobile and e-learning;

1. **Portability**: mobile devices can range in size, but generally are pocket-sized,

2. **Any time/any place connectivity**: as mobile devices enable flexible on-hand access to e-learning resources and;

3. **Immediacy of communication** through mobile phone or email leads to empowerment and more effective management of learners (especially in dispersed communities). However, these benefits are conditional to where there is connectivity.

JISC summarise the educational benefits in terms of:

- **Accessibility**: Education in a variety of modalities, such as sound files, is useful not just for visually-impaired learners, but to students with different learning styles;
- **Tools already in use**: Students are already using **NM & NT** for communicating; can they be exploited for design and technology education?
- **Added value to learning**: More learning resources available in different formats.
- **Enhanced learning**: The way students learn can potentially be improved.
- **Mobility**: Does not tie the student to the computer, can be used while on the move.

Describing the benefits of **NM & NT** for education allow for more effective research of new media, such as web resources, and general use of new technologies, such as Mp3/4 players. This research wanted to find further evidence for those educational benefits.

1.1.2 Challenges for Learning with New Media and New Technologies

To take advantage of the potential for **NM & NT** for learning offered by mobile devices, teaching needs to be redefined (Swan, Kratcoski, and van ‘t Hooft, 2007). However, imagine the implications of **NM & NT** for lecturers, who have a process for teaching modules already in place, which have taken years to refine and develop. Redefinition of teaching needs with digital technologies would require further Information Technology (IT) speciality, which not all lecturers will be comfortable with adopting, nor deem practical to their subject area.

Not only does it involve changing stakeholders educational habits, but lecturers face the prospect of recreating module content for virtual learning environments (and mobile devices)
and checking that learning outcomes can be obtained using specific types of \textit{NM & NT}; a daunting task indeed! Recent work in the Design School describes some of the difficulties for incorporating V.L.Es in the teaching and learning process, such as designing e-learning does not seem to save the module lecturer time (Denton, 2005). The virtual learning environment at Loughborough University is based on open source technology and is called Moodle (short for Modular Object – Oriented Dynamic Learning Environment). Loughborough University have a bespoke version of this which is called learn@lboro.

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<tr>
<th>EDUCATIONAL BENEFITS</th>
<th>EDUCATIONAL CHALLENGES</th>
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<tr>
<td>Portability</td>
<td>Change of teaching and learning practices</td>
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<tr>
<td>Immediacy of communication</td>
<td>Redevelopment of module material</td>
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<tr>
<td>Student satisfaction</td>
<td>Cost of technology</td>
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<tr>
<td>Lecturers save time</td>
<td>Time spent on development</td>
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<td>Enhanced learning</td>
<td>Technology- led learning</td>
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Table A: Perceived Educational Benefits and Challenges of New Media and New Technologies

Table A above clarifies the perceived benefits and challenges for \textit{NM & NT} in D and T undergraduate education. Despite the existence of challenges, the benefits for education are clear. Exploring the potential benefits for \textit{NM & NT} in various ways, it is hoped this will instigate a change in educational habits. It is envisaged that these changes can increase students’ learning abilities to design products which people will want. In particular, it is envisaged that developing a deeper understanding of \textit{NM & NT} will equip students with a set of skills required for industry, which is becoming ever more reliant on using \textit{NM & NT} for communication and work organisation.

1.2 Research Overview

\textit{This section sets out the aims of the research project exploring the use of \textit{NM & NT} in Design and Technology education at Loughborough University. This section introduces the research question and the research problem.}

The definition of "\textbf{New Media}" refers to any digital media objects with interactive features and which are digitally distributed. \textit{New media} encompasses the cultural practices that have arisen around Internet technologies, such as online chat rooms, Wikis, weblogs (or blogs), instant message chat, email and software and devices for communication. This research is
inspired by the way that \textit{NM} \& \textit{NT} has changed communication within society recently, and will explore students using it for their own learning development. Replicating this change in wider society in education is a challenge. However, this challenge is not impossible; Massachusetts Institute of Technology (MIT) offer 80\% of their modules online for anyone to view, in their Open Courseware Initiative (MIT, OCW, 2007).

1.2.1 Research Aims
The first aim of this research is to investigate the potential of \textit{NM} \& \textit{NT} for D and T undergraduate education. This research aim includes:

- Development of strategies for deploying \textit{NM} \& \textit{NT} for D and T education;
- Creation of multimedia learning resources available on new technologies;
- Furthering the field of e-learning and m-learning for D and T education;

The second research aim is to find out how exciting forms of \textit{NM} \& \textit{NT} could change education. A further aim of this research is to determine whether \textit{NM} \& \textit{NT} applications are usable for learning tasks on mobile devices. It has been argued that mobile devices may be suitable for students of D and T education as they may facilitate the project communication process required in design and make activities (Kimbell, 2005).

1.2.2 Research Objectives
A research objective is a goal or intended outcome from the research project. In order to fulfil the aim and research purpose, the following objectives and rationale for them within this research framework are identified:

\textbf{Objective 1: To engage with theoretical and methodological issues with investigating the potential for \textit{NM} \& \textit{NT} in D and T undergraduate education.}

\textbf{Objective 2: To devise an appropriate action research methodology for investigating potential for \textit{NM} \& \textit{NT} in D and T undergraduate education.}

The rationale for these two objectives; existing theories and methodologies need to be explored and developed to assist with initiating the appropriate research approach to answer the research question.
Objective 3: To investigate the different types and features of New Media & New Technologies, and whether they are useful for learning activities within Design and Technology undergraduate education.

This involves a classification of different types of NM & NT. The rationale for this objective is to explore the potential for particular types and features of NM & NT relative to the undergraduate modules they may be suited for.

Objective 4: To consider which activities in Design and Technology undergraduate education would benefit from the introduction of particular types of NM & NT.

The rationale for this objective is to derive stakeholder views on where NM & NT might be useful. It is envisaged that some modules may be more suited to using NM & NT than others.

Objective 5: To develop learning scenarios with NM & NT for educational purposes within Design and Technology education.

This objective develops learning scenarios; contexts of use for NM & NT. The rationale is that a tool would be useful for exploring potential for different types of NM & NT in Design and Technology education. Thus learning scenarios form a part of this research.

Objective 6: To investigate the potential of New Media and New Technologies, assessing the simplest, low cost and most efficient way to deliver NM & NT to stakeholders of Design and Technology undergraduate education.

This objective investigates current practices using NM & NT for learning within the Design School. The rationale for this objective is to establish the best way of delivering NM & NT to students.

Objective 7: To investigate new forms of learning with Design and Technology modules, through the delivery of NM & NT through mobile devices, mobile learning and elearning.

This objective involves a review of how communication practices within educational settings are different with NM & NT. This researcher aims to review implementing NM & NT into education. The rationale for this objective is that because the area of NM & NT is quite wide, the researcher needs to have some idea of existing functionality of NM & NT. This objective
includes keeping abreast of the latest developments in learning technologies, through M-learning and E-learning. Mobile learning refers to m-learning and e-learning can be distinguished as it is more through computer-based learning.

**Objective 8: To produce guidelines and a framework for disseminating best practice for NM & NT in D and T undergraduate education.**

Research evaluation should reveal guidelines to help understand how to implement NM & NT in D and T undergraduate education. Specifying a learning framework will assist with future investigations of potential for NM & NT in D and T undergraduate education.

**1.2.3 Research Question**

The overall purpose of this work is to sustain Loughborough University as a centre for excellence in D and T teaching, learning and education, with respect to D and T curriculum development and research at undergraduate level. Thus, the research question is:

*What potential exists for introducing New Media & New Technologies for learning to students of Design and Technology undergraduate education?*

Research questions become more particular as the research progresses. This research question gives rise to the following sub-questions;

- What kinds of NM & NT are available, (for Universities, Loughborough University and the Design School), and are particularly useful for teaching and learning?
- What kinds of learning and learning theories can be supported with NM & NT?
- What are student/lecturer’s level of knowledge of NM & NT?
- What are the students/lecturer perceptions of using their mobile devices for learning?
- How to teach students to make use of online tools for their D and T education;
- Can mobile devices help students as a tool for D and T education and communication?

**1.3 Particulars of Research**

*This section provides a brief overview of research methodology, research stakeholders and research deliverables.*
The previous section highlighted the research aims and objectives. The extent of the research problem which this research question is up against is highlighted by the following statement:

"The Web has become established, interface design has matured, and PC access has become widespread. The demands of technological change have hindered the theory and practices of its application, however. Learning technologies are unfamiliar and complex. Few of the current generation of academics have ever learned through technology, so practice develops slowly, and theory hardly at all." (Laurillard, 2002, xvi).

This research will try to find out whether this situation from this quote is still the case. Therefore, innovative situations where NM & NT might prove of benefit to undergraduate D and T education will need to be discovered, furthering the area of e-learning and m-learning. It may be the case that not all modules in Design and Technology will benefit the same from introducing mobile and wireless technologies. A methodology and methods are required to answer the research question and to explore the potential of NM & NT in D and T education.

1.3.1 Research Methodology: The Modular Double-Helix Metaphor in Action research

One of the problems with exploring potential is how to go about it, when to start or stop a particular research activity. Thus this author came up with a new way of investigating potential within university settings. This really helped the researcher with research progression, and formed the “Modularized Double-Helix Metaphor”, (or hereafter MDHM), for use within action research as a methodological approach. The use of the double helix is most famous in the world of science, where it represents the structure of DNA. It consists of two spirals intertwined together. Use of this symbol has been used as a metaphor for how to understand project organisation and research progression in action research by a number of different authors, in different ways (Dick, 2000; Hannon, 2004; Pete & Fregona, 2004 & Hughes, 2000).

However, crucial differences in the design in this use of this double helix symbol forms a new way of doing an action research project. This researcher combined Susman and Evereds’ canonical action research (i.e. use of the five cycles) with the double helix structure. Concern over the validity of findings from action research can seemingly be alleviated by repetition of these five cycles (Kock, MacQueen and Scott, 1997). Thus, the MDHM contains five cycles
in one spiral and the other spiral uses the five cycles at each stage for further decomposition of each of the five cycles.

Using MDHM as a research methodology has revealed some interesting findings on the potential for NM & NT in D and T education. Another reason for using MDHM is that there does not seem to be many research examples of NM & NT at university-level D and T education. Types of NM & NT and educational area was vast and quite wide, knowing the “who, where what and why” was difficult without some overarching structure. Chapters 1, 2 and 3 contain the first meta-cycle of MDHM, diagnosing, which identifies potential for NM & NT for learning generally. Within this meta-cycle, the following steps, as action research, have been undertaken:

1. **Diagnose research (1C1):** “What is the potential for NM & NT for D and T education?”
2. **Action Planning (1C2):** Identifying a research methodology to answer the research question.
3. **Action Taking (1C3):** A literature survey tool reviews potential for NM & NT for learning and confirms a research gap.
4. **Evaluation (1C3):** Literature survey summary of salient points in relation to potential for NM & NT generally.
5. **Specifying Learning (1C5):** involves knowledge building in the form of a model describing the situation under study.

Figure 1: Diagnosing Research Potential of New Media and New Technologies for Learning
Figure 1 describes Cycle 1 of the MDHM in action research. Further information is contained in Chapter 2. Using MDHM for action research created an exciting, new way to make sense of how “action” and “research” intertwine. It was useful for this researcher to help make decisions about when to move from one part of the research to another (see Chapter 2 “Research Methodology”, Section 2.7.3 below).

1.3.2 Research Stakeholders

Research does not assume that roles, either teacher, or researcher or student are separate and distinguishable (Ehiyazaryan, 2008). The researcher rationale for choosing action research - (see Research Methodology, Chapter 2) - is that it can take into consideration the differing roles of the researcher as new media user, researcher and educator, in a self-reflexive way. This allows the researcher to make explicit the biases, assumptions and concerns upon which research decisions are made. These judgements guide the research process and contribute new knowledge within the area of design and technology education research generally.

Thus the stakeholders in this project are envisaged as:

1. **This researcher:** (the practitioner researching this field and writing this thesis);
2. **The client system:** (i.e. the Design School and Loughborough University);
3. **Lecturers and students:** benefiting from investigating the potential for new media and new technologies in design and technology undergraduate education.

1.3.3 Research Deliverables

Kimbell, Saxton and Miller (no date) identified the ways in which design-based education may benefit from *NM & NT*. They identify ways in which design and technology education are changing. They suggest design training in the new university context is moving to more computer-based design, possibly due to the growth of student numbers over the last decade. Many informal meetings with D and T staff, students and outside stakeholders took place to find out about the potential for *NM & NT* in D and T education. Other research activities conducted include creating learning resource templates and the following data was also collected:

- 6 lecturers interviewed;
- 97 students surveyed;
- Video Observation Data: 6 students video - recorded using *NM & NT*;
- Vodcasts for learning created through Camtasia®;
- Video Observation Data: 4 students trialled with Vodcasts with mobile devices;
- Really Simple Syndication (RSS) for m-learning of Sustainable Design module. (RSS is a way for students and lecturers to keep track of websites which change their content and thus useful to lecturers and students);
- M-learning resources developed for Electronics component of a module;
- User guides/ module developments for staff and;
- Research dissemination through conference and journal papers.

There was a design component involved in creating videos; this researcher learnt best practice used to design small video learning objects to review with students.

The deliverables are to develop approaches for D and T education to using NM & NT. This will be in a way which might help all stakeholders in their learning, research and design activities. Research outcomes of this research are thus:
1. Findings on how competent design and technology students are using NM & NT and;
2. Findings on the potential of using NM & NT in D and T education, in terms of matching differing module learning outcomes to different NM & NT;
3. Strategies, recommendations and guidance on how to use NM & NT in future in design and technology education.

1.4 Area of New Knowledge

This section on justification for this action research project identifies where the research gap is, and why the particular topic was of interest to the researcher.

The research explores the uses of NM & NT to support informal learning through the use of mobile devices for on-hand learning, any time of the day suitable to different contexts of the stakeholders. Accessing the Internet from a small screen has disadvantages but also educational benefits, as highlighted in Table A above. The Mobile Data Organisation (2007) recently reported that 65% of mobile phone users had accessed the Internet via their mobile device. This is a high proportion of the UK mobile phone users and will have future effects on how people research information using the World Wide Web. This research provides new knowledge in the area of m-learning within a wider elearning framework.
This area of new knowledge relates specifically to the context of the Design School within wider society. As we move from production-based economy to a knowledge economy (Kimbell and Perry, 2001), any module materials on Design and Technology need to keep up with the latest NM & NT which will be used in industry. In particular, due to the nature of design education occurring often in workshops or studios, use of mobile and other “back-pocket technologies”, (Kimbell, 2005), have been useful for education. However, at the time of writing, little or no research exists on how to devise lecturer/student learning scenarios explaining HOW to integrate NM & NT into D and T higher education, despite the widespread adoption of NM & NT in wider society.

This research will open up areas of new knowledge; as noted, as there does not seem to be many research examples of NM & NT at university-level D and T education. The existing literature in relation to NM & NT, D and T education, design education, and technology education, will be reviewed to find areas of knowledge which might be relevant to this research, (see Chapter 3, Literature Review). The literature review provides an overview on the different types and appropriate uses of NM & NT, and how it could be embedded within design-based modules and programmes of study.

1.5 Motivations for this work

Motivations for this work and why this research topic was of interest will be explained.

The proliferation of new media, through social networking websites, such as Facebook and Myspace, has opened up new modes of communication for students (Selwyn, 2009). Many students arrive at the Design School with considerable skills in using NM & NT, known as “digital literacy” (Prensky, 2001). This enthusiasm for using new media is also true for new technologies, such as mobile phones (Haste, Mori Poll, 2005). However, this enthusiasm does not appear to be fully exploited by the styles of teaching to which they are exposed. The lack of enthusiasm may reflect a gap, not only between the skills and expectations of lecturers, and students but in the particular subject area, D and T education.

The rationale for this thesis is to explore and address some of these gaps in order to find the best way to incorporate NM & NT into D and T education, in a way that fits with the lecturers’ and students’ skills and habits. This research was motivated by a desire to help D
and T students, and lecturers develop better habits of teaching, learning, recording and observing using the latest in Information and Communications Technologies, including mobile technology.

1.6 The Educational Context for This Research

This section explores the educational context for this research. This section highlights the standards which every programme, module, and session has to adhere to within Universities in the United Kingdom.

1.6.1 What is Education? Generic Standards for Learning in Universities

The research aim was to find out how exciting forms of NM & NT could change education, and engage all the stakeholders in the learning process. By “learning process”, it is generally assumed that a lecturer/teacher will scaffold the student to achieve LEARNING OUTCOMES. These learning outcomes apply differently at degree levels (1, 2, 3, 4 and 5), attaching to their corresponding year of study. These learning outcomes work across the following:

1. Degree Programmes: The overall learning outcomes for any programme of study should identify the learning achievable by a student. They should be written in the context of the appropriate national subject benchmark statements produced by the Quality Assurance Agency. The learning outcomes for a programme should therefore follow those as defined in the appropriate subject benchmark statements.

2. Modules: A programme will consist of modules. Learning outcomes for a module should be written to identify the learning achievable by a student. They should be written in the context of the assigned level of the module, and should demonstrate that there is general progression within a programme from one level to the next. Taken together, the learning outcomes for all of the modules available within a programme should reflect the outcomes for that programme as a whole.

3. Session: A session is a period of time where supported learning takes place and could include lecture, tutorial, workshop and/or practical within a particular module.

1.6.2 The Language of “Learning Outcomes”

A learning outcome is a student centred learning goal which can occur at module and session level. At module level, the way in which learning outcomes are measured and reviewed is through module assessment. An assessment driven model of education is therefore, one
which the student can see. This method of learning has benefits, but also drawbacks, such as it does not propose a “lifelong learning” paradigm to learning. The way the learning outcomes are written calls on students to demonstrate on the knowledge, comprehension, application, analysis, synthesis and evaluation of the appropriate topic. The way in which learning outcomes are achieved at module level, is through student assessment. Investigating the potential for NM & NT takes into account the learning outcomes, when designing appropriate technology into the D and T curriculum.

1.6.3 Programmes and Standards for "D and T Undergraduate Education"

This section will explore D and T education, as it applies in the Design School, Loughborough University. The educational degrees offered relate to the Subject Benchmarks across the disciplines of Art and Design as well as Engineering (see the QAA website for these three Benchmark Statements). These benchmarks are a reference point from which outcomes can be measured. Developed by the Quality Assurance Agency (QAA) for Higher Education, these benchmarks generally apply to Bachelors with Honours programmes within Higher Education. There are different levels of subject benchmarks, depending on which year the student is in; findings from this research will strive to match the different types and appropriate uses of NM & NT to the different levels.

At Loughborough University, there are two undergraduate degree programmes at the Design School; BA (Hons) Industrial Design and Technology and BSc (Hons) Product Design and Technology. These programmes have recently been awarded Certificates of Accreditation to the Institute of Engineering Designers, and the BSc (Hons) Product Design and Technology has met academic standards for Incorporated Engineers, registered with the UK Engineering Council. Also for 2007/2008 there were the following MDes/MA/ MSc modules offered within the Design School; Sustainable Product Design, Industrial Design, User Centred Product Design and Virtual Product Design. A current review of teaching methods within these programmes indicate that they are:

- Workshop-based
- Lectures
- Design simulations through computer software
- Group-work and;
- Individual study.
To conclude, all programmes of study in D and T must be created following subject benchmarks for Art, Design and Engineering derived from the Quality Assurance Agency. If a programme changes significantly over a certain percentage a revalidation of the programme must occur to ensure the changes do not conflict with the subject benchmarks or programmes aims. This must be a consideration when embarking on any action research project in education. The role that NM & NT could play in assisting students to attain their learning outcomes is evaluated.

1.7 Research Definitions: New Media and New Technologies

*In this section the research definitions, new media and new technologies, are explored.*

The research question is to find out potential for NM & NT in D and T undergraduate education. This section looks in-depth at the research definitions in this project.

1.7.1 Exploring New Media and New Technologies

This section will define *New Media* and explore the term. This section will also provide a brief overview of what is meant by new technologies, in relation to this thesis. It is argued that *New Media* has had revolutionary effects on information, education and communication. As early as 1963, the concept of “New Media” in higher education was being explored (James and Thornton, 1963). But, the concept of *New Media* takes on a different meaning in society today. At its most basic level, the definition of *New Media* refers to any digital media objects with interactive features and which are digitally distributed.

1.7.2 New Advances in New Media

*New Media* also encompasses the cultural practices that have arisen around Internet technologies, such as online chat rooms, Wikis, weblogs (or blogs), instant message chat, email and software and devices for communication. So, *New Media* is not only a collection of devices and software, but it also relates to the cultural habits which have arisen around their operation and use. Lievrouw and Livingstone (2002) define *New Media* in three ways; focussing on technological devices, the communicative practices with those devices, and the social contexts and institutional practices of their use.
There is much associated terminology with New Media. For example, the term "social software" is synonymous with the term New Media. The term encompasses computer programs, which enable people to rendezvous (virtually), connect, communicate or collaborate through computers. The tools are “instant messaging”, weblogs (or blogs), forums, wikis and file-sharing software.

New Media are typically accessed on computers. But increasingly, small handheld devices such as mobile phones and PDAs are being used to access New Media (Trindler, MacGill and Roy, 2005); but not without problems. The use of mobile devices for learning is being developed rapidly all the time (e.g. see websites such as www.handheld-learning.co.uk, which aim to deliver educational content via handheld devices, and the work of Nesta Futurelab, who have been researching introducing handhelds into the school classrooms of the UK).

1.7.3 New Technologies

New Technologies in a learning context are defined often by their ability to access new media to provide learning resources. The new technologies used to access New Media include:

- Mobile phones/ Personal Digital Assistants (PDAs);
- iPods®/ MP3/MP4 players;
- Tablet PCs such as the iPad®;
- Laptops/ desktop computers;
- Software;
- Information and Communications Technologies, (ICTs).

There have been significant developments in NM & NT, particularly in relation to Internet and gaming technologies which could hold potential for D and T undergraduate education. It must be noted that what constitutes NM & NT may change very rapidly.

1.8 Limitation of Research Scope

This section provides a limitation of scope, and sets out the boundaries of this potentially wide area for research.

The research developed into looking at NM & NT, as the original problem definition looked into mobile devices for learning. Developing many scenarios for their use, the aim was to tie
them to latest theories and methodologies for exploring potential on NM & NT. Investigating how they could be applied to the Design School in Loughborough University, allowed this researcher to narrow down the learning scenarios based on data on D and T lecturer goals and students’ learning.

1.9 Thesis Structure

This section provides an overview of the structure of this thesis, and pointers as to what can be found in the various chapters of this thesis.

The structure of the thesis is as follows; it is divided into 12 chapters exploring the potential of NM & NT for learning within D and T education, Loughborough University.

Chapter 2 explains the research methodology used to explore the potential for NM & NT within D and T education. This chapter will justify the approach adopted to answer the research questions and achieve the objectives outlined in Chapter 1.

Chapter 3 is the literature review and is in 3 parts. Part 1 explores Objectives 1 and 2, conducting theoretical and methodological review in this area. Part 2 contains a literature review identifying features of NM & NT. Part 3 diagnoses potential on what is known.

Chapter 4 reveals findings from six interviews with lecturers from the Design School. Lecturer interviews revealed some requirements which NM & NT should support in relation to learning. It also gave an indication of lecturer familiarity with using NM & NT for learning.

Chapter 5 describes results from 100 student questionnaires identifying features of NM & NT they are familiar using. Student questionnaires revealed further requirements which NM & NT should support in relation to learning.

Chapter 6 reviews all the data collected and develops learning scenarios from the data presented, it then moves to describe the major action-taking stage for this research. Thus this chapter proposes solutions or “learning scenarios” with NM & NT to the problems identified in the diagnosis stage of this research.
Chapter 7 reviews current use of NM & NT by the Design School, Loughborough University. It performs an ICT/ Media Analysis to identify core components of NM & NT, to further investigate detail of delivering “learning scenarios”. It describes pilot developments.

Chapter 8 initiates “action”, looking at how RSS could be used on a D and T module.

Chapter 9 reveals findings on the use of Vodcasting for students learning design and technology subjects. The word Vodcasting refers to the broadcasting of video-on demand. Vodcasting is the dissemination of small videos accessible on a computer but also a mobile device.

Chapter 10 evaluates the research. This chapter assesses the results from Diagnosing, Action – Planning and Action – Taking, and reviews educational benefits of RSS and Vodcasts.

Chapter 11 identifies and specifies learning scenarios using the model for investigating the potential for NM & NT in D and T education. It answers the research question, discusses the outcomes of this research and what was learnt from this approach.

Chapter 12 concludes the research into the potential for NM & NT in D and T undergraduate education.

1.10 Summary and Conclusion

This section summarises this research and concludes on the content of this chapter; - to introduce the readers to the research conducted in this thesis.

This chapter provided motivation and purpose for this research; to further m-learning to improve undergraduate education. Motivated by a keen interest to learn how to teach stakeholders about NM & NT so they can use them as tools for education, as well as communication, it is envisaged that introducing them to NM & NT will help them design better products. But first the potential of NM & NT in D and T education needs to be investigated. It is envisaged that these students will be “digital natives” (Prensky: 2001, p.1), in so far as they are used to the new types of learning experience - (elearning and m-learning)- with the use of NM & NT. Exciting new types of NM & NT are available to design
and technology students at Loughborough University. This thesis attempts to explore what they are and how they can be used. The next chapter identifies the appropriate research methodology for answering the research questions, and completing the research objectives.
Chapter 2: Research Methodology and Methods

2.0 Introducing the Research Methodology

This chapter reviews research methodologies and shows why action research is most suitable. It introduces the “Modular Double-Helix Metaphor” used to guide the action research process. This new approach for action research is a useful finding for future action research projects.

The previous chapter identified the research question, aims and objectives of this research. This chapter reviews different research methodologies and identifies the methods used to achieve the research objectives in this research. Methodology is the principles upon which one selects research methods. Thus, this chapter selects an appropriate methodology to answer the research questions. The next section examines all of the different research methodologies available.

2.1 Methodology in Research

Research methodology should provide theory and methods for how to answer the research question.

Methodology is distinguished from method in that it is the study of method, and the reasons underlying the approach used in the research. To distinguish, methods are, on the other hand, the techniques and tools by which research information is gathered.

2.1.1 Different Methodologies

A brief overview of the different methodologies will be provided in this research (contained in Appendix I: Research Methodology and Methods: A Literature Review). The variety of methodologies and methods, and whether they are quantitative or qualitative have been explored. This Appendix goes into more detail concerning the different methodologies:

- Scientific Research
- Social Sciences Research
- Practice-Based Research
- Design Research
• **Action Research**

There are a variety of different methodologies to answer a research question. The variety of methodologies relate to different theories about the nature of research knowledge which will answer the research question. An investigation of the different research and education theories are contained in **Appendix II: Theoretical Investigations**.

2.1.2 **Reviewing Appropriate Methodologies against Research Objectives**

The research objectives overall try to map *NM & NT* with D and T learner goals. Scientific method relies on theories of cognition and behaviour. The scientific method and performing experiments cannot be relevant where this research question is related to exploring the potential in an organisation. Also, there is no ability to control variables.

Practice- based methodology does not have a clear structure for action in a research project. The social sciences method is a more observational and **does not apply** the findings of the data as neatly as action research in an organisational context. It would appear action research can help with engaging with stakeholders and introducing some *NM & NT* in D and T education. It uses mostly qualitative methods to try out changes in organisational settings. Also it can provide a more holistic account of how to implement change within organisations, taking into account all factors.

2.1.3 **Justification for Adopting Action Research**

After developing a research question which looks at potential for *NM & NT* in D and T education, a flexible research design was deemed necessary to answer this research question. Trying out some *NM & NT* in D and T education was also an aim. Appendix I and II conducts a literature review which weighs up the pros and cons of using different methodologies and different theories. **Action Research has been shown to be most suitable for exploring this potential, as it can fulfil the aims.** Action research has typically been used in educational research. This chapter will identify the form it takes for the purposes of this research. It describes the development of a new way of conducting action research using the “*Modular Double-Helix Metaphor*” to guide the progress of this action research project.

In other methodologies, the research findings themselves may be wide, and it will be difficult to see how to apply those findings. Action research can include a number of research
methods, - (of a qualitative and quantitative nature)- undertaken by people in social situations in order to improve the social or educational practices, as well as understanding of these practices and the situations in which these practices are carried out, (Carr & Kemmis, 1988, p.3). Thus, action research is research which pursues two goals; action or change, and research. It is the focus on producing research which helps make decisions about appropriate courses of action which gives action research its’ strength. This section has looked at the rationale for action research methodology. The next stage investigates this action research methodology further.

2.2 Adopting a Research Methodology: Action Research

Section 2.2 justifies why action research was chosen for this research. It also defines action research, shows how it works and explores the different types.

The research objectives in Chapter 1 will be achieved by action research. The term action research was created in the United States by the social psychologist Kurt Lewin (1947). As a new methodology for this researcher, much in-depth review of the literature was performed. This is contained in Appendix I where it was possible to go into more detail regarding:

- Action Research Benefits As a Change Methodology
- Action Research in Use: Previous Examples
- Different Types of Action Research, canonical, diagnostic, emancipatory
- Distinguishing Action Research from Case Study Research
- Similarities between Design Research and Action Research

Action research was created because it could be used to simultaneously achieve advances in theory and much needed social change.

2.2.1 Defining Action Research

Carr and Kemmis define action research as... “simply a form of self-reflective enquiry undertaken in order to improve the rationality and justice of their own practices, their understanding of these practices and the situations in which the practices are carried out” (Carr and Kemmis, 1986, p. 162). Using an action research framework to explore the potential of NM & NT for undergraduate D and T education has resulted in the development of a new methodological approach to answer the research question. This uses a mixed method approach.
2.2.2 Rationale for Action Research
The ever-changing aspects of this subject area, NM & NT for learning, make action research the perfect methodology to take into consideration these changes. It is known as a “change” methodology. This is due in part to the cyclical process; this also allows the researcher to take into consideration new technology in D and T education, and how it integrates with the context; with management processes of the institute and academic Schools, the design and development of the teaching materials, and the students’ management of their own learning.

2.2.3 Action Research in Use: Previous Examples
Looking at how other action research projects have incorporated the differing types of action research has been invaluable to this research. This section takes a look at relevant examples of action research in the field of NM & NT (Baskerville, 1999; Hearn & Foth, 2004; Taachi, Slater & Hearn, 2006). Action research is a way of imagining how change can occur with an action research project.

To imagine this change, Hearn and Foth, (2004) advocate the use of action research in the design of new media resources and ICT applications to overcome problems. Action research is research on one’s own practices and thus upsets the researcher/researched dichotomy. The authors (ibid) argue that the action research process is adopted either to design or to evaluate aspects of new technology. The methodological approach thus focuses on actual practices of use and interaction with new media technologies in the wider context of people’s lives; dubbed the primacy of “respondent phenomenology”.

To conclude; this project is action research through diagnosing the research problem, as untapped potential for NM & NT in D and T education, and seeks to find solutions (through learning scenarios).

2.3 Validity and Ethics in Action Research
*This section explores what makes action research possess research validity and its relationship to research ethics.*
Firstly, by being completely co-operative, action research takes away the agency of the researcher, whom (it is assumed) has the domain knowledge in the field. Secondly, in being responsive, there is a worry that this type of action research blurs the boundary between research and “work”.

These research findings strive for validity in their ability to be generalised to new situations. Derntl and Motschnig-Pitrik (2004), argue that their action research findings can allow for a generalisation of results, through abstracting patterns of teaching/learning activities, organising them into a reusable, conceptual framework. The authors develop a five layer blended learning system where scenarios form the second stage of their methodology. Thus in terms of validity, action research appears as research rigorous as any other methodology. This is so long as it conforms to ethics, in relation to guidelines for research.

2.4 Action Research Theory

This section investigates how theory and action research intertwine, and what value action research can derive from theory and vice versa.

Action research theoretical starting point is better equipped to answer the research question on the potential for NM & NT. In this research, theoretical advances in the area of NM & NT for D and T education develop, while simultaneously impacting on the advance of NM & NT in D and T education. Theories of learning can be broadly classified in terms of;

1. **Positivist/ scientific:** The only valid knowledge which can exist is derived from affirming theories through scientific methods, which seek to predict and control the outcomes of a study in order to make claims; for example, concerning a hypothesis about learning technology which can be generalised to wider society and;

2. **Phenomenological/ humanistic:** The only valid knowledge which can exist focuses on personal/social values usually from a first person point of view.

In order to better understand the action research approach to methodology, the theoretical underpinnings of this approach will be explored.

2.4.1 Action Research’s Theoretical Start Point

As this research uses the five cycle framework posited by Susman and Evered, (1978), their theoretical review will be looked at. The authors wrote ‘An Assessment of the Scientific
Merits of Action Research’ in 1978, facing dissatisfaction with claims from positivist science. They suggest that positivist approaches to science - (an approach that assumes that the goal of knowledge is simply to describe the stable realities that are directly observable and measurable through scientific enquiry) - are deficient in their capacity to generate knowledge that would allow members of organizations to solve their problems.

Susman and Evered’s article (1978), more thoroughly explores the positivist deficiencies of action research; asserting that the criteria for judging the scientific legitimacy for action research should be based on its philosophical foundations (see Appendix II for a fuller insight into theory and action research). Thus they refute positivism in favour of more phenomenological approaches in how action research projects should be conducted. Phenomenological approaches will be used in this research. A social constructivist account of the potential for NM & NT, can consider all of the stakeholders’ perspectives in this research. For a more detailed account of how this research concluded on these theories, please refer to Appendix II below.

2.4.2 The Role of Theory in Self- Reflexive Action Research
As Figure 2 below suggests, theory affects many tenets of the action research process, perhaps most fundamentally in assuming that researchers have a right to orchestrate change in the client system. Academic theory and how it informs research methods in D and T education can be a black box to practitioners, who rely on their own experiential learning to in turn, help students to learn.

Figure 2: How Theory Relates to an Action Research Project
Drawing on different theories at different times draws on postmodern theory in the research design (Whitehead, 2005; Stringer, 2007; and Constas, 1998). Postmodern action research differs from other forms of action research in its political aims, methodological practices, and representational styles (Constas, 1998). This is, for example, through the ways in which the research agenda kept changing according to stakeholder’s differing views. A theoretical review was conducted. It concluded that this research is socio-constructivist as it considers how social knowledge develops in a social (in particular educational) context, depending on the decisions of all stakeholders. This theory influenced the development of a methodology for exploring the potential for NM & NT in D and T education through action research. The next section explains this canonical action research, by Susman and Evered (ibid), adopted as a way of structuring this research.

2.5 Research Methodology Design

This section explains the design of the action research methodology, which uses Susman and Evered’s five cycles of action research for structuring this research project.

Action research uses research collected through data collection methods, such as interview, to inform action. Often it can be difficult to know when it is appropriate to stop collecting data and start performing action. Thus a blueprint for how the research should proceed will help make this decision. This research uses the five cycles for action research created by Susman and Evered (ibid) to guide the research progress.

2.5.1 Introducing Susman and Evered Five Cycles of Action Research

This research maps out an action research project using a five-phase, cyclical process (Susman & Evered, 1978). The method first creates a client-system infrastructure or appropriate research environment. Then, five identifiable phases are iterated:

1. **Diagnosing**: improvement opportunity/ general problem in the client organisation;
2. **Action planning**: consideration of *alternative courses of action* required for the improvement or to solve the problem identified;
3. **Action taking**: selection and *realisation* of one of the courses of action identified in the previous stage;
4. **Evaluating**: study of the *outcomes* of the selected course of action and;
**2.5.2 How Do The Five Cycles in Action Research Work in Practice?**

Baskerville, (1999), describes the operation of the five cycles above in a paper developed as a tutorial for information systems action research. Using the five points above the researcher defines **diagnosing** as developing a working hypothesis or theory as to why the organisation requires change and the primary problems which have given rise to the need for that change. **Action planning** can involve the researchers and practitioners in planning actions to meet some desired future state. **Action taking** implements the desired change. **Evaluation** is where the practitioners and researcher evaluate the outcomes, and assess whether the theoretical work developed at the diagnosing stage have been achieved. Baskerville notes that while **specifying learning** occurs as a last stage it is an ongoing process with three outcomes to it.

- The restructuring of organisational norms derived from the research to feedback to the organisation (Baskerville calls this “double-loop learning”)
- Specifying learning where the intervention was unsuccessful, to inform the next intervention
• Identifying whether the success or failure of the theoretical model provides valuable insights to future research in the particular field

This research adopts the five cycles of action research as its methodology to explore the potential for NM & NT in D and T undergraduate education.

2.5.3 Extending Susman and Evereds’ Research Model

This research looked to extending Susman and Evered’s five cycles above, developing the “Modular Double- Helix Metaphor” (or MDHM) in action research. Difficulties in assessing when the diagnosis stage was finished, was cured by using this new type of action research. The MDHM allowed for a series of the five cycles within each individual cycle, as one large meta-cycle. This allowed the researcher to know when to move on to a next stage of action or research, and links all the sections together to investigate that potential for NM & NT. It thus extends further Susman and Evereds’ five cycles in an action research framework. The next section will explore this extended action research approach further.

2.6 Developing the Double Helix Metaphor in an Action Research Framework

There were certain benefits to adopting the MDHM in action research. This section briefly explores these benefits.

The Susman and Evered model in Figure 3 above would have been enough had this research explored a clearly defined single piece of technology within an institutional setting. However, because the area of NM & NT was so large, and “investigating potential” was a wide remit in itself, the five cycles seemed too simplistic. Thus using the MDHM allowed a certain degree of flexibility AND guidance at the same time, where other models of research proved too vague or inflexible.

The nature of action research possessing two strands – action and research – can mean that it is difficult to make judgements on when it is appropriate to deploy both. Previous action researchers have used the MDHM to help structure their research. This section will look at:

• Extending the 5 cycles canonical action research through the double helix metaphor
  • Previous examples of action research using the double helix metaphor
• Benefits of using the MDHM in this research

However, this research extends the metaphor by being very different from the versions presented by the authors below.

2.6.1 Introducing the MDHM to Guide Action Research

The double helix metaphor was originally developed into an action research approach by action researcher Dick, (2000) originally. The difference between the double helix metaphor proposed by Dick and this one is the way the metaphor used in this research produced a clear overview of the research process, step-by-step. Thus a modular methodological architecture forms a research finding from this work. This is a metaphor for how the action research project progressed and shows two spirals which interlock each other - characteristic of a double helix.

The metaphor of the double helix architecture is a useful tool to understanding the process of managing enquiry in action research. The notion of a big spiral describing, for example, diagnosing at a macro level is one spiral. Then within each of these “metacycles”, the five cycles are carried out at a micro level, but achieving the particular metacycle outcome, such as diagnosing the research problem. The MDHM used in this research clearly defined the areas of research focussed upon. (Please refer to Figure 5, section 2.7 below for a diagram of what this architecture looks like).

The benefits of having two interlocking spirals allow the research to develop along a trajectory of action and research. The meta-cycle (spiral 1) contains the five individual cycles, which guide the research as a whole to completion stage. The repetition of the five stages-(spiral 2) - within each major node allow decisions to flow based on a decision-making structure. This is a novel topology for the management of inquiry in action research. It allows each finding from the 5 stage research cycle to inform the future directions of the research.

2.6.2 Previous Research Examples of the Double Helix Metaphor

The double helix metaphor in action research is not a completely new approach (Pete and Fregona, 2004; Hannon, 2004; Hughes, 2000; Dick, 2000). Hughes (2000) also uses the notion of a double helix metaphor to describe working as part of a team and having individual
reflection to guide the research. Hannon (2004) in *Quality Management in Education* shows how the metaphor of the double helix was a useful research methodology for teaching science and the promotion of disability awareness within her curriculum. Figure 4 below shows how Hannon used the double helix metaphor to inform a visual representation of her action research project.

One of the central ideas of any action research project is first to understand an issue, and then to think about how to change it. As Hearn and Foth (2004) note, action research can incorporate any method, oscillating between generating knowledge and understanding, and reflexive consideration of findings. They point out the value of the helix metaphor in this recursive process, working towards reaching ever deeper understandings in the research process.

![Figure 4: The Double Helix Metaphor: Hannon, D. 1996, (p56).](image)
2.6.3 Benefits of the MDHM for this Research
This section will identify why this metaphor was adopted. The benefits of the modular double helix model are that they provided a structure and a clear framework within which to make decisions about the appropriateness of NM & NT for D and T education. The MDHM allowed for complex theories, data and new technologies to intertwine as it represents the two recurring cyclical strands of this work. This clear overview helped in making informed decisions on the basis of new information from all stakeholders’ viewpoints and competencies, technological developments and learning theories. There were certain benefits to adopting this metaphor.

1. Beneficially Accommodated the Subject Area: This metaphor was better than the other approaches, it provided a clear way forward where the research question was broad and vague; i.e., to investigate the potential for new media and new technologies in design and technology education.

2. Provided a Clear Academic Framework: The metaphor tied the research question to the aim of this research;

3. Extendable and Open- Ended: This MDHM could be used on a variety of different levels.

4. Recursive and thus Reflexive: One can go over previous steps undertaken to inform research at different stages.

One of the critiques levied at action research is its lack of structure (Kock, Macqueen and Scott, 1997), so the benefits for helping understand this researchers’ own decision structure over a three year project were invaluable.

2.7 Fundamentals of the Modular Double- Helix Metaphor

This section will highlight the fundamentals of the double helix m, and thus why it is particularly suited to this research.

This research seeks to extend the double helix metaphor by Pete and Fregona (2004), who use the metaphor to explain the dynamic process of action research. The five cycles are completed within a cycle – (a cycle within a cycle) - in the research which follows the double helix shape. So at each individual Cycle phase for example, diagnosing, the five stage process was adopted to help make decisions about what would be appropriate. This metaphor has the
possibility to develop towards a new methodology for tackling the research questions on potential in action research. The MDHM was really useful for research structure, allowing the research to progress organically.

Thus, the spiral made out the small components feeding into the main five describes the way in which the research project progressed. The features of the metaphor are:
1. Follows the five stage model for action research in a cyclical way, this helps develop a more reflexive approach to how one does research.
2. Provides an understanding of how the research progressed within a metaphor– like framework
3. Shows a direction took in the research and why – note this direction is NOT linear but recursive.

The full diagram of this new research methodology is contained below.

This research model combines the double helix metaphor used by Hannon (1996), Hughes (2000) and Dick (2000) with the notion that multiple iterations of Susman and Evered’s five cycles will create more valid research (Kock, MacQueen & Scott, 1997). In an investigation of action research in information science conducted by the authors, they highlight how Action Research becomes more “positivist” - (and thus more research rigorous, they argue) - through multiple iterations of the action research five cycles proposed by Susman and Evered, The authors argue that scientific advancement through iterations can lead the researcher to gradually broaden the research, adding generality to the research findings. Thus the architecture of this research model takes into account these seminal pieces of research, and forges a new way of conduction an action research project. Figure 5 below provides a graphical representation of the MDHM. Where you are implementing a NEW technology, evaluation is very important as you go along.
Figure 5: The Modular Double-Helix Metaphor for Action Research

Looking at the detail of delivery of learning scenarios in D and T

3C1: DIAGNOSE: How to Implement Learning Scenarios

3C2: ACTION PLANNING: Pilot Learning Scenarios

3C3: ACTION TAKING: RSS & Vodcasting for D and T Education

3C4: EVALUATE 3C3: NM & NT Learning Scenarios in D and T Education

3C5: SPECIFY LEARNING: Future directions for RSS and Vodcasting

5C1: DIAGNOSE future directions for NM & NT in D and T education

5C2: ACTION PLAN: Future scenarios for NM & NT in D and T modules

5C3: ACTION TAKE: Toward a framework for NM & NT in D and T education

5C4: EVALUATION of framework for NM & NT in D and T education

5C5: SPECIFY LEARNING potential for NM & NT in D and T education

Chapter 1: Introduction

Chapter 2: Methodology

Chapter 3: Literature Survey

Chapter 4: Lecturer Interview

Chapter 5: Student Survey

Chapter 6: Learning Scenarios

Chapter 7: Scope Learning Scenarios

Chapter 8: RSS for D and T Education

Chapter 9: Vodcasts in D & T

Chapter 10: Evaluation

Chapter 11: Specify Learning

Links Potential to Specific Design and Technology Education Issues

Analysis of Research Results

4C1: DIAGNOSE: Evaluation strategy for research

4C2: ACTION PLANNING: future direction for learning scenarios

4C3: ACTION TAKING: Revise Evaluation into Guidelines

4C4: EVALUATE NM & NT potential in Design & Technology education

4C5: SPECIFY LEARNING what would have been done differently and why

Potential for NM & NT for learning generally
2.8 Towards a New Research Approach: The MDHM in Action Research

*The purpose of this section is to demonstrate the intertwining of the MDHM and research methods to demonstrate how they operate.*

This research has seen the utility on focussing on the 5 stages of action research by Susman and Evered (ibid). This meta-narrative is useful for describing how the methods utilised fit together to create an action research project within the 5 cycles of action research. Each data collection method was selected on the basis of what point in the cyclical process the research was at. Exploring the potential for *NM & NT* takes place through mixed methods approach. An action research project often follows a recursive, cyclical spiral pattern of the five points in the diagram above (Baskerville, 1999).

2.9 An Overview of Methods in this Project

*This section describes the mixed methods adopted in this research and rationale for them. These methods were selected on the basis of what this researcher needed to know next.*

The previous section describes the structure of the thesis in terms of chapters. Some of the chapters specifically relate to the types of research methods adopted. This section will identify further those methods and the rationale for employing them. Mixed methods were adopted to gain insight into the research problem and are listed below:

<table>
<thead>
<tr>
<th>Method</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature Review</td>
<td>To address research gap and diagnose potential for <em>NM &amp; NT</em></td>
</tr>
<tr>
<td>Interview</td>
<td>To find out what lecturers think about <em>NM &amp; NT</em> for learning</td>
</tr>
<tr>
<td>Survey and Pre/Post-Task Questionnaire</td>
<td>Data can be gathered from a large sample on a range of research <em>NM &amp; NT</em> for learning issues. These and interviews help to action plan!</td>
</tr>
<tr>
<td>Observational Data (Video and Real-World)</td>
<td>New technologies cannot adequately be described by stakeholders and learners displayed competencies need to be observed</td>
</tr>
</tbody>
</table>
Table B: Overview of Methods Used in this Project

The method of ICT/ Media Content Analysis (Taachi, Hearn and Foth, 2004) is not a well-known method, such as interview. It reviews current types of NM & NT for the Design School at Loughborough University. The rationale for using ICT/ Media Content Analysis is that exploring the potential for NM & NT requires knowledge of their pedagogic value to Design School stakeholders. The results from the ICT/ Media analysis gave an insight into the current use of NM & NT; this explored the potential for particular learning scenarios further.

Why so many methods? Taachi, Slater and Hearn (2003), conducting an action research project where they introduce women in India to computers, state that the more varied methods are used the better the research; methods such as observation and participant observation and field notes (Taachi, Slater and Hearn, 2003, p. 52). As exploring potential as a task was so wide, many methods could highlight potential in different organisational contexts.

A brief mention of early approaches in the project which informed the methods and methodology;

- **Investigations on mobile learning and mobile devices:** the researcher acquired a smartphone and an iPod® in order to explore the possibilities of using a smaller interface for learning tasks. This included a review of examples of new technologies (particularly mobile devices): MDA Vario smartphone, iPods®, and using the internet on mobile devices.

- **Practice- Based Review of new media types and applications for learning:** Creating profiles for new media such as Facebook and Myspace, early on in the project. Also this researcher took part in a wiki workshop with Loughborough University on “Learning Collaboratively”. This introduced wiki technology and provided an insight into potential learning scenarios with wikis, what worked and what did not work.

- **Field Notes:** Notes from speaking to students and lecturers.

- **Interview with New Technology Companies:** In particular, members of the Hypertag company were interviewed. At the time, a learning scenario of using mobile devices to deliver lecture content via Bluetooth was investigated. The outcome of this
scenario was abandoned on the basis that students did not have suitable phones to take part in the MMS scenario.

- **Workshop Attendance:** at ACMSIG on Accessibility in Elearning, and "Beyond Distance Conference", University of Leicester, January 10th 2006. (See Appendix III for full report).

- **Doctoral Course Attendance:** a competitive doctoral place was offered to this researcher to explore “new media and the public” in Bergen, Norway assisting understanding with theory and new media. This researcher produced an unpublished paper as part of the attendance criteria (see Appendix IV for full report).

- **Tutor Role:** This author undertook a part time role as a tutor for one of the modules “Internet and Interfaces for Designers” allowed for understanding of HOW to teach using video from the Internet (See Appendix V)

- **Informal discussions with students:** unplanned discussions occurred if for example, the researcher spotted that a student owned an iPod®, or high-end mobile phone.

- **Publications:** Drafting of collaborative publications on Virtual Learning Environments and NM & NT (contained in Appendix VI)

These initial stages helped with decisions on the most useful type of methodology and methods to explore NM & NT for D and T education. The varied research methods in this research allow for the potential of NM & NT in D and T education to be fully explored. These methods helped to identify where and how to conduct action. The varied methods used here ensured that any action undertaken was not based on whim of the researcher, and helped overall with exploring the potential for NM & NT in D and T education.

### 2.10 Summarising Methodological Advancements of this Research

*The way this research used the MDHM to structure this research will be summarised. The methodological advancements of this as a guide to research will be illustrated.*

Action research can be both action and research with a view to collaboratively addressing a problem. Action research has been a useful methodology as it allows contextual problem solving and a hands-on approach to helping explore the potential for NM & NT in the Design School, Loughborough University. Both of these goals are achieved through cycles of
planning, doing and reflecting, and crucially through the involvement of the participants under investigation (Reason and Bradbury, 2001).

2.11 Conclusion: Extending the Action Research Methodology

This section concludes the chapter on research methodology and research methods.

The double helix model allowed for complex theories, data and new technologies to intertwine. This helped the researcher create a new methodological approach, called MDHM. The benefits of MDHM allow the researcher to make informed decisions on the basis of new information from all stakeholders’ viewpoints and competencies, technological developments and learning theories. Using MDHM, with the research methods will provide research outcomes on the potential for NM & NT n D and T education.

Susman and Evered (1978) have provided some insight into the research outcomes using the five cycles for action research:

“Action research facilitates the development of techniques which we will call "practics" (to distinguish from positivist techniques). Practics would provide the action researcher with know-how such as how to create settings for organizational learning, how to act in unprescribed, nonprogrammed situations, how to generate organizational self-help, how to establish action guides where none exist, how to review, revise, redefine the system of which we are part, how to formulate fruitful metaphors, constructs, and images for articulating a more desirable future” (Susman and Evered: 1978, p.599).

Thus the MDHM of action research will hopefully reveal “action guides” for potential of NM & NT within D and T undergraduate education.
Chapter 3: Literature Review on Researching New Media and New Technologies in Education

PART 1: Reviewing Potential for NM & NT in education

Chapter 1 illustrated some perceived benefits of NM & NT in D and T education. This chapter will look for evidence of these benefits in key references. Chapter 2 describes the methodology which will investigate the potential for NM & NT in D and T education. This chapter takes a closer look at the literature investigating the potential of NM & NT for D and T education.

In Part 1, specific examples of NM & NT in education will be reviewed. It is argued that action research, as the adopted methodology, is ideally suited to explore the potential for NM & NT in D and T education. New insights into the potential for NM & NT for learning will be explored. Appendix I and II provide further literature review which was very in-depth was nonetheless essential to the understanding of how NM & NT operates in a learning context and wider society. Appendix XIV Review of NM & NT Literature and Projects contains further review of the different projects that each individual university is undertaking. Part II of this literature review concludes the diagnosing cycle.

3.0 Literature Review Approach

This section describes the literature review approach, identifying where this literature review has specifically addressed the research objectives.

It is recognised in conducting this review that the pace of change in NM & NT is extremely fast, and what may be experimental and cutting edge technology one year becomes standard issue the next. Hence some of what this thesis aims to achieve is as much an assessment and development of research for NM & NT, as a review of that field in itself. As always with action research, developments and new directions will only be apparent as the research proceeds and engages with the stakeholders, the lecturers and learners. At the time of writing, there were some clear research gaps that showed promise as a starting point.

Existing literature in relation to NM & NT, D and T education, design education, and technology education, is reviewed to find points which might be relevant to this research.
This should offer an overview on the different *New Media* and how it is used in education design-based modules and programmes of study. This aspect of the research is relevant to assist with the development of scenarios, specifically for D and T education, within Loughborough University.

**Table C: Linking Research Objectives to Part 1 and 2 of Literature Review**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>RESEARCH OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lit review, Part 1</td>
<td>Objective 1: To engage with the theoretical and methodological issues in investigating the potential for using <em>NM &amp; NT</em> in D and T undergraduate education</td>
</tr>
<tr>
<td></td>
<td>Objective 2: To devise an appropriate action research methodology for investigating potential for <em>NM &amp; NT</em> in D and T undergraduate education.</td>
</tr>
<tr>
<td>Lit. review Part 2</td>
<td>Objective 3: To investigate the different types and features of <em>NM &amp; NT</em>, and whether they are useful for learning activities within D and T undergraduate education</td>
</tr>
</tbody>
</table>

Much of this literature review covers the potential for *NM & NT* in D and T undergraduate education in a general way. This means it is wide in its scope and potential application; it is not clear at this stage which *NM & NT* will be of most use to D and T undergraduate education, if any. Therefore the literature review looks at many examples to provide insight into how other higher education institutions have applied *NM & NT*. Aims of the literature review identified above link to the following research objectives in Table C above (as identified in Chapter 1, section 1.2.3).

**3.1 Scope of Literature Review**

The results of this literature review show whether there is a research gap for exploring the potential for *NM & NT* in D and T undergraduate education and identify possible barriers to researching this topic. Thus the aims of this literature review are:

- To review literature where *NM & NT* are used in D and T education;
- To explore new practices and potential relating to the use of mobile technologies for learning D and T education
- To identify the learning theories and methodologies relevant to these new practices.

To conclude this section has shown how the research objectives will be addressed and shown how the literature review will be tackled.
This section of the literature review explores elearning and m-learning research fields. It provides literature review on Internet communication tools, and new media such as wikis, Really Simple Syndication (RSS as explained in Section 1.9) and blogs, for education. Investigating other research assists with the action part of this research, because the researcher has to make informed decisions on the most appropriate use of NM & NT for D and T undergraduate education.

3.2 New Media and New Technologies in Education

This section explains different types of NM & NT, provides examples in education and reviews some key references which use New Media and action research.

Due to the lack of available literature specifically relating to NM & NT in D and T education, this section begins by reviewing all the relevant, current examples in other universities where NM & NT has been used. The small amount of literature which exists in NM & NT in D and T education is also reviewed. To recap; this literature review investigates the potential of new media in D and T education, and in other educational fields.

3.2.1 Different Types of New Media and New Technologies

The types of new media which have been identified include:

- Mobile devices – (such as iPods®, cameras and mobile phones)
- Blogs – (like a digital web diary) and Wikis – (good for updating knowledge)
- RSS – (the technology behind podcasts)
- Social networking sites (virtual places for people to hang out)
- Virtual Learning Environments (online didactic tools for teaching and study)
- Podcasts/ Vodcast

3.2.2 Future New media and New Technologies for Learning

The nature of what “new” is about NM & NT is forever changing. The New Media Consortium identifies some new and cutting edge technology which might be used in University institutions in the future. The future technologies which shape the potential for learning, not just in design and technology education, but other forms of education have been identified (NMC: 2007). They are:
1. **Grassroots videos:** The proliferation of mobile devices such as digital cameras and mobile phones for recording video, coupled with easier ways of uploading and distributing video content over websites such as YouTube have resulted in a surge in home video production. It is and predicted that this will filter down to have an impact on learning delivery. However on balance, videos created need to be of an acceptable standard of resolution and the students need to have good enough Internet connections. It is suggested that students would have to develop competent use of the technology as well as the subject matter.

2. **Collaboration Webs:** online web tools which combine project management tools with online spreadsheets, pictures etc. This tool might be useful for designing in teams who are not co-located.

3. **Mobile Broadband:** the use of mobile phones to access the internet will result in better download capabilities.

4. **Data Mashups:** for example, linking a Google map with interactive pictures, such as in the program Panoramio, where users have control over the content, and photos.

5. **Collective intelligence:** use of blogging, forums and wikis to provide learning.

6. **Social Operating Systems:** defined as a system for management and facilitation for human interaction and social relationships. So for example, by opening up their architecture to third- party programmers, Facebook is no longer just about sharing photos, it provides means of identity and communication management, by allowing them to design bits of it.

There are many new media and new technologies with different features that could be useful for D and T undergraduate education. However, Universities are just scratching the surface of the potential for them, with the introduction of V.L.Es which can support some but not all of the NM & NTs available. The crucial issue will be which NM & NTs are of most use to students and staff within the Design School. D and T undergraduate education has its own set of requirements which need to be explored.

3.2.3 **Key references in NM & NT and Action Research**

Some literature specifically relates to new media (but not new technologies!) and action research. Hearn and Foth (2004) describe the application of action research to the topic of
new media, and show how it might be useful to the design and research of new media for learning; they advocate *new media action research*. It is useful to the design/evaluation of new media in three ways; Firstly, it involves participants who benefit and guide the direction of the research; Secondly, the activities of recipients of the research, generate knowledge alongside more formal methods (it is argued that this is especially important in a learning context); and lastly, they report the generation of action and solutions to problem. *New media action research* is useful to this research into *NM & NT* in D & T education, as it provides a blueprint for how to proceed.

Similar work uses computers more generally to encourage learning through action research. Action Research inspired by the work of Taachi, Slater and Hearn (2006) uses ethnographic action research to put ICTs in the “hands of the poor”. They use the term “communicative ecology”, to describe ways of looking at a component within a whole system. They research media repertoires and the social nature of media, while looking at poverty and women’s digital literacy in India, trying to run computer classes with them. To apply this concept to this research; the concept of “communicative ecology” was taken to investigate how to use different types of new media with RSS applications through new technologies (mobile devices) for D and T undergraduate education. This is within a university learning institution.

### 3.3 New Media and New Technologies in Design and Technology Education

*This section reviews key literature examples of NM & NT in D and T education, the change to standards of teaching D and T, and the benefits to NM & NT in D and T education.*

The proliferation of elearning and m-learning very much depends on the support available from University institutions. Internet technology is now used extensively by students and lecturers for their research. This makes elearning and mlearning with *NM & NT* in D and T education possible, but is it of benefit to the stakeholders. The findings from PATT conference “*New Media in Technology Education*”, (Mottier and de Vries, 2001), highlight some of the changes in educational design-based programs highlighted by Kimbell, Saxton and Miller (no date). The most cited example of new media in Design and Technology education literature refers to website applications for learning. Barlex (2001), exploring new
media for D and T education reports the use of a website to supplement teachers of D and T education.

3.3.1 Examples of New Media and New Technologies in Design and Technology Education

Fun ways of learning CAD with new media and new technologies have already been devised. Prensky (2001) describes the creation of a game to help students use CAD, in the style of the first-person shooter, called The Monkey Wrench Conspiracy (TMWC). The plot: save a space station from attack by Dr. Monkey Wrench. The only way to defeat him is to use the CAD software, which the learner must employ to build tools, fix weapons, and defeat booby traps. There is one hour of game time, plus 30 activities which can take from 15 minutes to several hours depending on one’s experience level.

TMWC gets young people interested in learning CAD software. According to Prensky, it is widely used. While the game was easy to invent for the researcher, the hard part was getting the right information and ideas from the professors. This researcher would agree that it is difficult to translate learning materials to the virtual environment. Do Yi-Luen and Gross, (2004), note that now students of CAD have to become expert in computing and design. They suggest that this means that students inhabit a “peculiar” space between the worlds of science and engineering and arts. Offering visions of the future of CAD, they suggest that CAD teaching follows a tripartite approach: 1. Basic research in design, 2. computation in the built environment, and 3. Simulation and visualisation. (p. 345).

Dugger (2001) describes the architecture and standards required for the use of new media in technology education. This focuses on what every school student, age 5 - 18 should know. The author argues for standards in technological literacy. There have been no similar calls for standards to be included at university-level Design and Technology courses (Williams, 2007). This is perhaps as a result of Universities having invested well in the appropriate equipment for industrial design and these changing standards using NM & NT is not how D and T is taught at undergraduate level. Changing standards mean a move to new teaching styles; one where NM & NT mediates between the technology trying to be taught and workshop – based learning experiences.
Baskerville (1999) assumes that information systems and new media can be drivers for change within organisational settings, but can they assist with changes in Design and Technology educational settings? Changes in educational design-based programs are subject to:

- The changing view of design and its influence on society,
- Design training in the new university context (perhaps movements to more computer-based design)
- Mass higher education and the growth of student numbers
- Changing professional needs and changes in the employment patterns of graduates.
- An emerging design culture with its own integrity and identity
- Changed recruitment patterns into higher education.
- New technologies

(Kimbell, Saxton and Miller: No date: p.43).

3.3.2 Benefits and Drawbacks of New Media and New Technologies in Design and Technology Education

Findings from the PATT conference summary on “New media in Technology Education” (2006) cite certain benefits to harnessing new media in technology education. The first benefit is student enjoyment and excitement at using new media! The second benefit is that it is useful for wider professional practice in industry. The third benefit is that new media can support different learning styles and even disabilities. Four further important functions of new media within technology education were identified with PATT-11 (2001) conference:

1. Information and instruction sources
2. Useful for design and project work in particular
3. Enhanced communication mechanisms
4. New media useful for testing (Barlex, 2001; Mottier & de Vries, 2001)

This conference was concerned with D and T education at GCSE level; more than with undergraduate schools or departments which teach design and technology subjects.

However, recent work in the Design School describes some of the difficulties in introducing V.L.Es in the teaching and learning process in design and technology education, (Denton, 2005). Using NM & NT in D and T education has its own drawbacks too. The above PATT conference (2001) highlighted some pitfalls of using new media in technology education,
such as its **addictiveness** and a **lack of standardisation** of different types of new media (Mottier & de Vries, 2001). Strategies for the employment of new media within technology education include ensuring that new media to fit into educational needs.

Bell, Cockburn, McKenzie and Vargo, (2001), also note worrying results from their research in delivery of flexible learning. They developed a comprehensive system for capturing audio and video lectures. What they found (including lack of use) led them to hypothesise that the availability of a flexible alternative to lectures removed the necessity of attending lectures, and that thus students deluded themselves about catching up using the digital repository. This research will take these pitfalls into consideration.

**3.3.3 NM & NT in the Design School**

In the Design School at Loughborough University, the use of interactive video instruction has been adapted for design and technology education to facilitate learning (Hodgson & Norman, 1993). Hodgson & Norman, (1993), identify the usefulness of video as a learning tool and develop a prototype interactive video application for school students. The learning content of the videos illustrates design contexts so as to identify design specifications. Discussing the nature of the term "interactive", they identify "planned interactions" which arise from Interactive Video as pedagogical tools for structured learning.

However, teacher feedback in this study identified control as an important aspect for the success of this type of technology. The issue of diminished control of the lecturer may be a hindrance to learning. For example, if the lecturer has to focus on facilitating learning through this type of technology, questions may arise for how to facilitate e.g. turn taking, and clarifying misconstrued meanings.

However the majority of digital learning resources for the Design School education are Word documents, and there is little uptake of *NM & NT* for learning beyond this in the Design School. This is viewed by this researcher as a disappointing feature of elearning. Reasons for this have been noted; Whitehouse and Brotherhood (2002), describe the UK government-funded project into elearning for Design and Technology education at school level. The authors note that teachers’ level of skill differs greatly and it is often difficult to imagine how the practice of D and T education can be moved to a virtual environment.
3.4 New Media & New Technologies in Education: RSS

Why use RSS for learning? Harrsch, (2003), makes claim that average person can enrich their lives with RSS technology; that is therefore the next “killer app” for education. She highlights four scenario examples where RSS can be used in education, concluding that RSS enhances choice, customisation and communication. RSS has been used for the following learning goals:

3.4.1 Potential Uses of RSS in Education

1. Module Specific Blogs
Online journals known as blogs, can be used as teaching tools. RSS is used to syndicate blog posts, so whenever anything changes on the blog the student is notified.

2. General University Events and School News
RSS feeds can be used to communicate events on or off campus to students. Subscribers of a schools calendar feed receive notification in their RSS aggregators as new items are added to the University calendar.

Schools big or small can use RSS to communicate school news with their population, announcing staff changes, new modules or any other news that is relevant and of interest to the student population.

3. Podcast/ Vodcasts of Lectures
Podcasts/ Vodcasts can be used as revision guides and even for students contemplating their module selections.

4. Monitor Research
Students involved in research can use RSS to monitor news and search engines for specific keywords by creating search feeds. Any time a mention of the keyword phrase occurs in a news piece the item will appear in the search feed.

5. Lecturer Professional Development
RSS can be used for remote education. Lecturers can lose less lecture time while still staying current on the latest information in their field of expertise.
6. Research Collaboration
Universities in particular actively participate in collaborative projects and research. New tools have never made collaboration easier. RSS can be used in conjunction with many of the online collaboration tools to notify other contributors of changes.

7. Search Feeds for Assessment – Related Topics
Students writing their assignments or working on research papers on specific topics can create search feeds, so each time that topic is mentioned, they receive notification in their custom search feed.

8. Study Guides
There are many websites focussed on studying. One creates RSS feeds that contain daily questions. There are feeds for "word of the day" or "problem of the day". Students can subscribe to the feed and integrate long-term studying into their daily routines.

Harssch (2003) identifies six potential uses of RSS:
1. Lecturers and students can keep track of their favourite websites from one location;
2. Large number of wikis, blogs and research constantly being published on a topic; Lecturers and students can thus be notified of updates and new developments from many websites that are relevant to the module topics;
3. Better solution than an email subscription list as it avoids spam;
4. Creating blogs with students, instead of visiting each student’s individual blog teachers can subscribe to an RSS feed that allows them to obtain instant notifications and updates relating to any new content added. This will dramatically reduce their workload. Additionally, students themselves can also subscribe to the feeds of their friends, peers and teachers
5. Lecturers and students can establish RSS feeds relating to assignment topics and areas of research interest. This allows access to up-to-date content on a wide variety of subjects automatically
6. Instead of hunting on portals to pull down information, with the RSS model users can have information ‘pushed’ to them that is customised to their personal interests.

3.4.2 Benefits to Using RSS in Education
Why has RSS been developed? Basically, there are too many websites and too many of them which add new content to keep track of. In addition, the nature of how people search using
search engines creates an "Iceberg" around a particular topic. This is because often when users do keyword searches, they only check the first ten results on the first page. However, due to the relative novelty of RSS, many people are unaware of how it could revolutionise traditional search and retrieval of different types of information, in different formats. Sampson, (2005), notes some setbacks to launching their podcasts, such as bandwidth issues. They set out to create podcasts for the library and examine log files to monitor usage patterns. Richardson, (2005) contains a quick guide for educators on how to use RSS for education, advocating Bloglines as the RSS reader of choice. He notes how to group feeds together which might make assessment procedure much more streamlined for lecturers.

Glotzbach, Mohler & Radwan (2007) sought implementation of RSS to provide students with another way of getting module announcements. The system was developed where students had to subscribe to the module feed. The preliminary findings indicated that developed system was useful and effective for students. A post task survey revealed that 75% of 200 students now understood what an RSS feed was. Also 30% of all participants indicated that they have been using an RSS feed at least once per week for gathering information from available sources.

Similar work in 2008 by Glotzbach, Mordovich, & Radwan (ibid) looked more in-depth at the primary and secondary questionnaires. Although there was no significant result in the t-tests, 65% used the classroom rss feed, indicating it was of value to the students. Reasons for lack of significant results were attributed to a lack of standardisation in the dissemination of module announcements across the curriculum modules.

3.4.3 Drawbacks to Using RSS in Education

Lee, Millar & Newnham, (2009), suggest that there has not been much uptake of podcasts provided for their students within a university setting. They suggest that students generally do not make use of RSS functionality, but instead prefer to download the media files manually. Lee, Millar and Newnham (2009), produce some reasons why students do not subscribe via RSS to educational feeds. They attribute this lack of uptake to:
- Lack of **technical knowledge** of students AND teachers
- Lack of **awareness** of capabilities of RSS
- Students’ possess **fixed habits** and patterns of behaviour in the way that they access the Internet and browse the Web
- **Type** of educational information – e.g. an article which does not change is not dynamic and time sensitive

**Costs outweigh Benefits**: Time taken to set up a feed not offset by the student just going and checking for new content manually

A note of caution when using RSS in education: Although students say they might like to use this technology, the reality might be very different. Lee, Millar and Newhams’ research is supported by research by Atkinson, Buntine, and McCrohan (2007) only 4% of participants subscribed to RSS feeds, despite 14% using a portable audio device to listen to lecture podcasts. This is worrying with respect to using vodcasts for D and T education.

Lee, Millar & Newnham, (2009), nonetheless view RSS as still pedagogically useful and cite some examples where syndication services could be a valuable tool. Despite highlighting these drawbacks, the authors argue that it is too soon to write off using podcasts for teaching and learning; “When a critical mass of podcasting is reached within the curricula, students may find it more worthwhile” (p.56). Students make use of a variety of computers to access the web (not a problem if using web– based RSS program, such as Bloglines). But Bloglines in particular, has not very good podcast support. Education content is provided using RSS to deliver small amounts of content over a single feed/source at fairly consistent intervals (e.g. weekly lectures in a single module). The authors suggest more amounts of dynamic, time-sensitive content across multiple feeds in a sporadic fashion.

### 3.5 New Media & New Technologies in Education: Podcasts/Vodcasts

RSS is the technology behind Podcasts and Vodcasts. RSS is the code which wraps around the audio and video file, which delivers small amounts of learning content over a single feed/source at consistent intervals. This section explores previous examples of Podcasting/Vodcasting in education.
3.5.1 Examples of Podcasts in Education

The University of Wales, Aberystwyth was the first university in the UK, using podcasts (Thomas, 2005). Physics lecturer, Andy Breen, conducted an experiment in September 2004. Initially, he recorded his own module lectures and uploaded them to the School's virtual learning environment (VLE).

Tynan, & Colbran, (2006), conduct a trial of podcasting in six law subjects involving 1244 law and business students during Semester 1. They found students were prepared to accept lengthier downloads for improved quality. The aim of this study was to investigate whether students changed their study habits, and this paper reported preliminary findings from a survey. One of the interesting findings was that they listened to them at home. Presumably, they had computers at home so this kind of defeats the purpose of mobile technology; only 20% listened to them on the way to work. Also 20% confirmed that they transcribed the audio podcasts. However, the authors conclude that students said they really wanted them and found them useful.

Koo and Kwong, (2006), describe the Boilercast system for administration of audio podcasts at Purdue University. A survey of students using podcasts led to a Theory of Planned Behaviour. Combined with the researchers Technology Acceptance Model, the results from this study provide guidelines for future use of podcasting in education. Guidelines relate to student attitudes, for example, which are influenced by ease of use and usefulness of the podcast for learning.
3.5.2 Research on Podcasts in Education
Edirisingha & Salmon (2007), report beginnings into a UK national study (IMPALA) investigating the impact of podcasting on student learning in higher education. At the start of the semester, a questionnaire revealed the students profile, whether they possessed podcast technology, and students’ familiarity with learning technologies; and through a questionnaire at the end of the semester, data was gathered on students’ pattern of using podcasts, and reasons for not using. Edirisingha & Salmon (2007) look for pedagogical models with podcasts. Pilot results indicated that podcasts helped student learning by providing good introductions to the online material. The pedagogical models developed included podcasts as:

- Extensions to lectures:
- Location- based student learning:
- 1st year Student study skills:
- Active learning:
- Topical Issues and Informal Content:
- Teaching large student numbers
- Support online learning

They argue and conclude that podcasts have the ability to be a valuable tool to encourage student engagement.
However, are Podcasts/ Vodcasts as good as traditional means of education? Evans (2007) surveyed 200 first year students, after they were given a series of revision podcasts for a module in Information and Communications Technology. As part of the subscription process, they had to complete an online questionnaire about their experience. The questionnaire contained 22 questions and a five-point Likert scale compared attitudes to lectures, podcasts, notes, textbooks and multimedia e-learning systems. The author established four hypotheses:

H1: Learners believe it is quicker to revise from podcasts compared with notes.
H2: Learners believe that revising from podcasts is more effective than from notes.
H3: Learners feel more receptive to revision material in podcast form than a traditional revision lecture
H4: Learners feel they can relate more to the lecturer in a podcast than in a traditional revision lecture

The results suggested that students believe that revision podcasts are a quicker way to revise than using their own notes (hypothesis H1). The results questions re: H2, the students report that podcasts are more effective revision tools than textbooks, but not their own notes. In H3, the students claimed they were more receptive to podcast material than material delivered in the form of a revision lecture or from the textbook. The purpose of the research (Evans, 2007) was to assess whether revision podcasts enhance the learning process and if the results from H4 are to be believed then there were two issues where there were no significant differences in comparisons of the two media: comparing the effectiveness of podcasts with their notes and comparing receptiveness of podcasts with revision lectures. Despite this, Evans concludes that podcasts have significant potential to enhance the learning process.

3.5.3 Barriers to Use of Podcasts in Education

Belanger, (2005), describes a large scale evaluation of iPods® in Duke Universities, reviewing the effectiveness and feasibility of these tools for university students and staff. They define the educational uses as a module content dissemination tool, a classroom and fieldwork recording tool, a study support tool combined with file transfer/ storage capabilities. The academic benefits of iPods® outlined are similar to the ones relating to NM & NT more generally; convenience, flexibility etc. They identify some barriers, such as mass hardware distribution and also:
- Integrating multiple systems
- No systems for bulk licence of academic content for .mp3 players
- Difficulties in obtaining academic content in the appropriate formats
- Limitations of the inputting to the device
- Suitable quality
- Lack of training resources
- Staff and students don’t know how to use the devices

One useful resource for D and T education from this research was the mp3s created for an engineering module, where iPods® were used as signal generators for computational engineering, where they could alter the frequency and compression rate. This might be useful for Electronics taught within the Design School.

3.6 Suitability of RSS and Podcasting/ Vodcasting for Education

Lee and Chan (2007), report some unexpected findings from a podcasting study conducted on distance education; namely students preferred to listen to podcasts on their computers. Therefore, the learners did not use the mobile aspects of the learning materials. They argue that m-learning is the future of distance education. They advocate the benefits of podcasting, which concern the ease with which podcasts integrate with learners lifestyles. They report the results of a survey for introducing podcasting to distance learning information technology students. They interviewed students and found level of learner focus on the podcast was determinant on whether the material was examinable. They were using audio podcasts. Despite the small sample size for the study making the results generalisable, they conclude that these results have implications for m-learning.

3.6.1 Podcasting/ Vodcasting & Educational Theory

Lee, Millar and Newnham (2009) argue that podcast technology relies on traditional behaviourist model of learning with the teacher imparting knowledge to the student. The authors suggest more scope for uptake when students figure out how to use it and start sharing knowledge; along a more social constructivist model of learning. Repackaging it as a more collaborative tool between the learning content, learner, the community the tutors and other new media types will make RSS syndication more appealing as an educational tool.
Adopting the notion of *connectivism* this extends the education theory of social constructivism by looking at the role of teacher as mediator. The authors cite three social constructivist examples where RSS would be viable education tools:
1. Peer-to-peer sharing of learning objects
2. RSS as a Personalised Learning Environment
3. Podcasts to Support Fieldwork.
They conclude for a more longitudinal study where podcasts fit more with teachers ICT norms and habits.

### 3.6.2 Educational Benefits of Podcasts/ Vodcasts in Higher Education Modules
M-learning can be achieved through podcast technology. Benefits of using podcasts are highlighted by research done at Purdue University (Frydenberg, 2008) below:
- Students repeat the lectures anytime, anywhere
- Non-native English speaking students repeat the lectures
- Students who were severely dyslexic, or having visual or hearing impairments
- Students review the lectures before exams
- Students listen to the lectures they have missed
- Students think over, and listen again to lectures and tutorials as a way of encouraging critical, analytical approaches
- Instructors listen to their own lectures to improve their presentations

### 3.6.3 Educational Benefits Specific to Vodcasting
Larraga & Coleman (2007), argue that creating a video podcast for the curriculum can be as useful as authoring a **web page** or creating a **PowerPoint** presentation. They argue that video podcasting is an evolutionary progression from those two types of education delivery. They describe the three-stage process required to create a video podcast:
1. Writing and rehearsing the script
2. Recording
3. Post-production and encoding
They conclude that it is possible to create video podcasts for learning, quickly and simply depending on the information one tries to convey.
To conclude this section on podcasts; are audio or video podcasts better? Work by Cebeci & Tekdal (2006), reports on features of integrating audio podcasts as learning objects. They argue that audio podcasts offer certain advantages over mobile video, such as the ability to listen while running, and driving. They conclude that podcasts should be redesigned with a close link between instructional theory and syndication technology – some podcasts are just .mp3 files, and are not tied to learning objectives. Therefore, they conclude that methods of using podcasting in e-learning should be developed more intensively. This researcher argues that there are many more benefits of video podcasts over audio podcasts in design and technology education. The ability for the student to familiarise with the techniques and equipment within the workshops is communicated better visually.

CHAPTER 3: LITERATURE REVIEW (Cont)

PART 2: Diagnosing Potential for NM & NT in D and T Undergraduate Education

3.7 Evaluation: Summary of Literature Review

This begins the evaluation phase of the diagnosis cycle. This section provides a summary of the literature review, to evaluate the potential for NM & NT in learning.

This section will evaluate key references in this literature review. The potential for NM & NT for learning relates to the stakeholders; lecturers and students within the Design School, Loughborough University.

3.7.1 Positive and Negative Aspects of NM & NT for Learning

However, there are positive and negative aspects to evaluate NM & NT in D and T education. For example, a negative view; no benefits of elearning for improving student performance was found (Smeaton and Keogh, 1999). However, Kimbell, (2005) finds a more positive view of the use of technology for learning for design and technology students, specifically with m-learning. The use of back-pocket technologies delivering learning content at the point of need seems useful to D and T students. Thus there is potential for m-learning (Trifenova; 2003 and Salmon; 2004).
M-learning and elearning in higher education typically occurs in Virtual Learning Environments (V.L.Es), such as the Learn@lboro learn server at Loughborough University. It tends to be web-based. Holtham and Courtney, 2005, describe some of the positive and negative aspects of VLEs in universities. Holtham and Courtney’s report posits Virtual Learning Environments (VLE) in e-learning and e-business context. Although VLEs have good value and potential, they are a business risk for universities. It is argued that there is waning support for spending on elearning, and that there may be a growing trend among institutions to invest in other aspects of learning infrastructures (e.g. physical buildings and information resources) rather than IT-based technologies alone. Extra effort is required for all parties within a distance learning approach and not all parties will have communication and technological know-how to thrive within a V.L.E.

3.7.2 Positive and Negative Aspects of Different Types of NM & NT for Learning
Research conducted with types of NM & NT, such as wikis, blogs, RSS and podcasting, has been reviewed. Duffy and Bruns (2006) highlight both the positive and negative aspects of using blogs in education. Also research by Trafford (2005) explores the potential of blogs in education further.

Duffy and Bruns (ibid), also highlight the benefits of wikis in education, although research from Brereton, Donovan & Viller, (2003), highlights some negative aspects. Using RSS in education has been called for (Cold, 2005). The positive factors in using this type of technology for learning have been highlighted (Duffy and Bruns, 2006); as have the negative aspects (D’Souza, 2006).

3.7.3 Summary of Key References
The following headings summarise the key references in this literature review to assist with evaluating the potential for NM & NT in D and T education:

Elearning and D and T education
• Hodgson (2006) using CAD to design

• Salmon (2005) developing protocols for elearning

• Whitehouse (2007) elearning and D and T education potential

**D and T education and Mobile Learning**

• Cochrane (2008) relies on a socioconstructivist model; Also cost an important factor in whether students use mobile technology (Traxler, 2004).

• Kimbell (2005) using PDAs and other “back pocket” technologies useful for workshops in D and T education

**D and T education, and Specific Types of NM & NT:**

• Evans (2007), uses questionnaires to compare podcasts with other types of learning

**Action Research and NM & NT**

• Baskerville, 1999; action research in imposing IT in organisations

• Hearn and Foth (2005);

• Taachi, Slater and Hearn, (2006).

**Using Learning Scenarios for NM & NT**

• Derntl and Motschnig-Pitrik (2004) learning scenarios

• Danielsson, Hedestig, Juslin and Orre (2004), also use the concept of scenarios in participatory design in mobile learning environments

A summary of the findings from the JISC report is very relevant to potential for NM & NT in D and T education. Firstly, students expected a bigger role in learning ICTs at Universities, as many of them not understanding newer technologies themselves. Secondly, in the use of new technology, only 57% (73 of cohort) agree they like to look for new technologies to help them learn. Students were happy with online materials provided, and were aware of issues of plagiarism and dubiousness of online resources.
3.8 Evaluation: Addressing the Research Gap

This literature review has investigated whether there is any literature which can aid the research. This section makes transparent the research gap, and evaluates the potential for NM & NT for learning.

From the literature surveyed there appears to be no similar sort of research, and thus an emerging research gap is identified. This literature draws on published studies and research which met the following criteria:
1. Theory and Methodology
2. Studies on e-learning, m-learning and new media and new technologies in education, focussing particularly on those done through action research.

3.8.1 Why are there so few references in NM & NT in D and T Education?
A note on the evident research gap: A recent keyword search into two major journals in D and T education; The International Journal for Technology and Design Education; and D and T Education found the following results to keyword searches located in abstracts:

Table G: Keyword Search of Design and Technology Education Journals - 2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile learning</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>New media</td>
<td>9</td>
<td>2 – McLaren, (2007)</td>
</tr>
<tr>
<td>New technologies</td>
<td>34</td>
<td>1 – Lehtonen et al., (2006)</td>
</tr>
</tbody>
</table>

As the table above shows, there are not many resources specifically devoted to new media and new technologies in design and technology education. Variations on keywords, such as “mlearning”, substituted for “mobile learning” revealed little uptake of NM & NT for D and T education. Thus, it seems there is a large research gap for exploring NM & NT in D and T education. Perhaps it is due to D and T seen by teachers and lecturers as a “design to make” discipline, not necessarily suited to using NM & NT. Barlex, (2008), provides a review of elearning in science and design and technology education. However, this author’s research work relates predominantly to school-based design and technology education. This research
into *NM & NT* focuses on D and T education at undergraduate level, there are different set of learning outcomes and styles, between these modes of education.

Why are there so few articles on *NM & NT* in D and T undergraduate education? McLaren (2007), in her survey of university lecturers, students and architects confounds Prenskys’ assertions that professionals and students within the field of design and technology all want to be “digital natives”; but when it comes to designing, using pen and pencil are the preferred methods. Although suggestive, on its own Prensky’s research is by no means conclusive. Thus with the introduction of comprehensive V.L.E systems within University contexts, and with the ever-changing nature of both technological advancements and users’ competencies, it is still worth exploring the potential for *NM & NT* for D and T education.

### 3.8.2 Research Gap in Action Research on Mobile Learning

Litchfield, Dyson, Lawrence, & Zmijewska, (2007) conducted literature review, and online questionnaire to discover five directions for mlearning, which could be exploited. They cite action research as the preferred methodology to investigate these directions, highlighting the following research gaps in the area;

1. Need large scale implementations
2. Need a body of learning and teaching principles for mlearning
3. Need evaluation of effectiveness with differing groups of students
4. Need to develop teaching strategies for effective learning about wireless and mobile technologies.

The directions were based on these gaps, for example the need for mlearning related to each individual discipline. The online survey confirmed 95% of the surveyed students regularly use a mobile phone and 72% stated they would be interested in using a mobile device in their studies. The researcher also gave students PDAs to collect their own learning course content. The results revealed certain usage and deployment difficulties with the mobile devices themselves, which were too difficult for most students to learn to use quickly in the short period of time they had to familiarise themselves with the technology. The authors conclude that an mPortal is required to answer further questions arising for m-learning for active and experiential learning.
3.9 Evaluation of the Diagnosis Cycle

The diagnosis stage has looked at the research fields of “design and technology education”, “mobile learning”, “e-learning” and “New Media and New Technologies”.

Chapter 1 reveals findings on the organisational aspects of the research question, framing the development of NM & NT within learning outcomes. The benefits of using this MDHM as a methodology is that it aids research performance in the field, as it can tell the researcher when to move onto the next cycle. The next cycle is action-planning, which will be explored in the next chapter.

3.9.1 Potential of Mobile Technology for Learning

Why concentrate on m-learning? Findings of this literature review do indicate that new media on mobile devices may be more useful to students of design and technology, who are in a workshop/studio environment (Kimbell, 2005). There are many potential learning scenarios which can be useful to the students of Design School. The "technological literacy" (Williams, 2007) of students and lecturers of the Design School will be explored in the research methods and methodology.

Kennedy, Krause, Judd, Churchward, & Gray (2006), assessed the potential for m-learning with first year undergraduate students – an age group regarded as digital natives. They produced data from a questionnaire of 2000 students on the use and access to new types of technology such as mp3 players and mobile phones. The results showed that these students have a range of competencies with these new technologies and the challenge is how to cater for the broad range in students' levels of access to, and encourage familiarity with new technological tools. For example, although most students possessed podcast technology, 40% were unsure or thought they might be unsuitable for learning.

3.9.2 Requirements for Successful Mobile Learning

Trinder, Magill, and Roy, (2005), describe the outcomes of introducing PDAs into education for a semiconductor design and technology module. A group of 14 students were given a PDA, with learning resources on it. There was a control group of students who had the same resources in paper form. Generally, there was little uptake and use from students with the
PDA which was disappointing, The authors suggest that if the students own the device themselves they are much more likely to use it, and aim to develop the project further.

For example, Trifinova (2003) concludes her review of m-learning literature by identifying some constraints necessary for the efficacy of m-learning. They should be:

- Short 5-10 minute long modules: examples of content should be small chunks of data, doing quizzes, using forums or chat to find answers to "on field" questions
- Simple, funny and added value functionality
- Area/ Domain- Specific Content

With respect to the last bullet point, the author contends that the delivery of content should be relative to location and context (i.e. the system knows the location where the learner resides and adjusts to it), Context can be either temporal -in that the system responds to time dependent data, behavioural insofar as the system monitors actions performed and/or interest specific. Whether the students and the technology are, at present, sufficiently advanced level to take advantage of these features remains to be seen.

### 3.9.3 Best Practice for M-learning in Design and Technology Education

The potential for mobile technology to generate and stimulate learners’ ideas for D & T has been argued for. As Kimbell (2005) notes there has been too much emphasis on the role of Information and Communications Technology in education on “doing and recording activities; to control, to simulate, to manufacture”, (p.6). However, the nature of D and T education at both school curriculum level and at undergraduate level is practice-based and not so focused on recording research.

Further work by Cochrane (2008) is very similar to this researchers’, where he found that cost to the student and a built-in camera was one of the most important features to students using Wireless Mobile Devices (WMDs) for learning. In assessing the educational potential of WMD and Web 2.0, the authors issued smartphones to the students with multimedia capabilities. Then they reviewed what the pre-trial priorities were assumed to be, with students and compared them with the actual use of the mobile device. One of the most significant findings lay in the fact that students valued the least the ability to access module content on the smartphones. Many of them preferred to upload media other than text to their blog.
3.10 Specifying Learning: The Potential of New Media & New Technology for Learning

Specifying learning involves developing a model of the subject under study. The research looks to mapping \( NM \) & \( NT \) to the Design School’s requirements. This literary investigation worked hard to assure that this research was addressing a research gap, not previously studied. Specifying learning should build a model of the research into \( NM \) & \( NT \) for learning.

3.10.1 In-Time Delivery of Learning Resources

Kimbell (2005) point to the assumption that teachers make; that this type of digital enhancement of learning will be computer-based and static. They state their assumptions quite differently; that the nature of design and technology in workshops and studios should rely on peripheral and back pocket technologies, cameras and PDAs.

The previous section provides a summary of the educational benefits and potential of mobile technology in design and technology education. It suggests that design and technology education could benefit greatly from \( NM \) & \( NT \), especially from mobile technology. The major benefit is in-time delivery of learning materials, when the students need to use them. This is supported by Trifonova (2003) in a review of m-learning. She concludes that m-learning best applies to learning situations, where specific knowledge should be retrieved/accessed at a particular point in time. Research suggests that if students own the mobile device themselves they are much more likely to use it (Trinder, Magill, and Roy, 2005).

3.10.2 An Extendable Model for Design and Technology Education

PDAs might prove useful to students of Design and Technology to facilitate field studies, and collect user requirements (Kimbell, 2005). With a PDA users can record user interviews to ascertain requirement within the field. Mobile/Handheld devices can be use to record student interviews with field informants. This function can be used for various subjects. How does it work in practice? Preloaded materials relevant to a particular exhibit help students to learn more during a design museum trip. Using the student’s mobile phone, they can take photos and upload to their VLEs. This model is therefore extendible to many aspects of the syllabus and types of learning, informal and formal.
Kimbell, (ibid), in introducing PDAs to D & T identifies salient research questions pertinent to these new technologies. Kimbell (ibid) asserts that the mobile technology system must work well enough to allow for the answering of important research question such as:

1. How is the nature of D & T and learner performance changed via digital conduct?
2. When digital means are used in design education, what happens to the way in which performance assessment is conducted?
3. Research questions exist in the technology itself and in what capacity it can it be most useful for learner performance.

Whitehouse and Brotherhood (2002) specifically focus on elearning through action research in design and technology school education. The research questions are very relevant to this project; How could learning materials be constructed within a V.L.E and what subject materials should be used? The MDHM used to guide the action research process can lead the way in answering this question, through trying out some different types of NM & NT on Design and Technology modules. This model is flexible, whilst ensuring that research progresses in a structured way. A summary of the diagnosis cycle is below.

**Summary of Diagnosis Cycle (1C)**

1. Diagnosing Research Problem: what is the potential for NM & NT?
2. Clarifying Research Aims, Objectives and Question
3. Identifying Appropriate Theory and Methodology
4. Evaluation of Potential: just- in- time delivery of learning resources through mobile learning
5. Addressing objectives 1 and 2 of this research.

### 3.11 Conclusion

Why explore m-learning and elearning for D and T education? The assumption is that students are used to using their computers and mobile device as an information tool as well as a communication tool. Some authors (e.g. Sharples, 2001), argued that a convergence of mobile devices and computers will lead to a change in how communication occurs and thus
how education occurs. The purpose of this research is to investigate potential, which seems to arise strongly for m-learning, but there is little previous research on how this potential can be realised. As Dumais and Czerwinski (2001) note, there will always be technology-usage scenarios for which the basic research simply does not exist to guide us.

This research develops a way of looking at and developing technology – usage scenarios. This literature review provided the following to guide the research:
a) An overview of how NM & NTs are used in education generally, and what the benefits are;
b) A review of suitable theories applicable to D and T education, NM & NT and ways of conducting research;
c) Identifying any useful guidelines in relation to learning technology design to inform development and;
d) Clarifying the research fields, elearning and m-learning, which this research falls into.

This research will specifically focus on learning scenarios with computer and mobile technology, in the field of D and T education. Bormida, G., Bo, G., Lefrere, P., & Taylor, J. (2003) introduce the Mobilearn project and refer to the Goteburg Conference (2001), which stresses the need for pilot experiments and applications for the rapid spread of innovations in mobile technologies. Implementing the “Mobilearn” project, Bormida et al., (2003) noted that this need has become urgent. This is especially true for Universities if they are to remain competitive in Europe and the rest of the world. Thus this research will further and enhance the field of m-learning.
**Chapter 4: Stakeholder Consultation with Lecturer Interview**

### 4.0 Introduction

*This chapter describes the action-planning cycle to investigate potential for NM & NT in Design and Technology undergraduate education. This section links the potential identified in previous chapters with specific D and T education problems.*

Chapter 4 introduces the action-planning cycle (Cycle 2) of this research. Action planning involves exploring various courses of action available. Lecturer interviews were used in the first instance to find out their views on NM & NT for learning; the remainder of this chapter describes the results from those interviews. Interview was used to find out if there was any potential for NM & NT in D and T education from D and T lecturers’ perspective.

Previous chapters **diagnosed** the research problem (Cycle 1). In this diagnosis cycle, the literature review showed a research gap for NM & NT in D and T undergraduate education. The previous chapter specified learning potential of NM & NT generally, concluding that:

1. Just-in-time delivery of learning resources was a major benefit to D and T education (see Chapter 3, section 3.19.1) and;
2. Using NM & NT in education could provide an extendable model for Design and Technology education, through elearning and m-learning (see chapter 3, section 3.19.2).

In the action planning stage, a wide range of solutions to the problems/issued identified in Cycle 1 should be considered.

### 4.1 A Précis of the Action Planning Cycle

*Within the action planning cycle, an iteration of the five cycles, diagnosing action planning, action taking, evaluating and specifying learning is performed.*

The action planning cycle (Cycle 2) follows on from diagnosis cycle (Cycle 1). This develops and explores various courses of action, based on this learning potential. These various courses of action are known as *learning scenarios*. Learning scenarios were based on data collected from students and lecturers on the potential for NM & NT in D and T education. This involved the following steps within Cycle 2:
2C1 - **Diagnose action planning:** the identity, nature or classification of the appropriate research tools to explore stakeholder capabilities with NM & NT;

2C2 – **Action- Planning:** planning how to use research tools identified above;

2C3 - **Action- Taking:** Using research instruments, interview and survey, to collect data;

2C4 - **Evaluate Action Taking:** Evaluate the potential for NM & NT derived from lecturer and student data and;

2C5 - **Specify Learning:** Specifying learning involves the researcher assessing the practical and theoretical outcomes from the action taking stage. This identifies “learning scenarios “for D and T education.

![Figure 10: The Action- Planning Approach in this Research](image)

4.1.1 **Diagnosing (2C1) and Action Planning (2C2) the Research Instruments**

This section links the potential identified in Cycle 1, to the Design School specific issues. To diagnose in Cycle 2 (2C1) means to determine the identity, of the appropriate research tools to plan some action. Appropriate research tools were lecturer interview and student survey. Reasons for using these methods were that stakeholders needed to be consulted on their
perceived competencies with $NM \& NT$. The potential (just-in-time delivery of learning and m-learning) can thus be investigated.

Action planning (2C2) in Cycle 2 plans how to use the research instruments in design and technology education. This means engaging with the stakeholders to find out from lecturers and students their competencies with $NM \& NT$. This section plans how to use the research instruments in D and T education, lecturer interview and student survey.

4.1.2 Action Taking (2C3): Research Methods Link Potential to Design and Technology Education

Next this research will describe action-taking within Cycle 2 (2C3 in section 4.1 above); operation of these methods; interview and survey (action-taking). According to results from the literature review, using $NM \& NT$ in education could provide an extendable model for education; but what do D and T lecturers think about that as an idea? Also, according from results from the literature review, the potential for $NM \& NT$ in D and T education lies in just-in-time delivery of learning resources. This suggests a need for mobile technology. Using a student survey allowed the collection of data from a wide user base, which gave some insights into whether students have potential for $NM \& NT$.

4.1.3 Evaluating (2C4) and Specifying Learning (2C5)

Within action planning metacycle, the cycles of diagnosing, action planning and action taking will have been performed. Once all the findings have been gathered and organised, they were evaluated (2C4). Specifying learning within the action-planning cycle involves building a model of the findings to help plan action. The tool of “Learning Scenario” was created for this purpose (2C5 in Chapter 6). The researcher wanted to have some idea of mapping the NT & NT to D and T education; in a manner appropriate to D and T stakeholders and education generally.

To conclude this section, the second cycle, **action-planning**, is a consideration of alternative courses of action required for the improvement or to solve the problem identified. These alternative courses of action are detailed in Chapter 6 called **learning scenarios**. Before creating learning scenarios it is necessary to link the potential for $NM \& NT$ to design and technology education specific issues. This involves research methods to consult D and T education stakeholders.
4.2 Gathering Data via Lecturer Interview

This section introduces the method of interview used to gather data. It justifies the use of this method and the aim of the interview questions.

At the outset it was not clear whether on the one hand lecturers in D and T were reluctant to embrace the benefits offered by \textit{NM \& NT} for D and T undergraduate modules, or on the other hand, whether they were simply unaware of them. Interviews were conducted to solve this puzzle. Interviews were also used to assess lecturer ability to use \textit{NM \& NT} in D and T education. Further action would depend on the outcome of these interviews and the reasons given for lack of deployment of technology in learning.

4.2.1 Rationale for the Interview

Interviews were conducted with D and T lecturers, to establish where there might be potential for \textit{NM \& NT}. Interview is a popular method in action research. Interviews were used at this stage, because, as Stringer (2007) notes; “primary data in action research are derived from interviews with primary and key stakeholders” (p.7). The interview, as well as asking questions of lecturers, also introduced lecturers to the potential for \textit{NM \& NT} for D and T education, in particular, RSS, wikis and blogs. Once they had these technologies explained to them, lecturers were asked whether they thought these technologies would be useful.

Why conduct an interview study? The results from literature review suggested that there was potential for \textit{NM \& NT} in D and T education, but conversation with lecturers would reveal in-depth perceptions on technology for learning. Interviews provided some in-depth information as to lecturer competencies and perspectives on using \textit{NM \& NT} within their own School. Linking the potential identified in Cycle 1 to design and technology issues was therefore possible. It was envisaged that lecturers would have some clear ideas about \textit{NM \& NT} and so interviews would be the best way to elicit that information.

4.2.2 Interview Aim

The purpose of interviewing D and T lecturers was to ascertain:

1. Lecturer knowledge of \textit{NM \& NT}, such as wikis. If they were unfamiliar with \textit{NM \& NT}, then introduce them and find out whether they thought it might be useful for their modules.
2. Pinpoint which modules would be appropriate for the implementation of $NM$ & $NT$ within the Design School;

The results from the interview inform the next stage of the research. Through action research, the interviews with lecturers informed organisational action within the Design School. The remainder of this chapter will investigate action-taking through interviews, gathering data on the D and T specific context.

### 4.3 Interview Questions and Motivations for Them

This section lists the interview questions and the rationale for asking those questions; such as to find out the extent which they use the learning technology, Learn@Lboro learn server.

Thus the purpose of interviewing lecturers was twofold. First, an assessment of lecturer familiarity with $NM$ & $NT$ would offer some starting points for further action and research. Knowledge of what works for lecturers and what does not, was hard to determine at this early stage. Secondly, the purpose was to get to know the stakeholders, and describe to them types of NM &NT. Thus a short interview schedule was devised to loosely structure the interview, with the following 9 questions.

#### 4.3.1 Overview of Design and Technology Modules and Their Assessment (Qs 1 – 2)

These general questions were enabling the lecturer to ease into the interview, with closed ended questions they knew the answers to. The first question;

1. Which Course Modules do you administrate / teach within the Department of Design and Technology?

The first close-ended question provides an overview of the type of work that the lecturers do, identifying which modules they administrate and teach. This simple question was designed to make the participant feel at ease. Also if they had a large number of modules to administrate and teach, they might require help, providing a way in to explore $NM$ & $NT$.

2. How are those modules assessed?

This question was designed to find out why a particular module was assessed in a particular way; results which inform how $NM$ & $NT$ might be useful for assessment. Identifying how they are assessed would provide an insight into whether the modules were portfolio-based, or exam and/or essay-based. So, whether the assessments were group or individually assessed was an issue, as this could affect which type of $NM$ & $NT$ was most suitable to introduce. So,
for example, a wiki is a type of new media which lends itself to being used by a group of students. The results from this question could indicate that wikis were more suitable, if the module predominantly contained group assessment.

4.3.2 Extent of Knowledge, Familiarity and Use of NM & NT for Modules (Qs 3 – 5)
The purpose of asking the lecturers about the learn server and then RSS, Wikis and blogs was to find out lecturer knowledge and familiarity with these technologies.

3. Do You Use the Learn Server for those modules? If so to what extent?
The third question concerned the use of the learn server and the extent to which lecturers used it for teaching their modules. Once they answered this question, a follow up question identified what kinds of new media they used it for. The purpose was to introduce the learn server as a form of teaching technology and find out what they thought about it.

4. What would encourage you use the learn server more?

Designed to probe lecturer opinions into using the learn server for administration of their modules, the purpose of this question was to find out whether lecturers had ideas on how it could further teaching goals, which were not currently being addressed.

The learn@lboro server has blog, RSS and wiki capabilities, and claims to be a comprehensive V.L.E. This question clarified whether lecturers were aware of NM & NT and if they knew what it was.

5. Have you ever used:
   (a) Wikis
   (b) blogs
   (c) RSS feeds

The fifth question was thus kept closed-ended to introduce the lecturers’ to examples of new media, wikis, blogs and RSS feeds, where they had no idea what they were. If the lecturer was not sure, a demonstration was offered through screenshots of RSS, wikis and blogs.

4.3.3 Successes and Scenarios for Using NM & NT for Modules (Qs 6 – 9)
The purpose of questions 6 – 9 was to consult with the lecturers on learning technology; their successes, scenarios and ideas.

6. What has been your most successful experience of using technology, such as computers, for your course modules?
This open-ended question identified the lecturers’ thoughts on aspects of technology which have worked for teaching goals in design and technology undergraduate education. This would reveal positive features in exploring the potential for NM & NT in D and T education.

7. What has been your least successful experience of using technology for your teaching?
This open-ended question was designed to find out lecturer insights into particular programs and applications they have found unhelpful in their goals of teaching design and technology undergraduate education.

8. Are there any scenarios you can think of where technology, such as computers or mobile phones, would not be suitable for learning?
Question 8 motivated lecturer responses; where they thought technology would not be suitable for modules within the Design School.

9. Do you have any ideas on how the departmental efficiency could be increased with technology, such as computers or mobile devices?
The purpose of Question 9 was to get a sense of areas which benefit most immediately from introducing NM & NT to them. This researcher was keen to introduce NM & NT to the Design School, in a manner helpful to lecturers, as well as students. This section has identified the rationale for the questions in the Interview Schedule (see Appendix VIII: Interview Schedule), and has justified why interviews are the most appropriate method to answer the questions identified.

4.4 Conducting the Interviews

This section covers conducting the interviews with Design and Technology lecturers and introduces how these interviews will be analysed: through thematic analysis.

Methods were sought that would encourage lecturers to communicate about their use of new media, such as websites for their own research. It was hoped that this stage would diagnose some problems/room for improvement where NM & NT could be useful to staff and students within D and T undergraduate education. Interviews of primary stakeholders, D and T lecturers, will assist with these questions. A corpus of data will allow us to plan how to address this issue.

4.4.1 Conducting the Interviews: Participants and Materials
Six interviews were collected with six lecturer participants, and nine open-ended questions were devised in advance (see section 4.3 above), although the interviewer asked many follow
on questions. The reason for six participants lay with the fact that these six participants undertook 80% of undergraduate teaching and seemed willing to be interviewed. A minidisk recorder was employed in the task of recording the verbal interactions between researcher and participant. The interviews revealed lecturer’s attitudes to "social software", in particular wikis, blogs and RSS feeds. Six open-ended interviews were conducted in the lecturers’ own work environment, and were designed to find out their views on technology in a learning context.

4.4.2 Procedure and Analysis: Transcript Analysis via Thematic Analysis

The interview transcripts were analysed using thematic analysis. Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data. Interviews with lecturers could diagnose some problems in relation to the potential for NM & NT.

Analysis of interview transcripts used thematic analysis. This method of analysis involves the identification of recurring themes within the dataset. A theme captures something about the data in relation to the research question, and represents some level of patterned response or meaning within the data set (Braun & Clarke, 2006). This method organizes and describes your data set in detail. In some cases, it extends further than this, and interprets various aspects of the research topic (ibid).

4.5 What is Thematic Analysis?

This section introduces thematic analysis, and describes how it operates.

The aim of thematic analysis is therefore to seek reoccurring themes which lecturers in D and T raise regarding technology for learning. This section describes the method step – by step, and applies it to our corpus of data; design and technology lecturers.

4.5.1 A Step-by-Step Guide to Thematic Analysis

Thematic analysis follows these stages:

Step 1 - Familiarise with data: transcribing and reading, noting ideas (See Appendix VIII: Interview Transcripts);

Step 2 - Generating Codes: Organising data, creating codes (Appendix IX: List of Codes);

Step 3 - Searching for themes: Coding data and collating codes into themes (Appendix X);

Step 4 - Reviewing themes: Checking consistency of themes against coded extracts and the entire data set, generating a thematic ‘map’ of the analysis (S.4.2.3).
Step 5 - Defining and Naming Themes: Refining themes into the story the analysis tells.

Step 6 - Producing the Report: Analysis report which relates analysis back to research questions, and picks out useful extracts. (See Appendix XI: Participant Summary and Thematic Analysis Report). The thematic analysis results are summarized below.

4.5.2 How is Thematic Analysis Done?
In order to generate clarity, thematic analysis uses specific terms that may be unfamiliar. For example, data corpus is all the data collected for a research project, and a data set is data from that corpus used for a particular analysis. So, for example, a data set will be collected through identifying data items which help to explain why there has been no or little uptake of NM & NT for D and T education. A data item is an individual piece of collected data (part of set). Data analysis can involve a rich description of a data set (looking at bigger picture, macro analysis) or detailed account of one aspect of the data (focussing in detail on particular data item, micro analysis), depending on the research objectives.

4.5.3 Applying Thematic Analysis to This Corpus of Data
Six lecturer interviews were transcribed. This section provides insight into how the codes were developed; the following steps were undertaken;

Step 1 - Familiarise with data: The first step involved transcribing the data in Word and adding line numbers.

Step 2 - Generating Codes: The second step involved deriving 36 reusable codes; these were from the literature review, which assessed the potential for NM & NT for learning generally. Appendix X contains the codes which allowed a thematic analysis, for example “NEG” is where there is evidence from the participants of a negative view of technology.

Step 3 - Searching for themes: this search applied the codes to the transcripts. Next to comments made by the lecturers a code was placed on the transcript page, Please see Appendix X for a rundown of the full transcripts used. Figure 11 demonstrates transcript with codes.
The codes were collated in Excel and looked for a number of themes. The more instances of a code the more likely it would form part of a theme. Major themes identified included, “Reasons for Little research of NM & NT in D and T Education” Whether a major theme was apparent was based on the number of instances of particular codes in the transcripts.

<table>
<thead>
<tr>
<th>No. of Codes</th>
<th>Meaning of Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 30</td>
<td>Major Themes</td>
</tr>
<tr>
<td>10 – 20</td>
<td>Secondary Theme</td>
</tr>
<tr>
<td>0 – 10</td>
<td>Not a Theme</td>
</tr>
</tbody>
</table>

Table H: Identifying Major and Secondary Themes in Thematic Analysis

Step 4- Reviewing themes: A concept map was drawn up from the findings (section 4.2.3). Some codes did not relate to a theme but instead answered a specific question in the Interview Schedule. Some themes were more prevalent than others, for example, in terms of student learning habits and lecturer teaching habits. Specific examples of these themes were ones which were related to technology for learning in some way.

Step 5 - Defining and Naming Themes: Drafting an overall story from the themes, paying particular attention for where there are problems in D and T education and/ or room for improvement where NM & NT can be used (section 4.4.1).
Step 6 - Finally, useful excerpts are extracted to help understanding of the potential for NM & NT in D and T education (section 4.5) The next section summarises these themes from the interview schedules to show potential for NM & NT in D and T education.

4.6 Interview Results

This section describes the results from thematic analysis.

This section details the results of the lecturer interviews, the themes found and presents this data as a concept map. A more full thematic analysis and participant summary is contained below. This section summarises the responses to Questions identified in Section 4.3 above. The process for results was:

1. Summarise the Participant responses in a table.
2. Derive codes from this table on D and T education and from literature review on potential. Codes were generally positive, neutral and negative aspects of NM & NT.
3. Identify number of instances of codes in the interview transcripts.
4. Defining and naming themes.
5. Revise codes into major themes or secondary themes based on number of codes identified, and create a Thematic Analysis Map (section 4.6.1).

This approach to results gave in-depth data on potential from lecturers of NM & NT for D and T education context.

The results were very helpful in diagnosing potential for NM & NT in D and T education from the lecturers’ perspective. The results are following secondary and major themes:
4.6.1 Design and Technology Modules and Their Assessment (Qs 1 – 2)

In questions 1 – 2, lecturers provided an overview of Design and Technology Modules and their assessment. The purpose of finding out the module assessment procedure was to establish useful areas where NM & NT might be appropriate. This allowed this researcher to investigate the potential for NM & NT in D and T education, as different types of NM & NT were suitable for different types of assessment. The results from this question could indicate that for example, wikis were more suitable, if the module predominantly contained group
assessment. There was an even mix of group, continuous, individual assessment which suggested use of a variety of different types of assessment.

4.6.2 Extent of Knowledge & Use of NM & NT for Modules (Qs 3 – 5)

The results from Questions 3 – 5 indicate that, the extent of knowledge, familiarity and use of New Media & New Technologies by lecturers was minimal overall. Question 3 concerned the use of the learn server and the extent to which lecturers used it for teaching their modules. Once they answered this question, a follow up question identified what kinds of new media they used it for. The results showed that lecturers did not feel they had the time to get to grips with all the New Media functionality available on learn@lboro. Not all lecturers were comfortable with using the learn server, so it could be assumed that if they did not want to use this, they would be uncomfortable with using NM & NT for learning.

Question 4 asked lecturers what would encourage them to use the learn@lboro V.L.E more. The aim was to find out whether lecturers had ideas on how it could further their own teaching goals. However, even the most technologically-savvied lecturer admitted that s/he found that getting the information on Learn “a pain”.

Question 5 on whether lecturers were familiar with Blogs, Wikis and RSS was closed-ended to introduce the lecturers’ to examples of new media, wikis, blogs and RSS feeds, where they had no idea what they were. All of the lecturers were unsure what these were, so a demonstration was offered through screenshots of RSS, wikis and blogs. Part of the purpose of the interview was to find suitable modules to use NM & NT for learning. When considering which modules of D and T education would benefit from the introduction of NM & NT, not many of the lecturers had heard of blogs, wikis and RSS. However, many thought RSS would be useful. There was less enthusiasm for wikis, one lecturer even thought they might be “dangerous, as you have no idea whether the information you have collected is correct or not (participant 3)”.

4.6.3 Successes, Scenarios and Ideas for NM & NT in Modules (Qs 6 – 9)

Questions 6 – 9, revealed results which successes, scenarios and ideas for using NM & NT for modules emerged. For example, lecturers thought RSS could be useful potentially for their modules. Some problems which NM & NT could cure include students using dubious resources from websites. Results from questions 6 and 7 concern successful and unsuccessful
uses of technology for learning. Successes include dissemination of learning resources using learn@lboro and unsuccessful experiences included the time to learn how to use NM & NT.

Question 8 found out whether there were any scenarios where NM & NT not suitable for learning, lecturers claimed that students “hid behind computers when they could not draw” and “design is visual not text based”. Results for Question 9, lecturers had ideas for departmental efficiency, some technological (“a way of accessing easily a large repository of images”) and some more associated with module administration.

4.7 Interview Analysis

Once the coding was done, the procedure was to gather together the instances of the data items, and collate them into themes. Themes were collated which illustrated where there was potential with NM & NT. The key aspect of analysis was to show a relationship, and link with literature review from the previous chapters, and the research objectives.
THEMATICAL ANALYSIS

MAJOR THEMES

SECONDARY THEMES

LECTURER THEMES ON NM & NT POTENTIAL

- REASONS FOR LITTLE NM & NT UPTAKE
- LECTURERS DO NOT KNOW HOW TO USE NM & NT
- DESIGN & TECH EDUCATION NOT NM & NT BASED
- RSS SEEMS MOST USEFUL TO LECTURERS
- LACK OF TIME & RESOURCES
- MODULE ADMINISTRATION ISSUES
- LECTURER ENVISAGES EDUCATIONAL POTENTIAL
- LECTURERS FACE TECHNICAL ISSUES
- NEGATIVE COMMENTS ON THE LEARNSERVER
- STUDENT LEARNING/LECTURER TEACHING HABITS

Figure 12: Map of Thematic Analysis
4.7.1 Exploring Secondary Themes Further

This section takes the thematically analysed data and derives one data set in particular, which can suggest reasons for why there has been little uptake on *NM & NT*. A reminder; a data set is data from corpus data used for a particular analysis. This data set includes **Secondary Theme A**, exploring reasons for little uptake of *NM & NT* in D and T education.

**Figure 13: Lecturer Reasons for Little Uptake of *NM & NT* for D and T Education**

Secondary Theme D, concerns Module Administration Issues. The ways in which lecturers perceive the way D and T modules should be administrated is a barrier to the implementation of *NM & NT* for D and T education: “Extract 1: P1. You need individual feedback from the lecturers unfortunately”. The context of this quote was in relation to the fact that D and T education is very much hands-on. Course administration issues can relate to the fact that lecturers have got into a habit of administrating a course in a certain way; the introduction of *NM & NT* would alter the method of administrating the course. This section demonstrates rich data obtained from lecturers to diagnose the potential for *NM & NT* on D and T undergraduate education. This helped the research to progress through identifying, in particular:

- Student learning habits, lecturer teaching habits and D and T Education
• Educational potential and possible benefits

• Lecturers not sure how to use NM & NTs

So to summarize, it seems that there are varying levels of ability and enthusiasm for using Learn@lboro among the sample of lecturers interviewed. In addition, there are different requirements which are factors of the very different styles of teaching. This makes it challenging to devise a ‘one size fits all’ solution. A tool should be developed as a way of tackling the heterogeneity of these problems.

4.8 Results from Design and Technology Lecturers

This section concludes the research identifying the potential improvement where new media and new technologies can be of use to D and T education.

The purpose of interviews was to identify some general points which emerged in diagnosing where the potential for NM & NT in D and T education lies. Using thematic analysis was a success; not only did it offer areas of potential for NM & NT, but it also revealed why there was little uptake of NM & NT in D and T education. This section concludes on what emerges from this chapter to help the research move forward.

4.8.1 Lecturer Scope for NM & NT in D and T Education

Section 4.6.2 above contains the thematic analysis map. This was used to make decisions on what technology for learning lecturers were most comfortable using; email emerged as the main type. There seemed to be much negative feedback on the learn server as a way of administrating design and technology specific information. This was often due to technical issues such as lack of support for image sizes.

Why was there little uptake of NM & NT amongst lecturers, and what problems/ room for improvement could be envisaged? The lack of uptake of NM & NT for learning identified in chapter 4, led to conducting interviews with lecturers to find out why. The interview responses to implementing technology for learning such as blogs, and RSS feeds was favourable, despite many of the lecturers having just encountered them for the first time during the interview. However, emphasis was made that they would not like to use something which made more work for them.
4.8.2 Towards Achieving Research Objectives

The results from the interview question 1, identified which modules lecturers administrate and teach. From the results of this question and from the interviews it was possible to get a sense of which modules might benefit from the introduction of \textit{NM & NT}. Four D and T modules were identified where implementing \textit{NM & NT} would be of use; Internet and Interfaces, Foundation Technology, Sustainable Design and Dissertation. Useful interview excerpts are extracted to help point the research in the right direction:

1. Email is most successful use of technology for lecturers (but they receive lots of confusing emails from students which need managed);

P3. Yes I think the learn servers covers more or less with the exception of sending out the information to the student, its’ just sitting there waiting for the student to go to it. So I think if it was more proactive then that’s a good thing, especially for some students who say their email doesn’t work, it’s actually being texted to their mobile or whatever

Thus if \textit{NM & NT} could manage emails and make this technology more successful, it would be in keeping with D and T lecturer existing practices and not require a new learning curve. The learn server seems to be a large enough learning curve without introducing other technologies to confuse the situation. This lecturer was technologically competent and had video demonstrations on learn@lboro.

2. The success of the learn server was qualified (by stating that students still need to be "spoon fed" with lecturers), and that you cannot rely on \textit{NM & NT} on its own.

P1. There are videos on the learn server with step-by-step instructions on how to create and do things, yet the students still want to be told with a lecturer standing at the front of them and repeating exactly what’s on the learn server, - infuriating - even though they all work at different speeds so one person is going to be struggling and another finds it boring - and that’s why it’s on the learn server so they can do it in their own time. Yet they don’t seem to be in that frame of mind to do it themselves. - in terms of mobile phones or whatever it’s still a technological and educational barrier as they haven’t been brought up that way - they have been brought up to be spoon fed.
3. Lecturers would like to be able to control the content of the Internet resources which students see, to stop them from using dubious sources from the web.

P3. I think definitely in the sustainable design module because it is something that is changing all the time so if there had been a government conference you could get the latest information. And the students do use the web a lot for their research, which is ok to a certain degree but it would be good if I could control the content of it; they put sustainability into Google and they use anything from there without looking at the quality of the source so being able to control the content if that would be possible would be quite good. so that could be linked to a special search engine then they only went to things that got my approval. bit big brother I know but...

As we have seen, analysis raises a number of problems, and these tend to cluster around individual staff. We have seen how a number of things present obstacles for lecturers: Other findings included:

- **Speeding up the process of marking might be useful, through providing a repository of images**
- **Getting stuff on Learn Server “a pain”**
- **Most felt RSS, wikis and blogs would be useful but didn’t know how to operate**
- **Nearly all participants mentioned email as a successful technology for learning and module administration issues.**
- **Lecturers are not really using new media for their own research.**

4.9 Conclusion

*Lecturer interviews revealed some promising areas for NM & NT in D and T undergraduate education.*

This chapter has involved some researchers in the process of exploring the potential for *NM & NT* in D and T education. It was possible to identify modules which might benefit from *NM & NT*. But before we can implement them on the modules, we need to find out whether
students on those modules possess technology and skills to be able to learn with NM & NT. There is considerable educational potential for NM & NT, which lecturers themselves identified in lecturer interview. However, the technology which is of most benefit to lecturers might not be of use to students. Research from the Literature Review, Chapter 3, (Trinder, Magill, and Roy, 2005), suggests that if the students own the device themselves they are much more likely to use them for learning. But do students possess suitable technology to be able to access new media related to Design and Technology subjects? The next chapter aims to find out.
5.0 Introduction

This chapter continues the action planning cycle of the research by looking at students’
perceptions on NM & NT for D and T education.

The last chapter engaged with lecturers’ views on technology for learning. Some crucial
possibilities were identified, but before this potential is realised, student perceptions will be
surveyed. This chapter continues the action – planning cycle by reviewing students’
competencies with NM & NT, and whether they perceive them to be useful for design and
technology education. Thus, this chapter focuses, in particular, on students’ perceptions of,
and technological competencies for using mobile devices for learning.

The aim is to explore the potential for NM & NT in D and T undergraduate education. In
particular this chapter relates to the following objective: Objective 6: - “To investigate the
potential of New Media and New Technologies (NM & NT), assessing the simplest, low
cost and most efficient way to deliver NM & NT to stakeholders of design and
technology education.” The previous chapter investigated potential for NM & NT in D and T
education, by interviewing lecturers. This chapter will attempt this also by surveying
students.

5.1 Gathering Data via Student Survey (2C3)

This section identifies why a questionnaire was used to diagnose potential for NM & NT in D
and T education. It sets out the aims and rationale for using this method.

Surveys and questionnaires are a good way of gathering a broad base of information from a
wide range of participants. They are not as exploratory as interviews, but they can provide a
rich set of data, depending on the type of questions asked. Use of questionnaire in action
research has been performed by Evans (2007) and is an appropriate method because it can
reveal data on student perceptions, technological competencies with NM & NT in education.
Ten questions were asked of the students in quantitative and qualitative forms (see Appendix
XII: Student Questionnaire Schedule) which discovers:
a) Which mobile devices do students own and cost implications for using mobile devices;

b) Students existing competencies and student preferences with mobile devices;

c) Student ideas on using NM & NT in the Design School.

5.1.1 Rationale for Survey

Surveys are a quick way to derive a relatively large amount of data from a participant group. Gathering data from a Foundation Technology module would help to plan, firstly, whether students on this module had the technological devices, and secondly, what they thought about using them for this module. If NM & NT were to be placed on this module, Foundation Technology, this researcher needed a quick way of finding out from a large population of students their capacity for, and perception of, using NM & NT for design and technology education. The aim of this questionnaire is to elicit:

1. **Student perceptions** of using NM & NT for learning D and T education, and;

2. **Technological prowess** of using different types of mobile devices.

3. **Potential cost implications** and whether students owned mobile devices.

Questionnaire data would allow an appropriate review of student capabilities as stakeholders and beneficiaries.

5.1.2 Participant and Materials

This section details the participant and materials used to analyse data from the questionnaires. The student participants were first year Design and Technology students studying the Foundation Technology module. This module is unique in that it has three core components, electronics, mechanics and materials.

Materials used were a paper questionnaire and SPSS software. The paper questionnaire informed students that; “this questionnaire is designed to gauge your response using mobile devices for learning. This information will be kept confidential in line with laws on data protection”. The schedule of questions asked is contained in Appendix XII below. Students were asked during the Foundation Technology lecture to complete the questionnaire, the results were then collated in SPSS. The full SPSS outputs for the results are contained in Appendix XIII below. There were 98 questionnaires collected from Foundation technology lecture but only 97 were usable.
5.1.3 Questionnaire Procedure and Analysis: Reusing Codes Identified from Literature Review

Students were asked during the Foundation Technology lecture to complete the questionnaire, the results were then collated in SPSS. The full reports for the results are contained below. Thematic analysis was used to analyse the questionnaires; this relied on the reusing of codes which were identified in the literature review, and used to analyse the lecturer interviews in the previous section.

Previous study from the literature review derived codes to help investigate the potential for NM & NT, such as blogs and mp3 players. These were used discuss the thematically analyse lecturer interviews in Chapter 4. This format of analysis will be used for the student questionnaire. Questions asked relate to the following NM & NT:

New Media: Blogs and Photos from Mobile Phones (MMS) and;

New Technologies: Streamed Lectures on the learn@lboro virtual learning environment and types of mobile devices.

Analysing questionnaire data would provide some insight into which learning scenarios were most appropriate to take to the next cycle, action-taking. One way of devising these scenarios was to look for similarities between lecturer interviews and student survey. Looking for some of the codes used to analyse interviews in the questionnaire data would help to find some similarities. Appendix IX: List of Codes contained a full list of all of the codes derived.

Previous research identified from the literature review indicated that consulting stakeholders on learning scenarios could provide useful data. Therefore a questionnaire was constructed to find out whether D and T students of a Foundation Technology module could contribute to establishing where NM & NT could be of most use to D and T education.

5.2 Survey Questions and Motivations for Them

This section highlights the features of the questionnaire, in particular, the questions and rationale for them.
Students were asked about using NM & NT for learning D and T. The aim was to find out their technological capabilities and desire to use mobile technology for D and T education. Questions were designed find out whether implementing NM & NT on a Foundation Technology module would be feasible.

5.2.1. Overview of Participants (Questions 1 - 2)
Questions 1 and 2 were designed to elicit standard data on age and sex. Ethical procedures were observed to ensure that all students taking part were above 18 and in the responses there was not a significant lack of technological competence by females or by males.

5.2.2 Mobile Device Types and Features Used (Questions 3 - 5)
Question 3 concerned the type of mobile devices the students used, where students could select the appropriate type (a) – (f):

a) Mp3 players
b) 3G mobile
c) PDA
d) Smartphone
e) Pocket PC
f) Other

This was a generic question to get data on the different mobile technology students owned; for example, did they all have technology for podcasts? The results would help understanding of students’ own devices. This would give an indication of what they are familiar with using. Question 4 aimed to find out whether students were on contract or pay-as-you-go (hereafter PAYG). The results tied into cost implications for this scenario as text message prices were different depending on whether the student used PAYG or contract. Also, finding out when the contracts expired allowed me to think about future use by participants of mobile devices for learning D and T education.

Using photos and videos for D and T education would require some technical knowledge by the students, on how to use features, such as camera on their mobile phone. The extent of student use of the features of their mobile devices would help to devise scenarios in keeping with student’s current habits of use. Question 5 identified, in particular, whether students used telephone calls, text, photo, audio (e.g. Mp3) and video, and if so how often. The aim
was to find out if students used the features of their mobile devices either daily, weekly, monthly, rarely or never.

5.2.3 New Media & New Technology Scenarios: Student Drawbacks, Opinions and Attractions (Questions 6 - 9)

The literature review identified the following promising new media and new technologies: such as blogging, and using audio visual tools, such as mp3/mp4 devices. Question 6 thus asked: “Which type of scenarios would you engage with your mobile devices?” Scenarios in m-learning applications can provide a blueprint for this research. Danielsson, Hedestig, Juslin and Orre (2004), also use the concept of scenarios in participatory design in m-learning environments. They discuss various NM & NT scenarios with the students. The students discuss the issues presented in a matrix on whether technology scenarios were public or private. (This research also uses a “Drawbacks Matrix” to make themes for different types of student’s negative responses to m-learning).

In terms of where the ideas for scenarios came from, the following authors from the literature review helped create this question

- (a) Streamed lectures on learn server for your mp3 player (Smeaton and Keogh 1999);
- (b) Sending photos for group work (Seppälä, 2002);
- (c) Quizzes on coursework (Colley and Stead, 2004);
- (d) Mobile text blog (Trafford, 2005);
- (e) Other;

Thus Question 6 asked the students directly on whether they would use their mobile device for D and T education: the answers to this would help to review potential NM & NT, which students want to use. The rationale for asking about these types of new technology relates to the new uses of these technologies in education, and whether Design School students could support them.

Question 7, 8, and 9 asks for the students’ perceived drawbacks, opinions and attractions of using NM & NT for D and T education. The rationale for these questions was to engage with the students’ own ideas for how mobile technology could be useful to them. Question 10 asked what would be the attraction(s) of learning with a mobile phone etc that would make the student want to use their mobile device(s) more. Students were asked during the Foundation Technology lecture to complete the questionnaire, the results were then collated.
in SPSS. Descriptive statistics were run on the data (see summary table). Full SPSS outputs for the results are contained in Appendix XIII below.

5.3 Survey Results: Student Technological Capabilities with Mobile Devices

This section highlights the results from student questionnaire investigating their potential for NM & NT in D and T education.

By reusing the codes in the interview chapter, (Chapter 4) which were developed from the literature review, it is possible to get an insight into student perceived potential for NM & NT in D and T education. Some of the codes are not relevant to questions 1 – 5 of this questionnaire which focus on the technology which students possess. The raw SPSS outputs are contained in Appendix XIII of this thesis.

5.3.1 Analysis of Questions 1 – 2 on Participants

The students were requested to identify themselves with their Student ID number. The rationale for this was to identify the individual with the particular device they were using for future research projects. In practice only 39 out of the 97 surveyed supplied this information. Questions 1 and 2 of the questionnaire concerned age and sex. So 67 males and 30 females responded to the questionnaire. The average age of the students selected was 18.7 years old.

5.3.2 Analysis of Questions 3 -5 on mobile device types

The percentage of student owning the specified device highlighted in the results below. This information was useful to find out whether their students had mobile devices which could be useful for exploring the potential for NM & NT in D and T education. Also the results indicated the type of mobile device which the students owned.

- 70% said they owned an mp3 player
- 13% said they owned a 3G Phone
- 3.1% owned a PDA
- 17.5% owned a smartphone
- 2.1% owned a pocket pc
- 6.2 % Other Device, such as Minidisk Players
- 64% Mobile Phone
All students surveyed owned a mobile device of one sort or another. It should be noted that as many student either did not own, or were unaware whether they owned a 3G mobile, their answer was to write “mobile phone” in Question 3(f) below. Any future exploration of NM & NT in D and T education, will take place in the knowledge that students mostly own some kind of mobile phone and an mp3 player. Question four identified the type of service they used for their mobile phone. Students who were on PAYG Tariff were separated from those on contract. This data was collected with a view to identifying potential students with device constraints that would prevent them from accessing learning resources. To download learning resources costs per Megabyte. This cost varies between devices.

**Figure 14: Type of Service of Mobile Device; Contract or Pay- As – You- Go (PAYG)?**

As Figure 14 demonstrates, there were a larger number of students on PAYG. The pie chart below demonstrates the results of this question; that more students are on PAYG than on contract. This question provided information as to costs for m-learning in D and T education. To pursue any scenario involving texts and MMS, funding will have to be provided to students.

Question 5 was designed to ascertain how often the students used the features of their mobile devices. The rationale was to identify how familiar students are with features such as texts. Table I contains results for Question 5 in percentage. It is possible to identify a pattern of use of mobile technology. Identifying this pattern of use, it is possible to identify features of mobile technology with students will be comfortable using. As JISC (2005) note, implementing new technology for learning depends on whether one wants to take students out of their “comfort zones”, using technology they may not be familiar with. This was by assessing the students’ familiarity with those features, voice calls; text; photo; audio and video. The responses are on a likert scale on how often students used the features, “daily”, “weekly”, “monthly”, “rarely” or “never”. Where the students left the question blank or wrote “N/ A”, this was interpreted as null value represented in the coding as “0”.

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5.3.3 Implications of Questions 5 for Potential for Mobile Learning

Question 5a and b reveal how often Foundation Technology students text or call with a mobile device. Students use text and phone calls daily according to the results, but that is expected and correlates with previous literature (Haste, 2000). A recent survey by Mori found that this was the predominant means of communication between 16 – 19 year old young adults (Haste: 2000). Students in this survey (95%), admitted to text daily, rather than making voice calls (78%).

The second interesting result is that of respondents used photo capabilities of their mobile device weekly. This is an encouraging number of respondents who appear familiar with the ability to use photo features of their device. The results from question 5c suggest that 43% and students use their photo capabilities of their mobile device weekly. Only 10% use it daily; however if over half the students are using this feature of the mobile device regularly then it has potential which could be explored in design and technology education. Photos taken with mobile devices could be exploited for D and T education, as most students are familiar using it on a regular basis.

5.4 Survey Results: Student Perceptions on Scenarios with Learning Technology

Questions 6 – 10 ask student opinion on NM & NT scenarios, and finds out student preferences for different scenarios.
Student participants identify some drawbacks, opinions and attractions. This section identifies student perceptions on drawbacks, attractions and ideas for m-learning in the Design School. These were coded into major themes. Question 6 results demonstrate the type of scenarios that students would like to see supported with m-learning. These four scenarios were investigated through Question 6 a) – f). The results were:

1. **Streamed lectures on learn server for your mp3 player**: 38% stated though streamed lectures were a good use of mobile technology for learning.

2. **Sending photos for group work**, 54% students thought using mobile phone photos for collaborative work would be a good learning scenario. Around 53% of students use photos on a regular basis, so this seems like a promising technology to explore.

3. **Quizzes on coursework**, 18% thought using mobile technology for quizzes on coursework was a good idea and;

4. **Mobile text blogs**. 26% of the students surveyed thought that using mobile technology for blogs was a good idea.

### 5.5 Survey Analysis: Student Ideas with Mobile Technology in Design and Technology Education

Question 6e asked whether students had ideas for where mobile technology would be useful for D and T education. Overwhelmingly, **73% of students** answered this question. The responses were coded according to the major themes of comments. Just under half of students surveyed wanted to be notified via mobile technology of timetable changes. A quarter of students thought that module deadlines and general updates delivered via mobile phone was a good thing. Most of the responses concerned mobile phone technology relating to two themes:

1. **Module Administration Issues**
2. **Departmental Efficiency**

#### 5.5.1 Module Administration Issues: Timetable Changes and Module Deadlines

- 42% of students express interest in being texted when there has been a timetable changes, such as cancellations. Examples of comments made on this topic include;
  
  "wap timetable, lecture time changes, lecture reminders, cancellations, sometimes emails are too late".
• 23% students wanted to be texted module deadlines reminders. Examples of comments made on this topic include:” text alerts for homework”; coursework reminder”; hand-in reminders”.

5.5.2 Departmental Efficiency: Mobile Updates for Students
An example of departmental efficiency theme was where mobile technology could be used; “as a sign-in device for lectures”.
There were more creative, futuristic ideas for how mobile technology could be used for D and T education, and also a few negative responses.

23% students would like more general module information delivered to their mobile devices; in particular, test results were mentioned a few times; “automated notices from lectures, test results, notification of incoming emails, mobile correspondence with tutors, sending text to their computer, daily updates in the design world”.

There were only 15 comments which did not fit into the above categories, they were coded as:

a) Negative comments on technology for learning: “It’s a personal device not for work”.

b) Technical issues; “no signal in my room”.

c) Student learning habits; “writing down notes, inspirational ideas; available books in the library; communicating for group work; I record lectures on MD [Minidisk] it allows me to pay attention rather than take notes and it allows me to revisit them”.

d) Educational benefits/ potential memory pen; taking pictures of products; take pictures to sketch; video; video conferencing”.

5.5.3 Drawbacks, Opinions and Attractions
This section reports results on drawbacks to using mobile devices for learning. Opinions and attractions are also made. Out of those that responded, 66% identified drawbacks to mobile
technology for D and T education. The codes which were most relevant to this section include:

- Technical Reasons
- Cost
- Student Learning Habits
- Negative Comments on Mobile Technology for learning

Also following Danielsson et al., (ibid), provided authority for consulting with the learners on learning scenarios which was worthwhile in exploring the potential for NM & NT n D and T education. Focussing on the need to integrate private use of personal technologies into university learning settings, this research concluded that learner- centred design was most effective when the goal is to help learners learn new learning practices. This work helped this research develop a “Drawbacks Matrix”; this provided a good way of understanding questionnaire data. This drawbacks matrix separates the identified drawbacks further, into interaction problems, hardware drawbacks, health, social and other drawbacks. The codes which were most relevant to the responses on opinions for this were:

- Student learning habits
- Positive re: mobile technology for learning
- Negative re: mobile technology for learning
- Educational Potential
- Technical Issues
- Reasons for Little Uptake

Only 39% of students replied to this question. 34% of these responses were negative. Reasons for a negative response were based on technical issues and student learning habits. So for example, negative responses citing technical issues of mobile devices; “too small to access detailed info; a lack of battery and memory would hinder”. Negative comments where student learning habits were cited include;
“...not really good as don’t want to sit and learn round a small mobile screen; liable to forget mobile; blur boundaries of social and work”.

There were a small number making a general query on who would bear the cost for the m-learning. Also some students offered reasons for little uptake of mobile technology for learning; “I would imagine that streaming lectures would decrease the number of people turning up to them”. Lastly, only a few students had opinions on the educational potential of mobile technology for D and T education.

Identifying attractions to using mobile technology could give direct results on potential for mobile technology in d and t undergraduate education. But in practice only 47 out of 97 students answered this question. The codes used from this section included:

- Student learning habits
- Module administration issues
- Technical issues
- Educational benefits
- Design and Technology education specific comments

Nine students highlighted educational benefits of “ease of use”, and easy to access as an attraction to using mobile technology for learning. Remote learning and the fact that students always have their mobiles to hand puts the learning material “at their fingertips”. This was seen as a big attraction for students.

Some Design and Technology education specific comments were made, that an attraction for student meant that “fewer lectures and more practicals”. In terms of student learning habits, 5 students admitted that it would mean they would not have to turn up to lectures and “stay in bed”. However, generally students saw the educational benefits/potential of being able to access learning resources through learning technology.
Figure 15. Map of Thematic Analysis of Student Questionnaires

Many students talked about the fact that they did not want to blur the boundary between work and social life, which mobile technology for learning is perceived as performing. This may reflect the current limitations of the devices they use, and their inability to see benefits. More than one student mentioned that mobile technology drawbacks include cheating. Although they did not mention how; this was an unexpected finding.

Figure 15 summarises the themes which arise from Questions 6e – 9, open ended questions from students of potential for mobile technology: Each of the responses was coded in
5.6 Potential Identified from Students of Design and Technology Education

This section highlights potential found for NM & NT in D and T education.

Finding out what devices were being used by students could be useful information to base future decisions. Questionnaires were the quickest and easiest way of collecting data on this, as a broad spectrum of data on how students felt about using their mobile devices for learning could be obtained. Assumptions were made from the literature, that students would be using these devices in the future for learning, or at least web surfing. The results suggest that students are not used to accessing learning content this way.

5.6.1 Student Scope for New Media and New Technologies

This section has allowed us to plan some action in the form of reviewing with stakeholders how to use the Learn@lboro system and look for evidence of the potential for NM & NT in D and T education. In particular, the findings suggest that students are worried about the cost to them of using mobile devices for learning. Many of them do not have phones which support web-browsing. Students existing competencies with NM & NT and student preferences with mobile devices demonstrate that they are concerned about using a personal device for education.

5.6.2 Towards Achieving Research Objectives

Some of the potential for NM & NT in D and T education has been realised. This section describes how this chapter achieves Objective 6: “To investigate the potential of New Media and New Technologies, assessing the simplest, low cost and most efficient way to deliver NM & NT to students of design and technology education.”

1. Most students would like to use their photo capabilities of their mobile phones/cameras for D and T education. However, MMS is quite expensive still.
2. Many students would like module administration issues to be texted to them as they do not always check their email. However, cost is still a major theme for students.

3. 70% of students have mp3 players and 40% would like lectures streamed. This would be a relatively low-cost method of delivering Design and Technology learning resources for students, but it would require all students to have the right devices. This could potentially be costly.

This section explored the potential identified from students; in terms of the student scope for NM & NT and how this research moved towards achieving the research objective. Reviewing major issues from this chapter, allow us to plan action to investigate the potential for NM & NT in D and T education.

5.7 Evaluate Action Planning (2C4): Matching Student and Lecturer Responses

This section looks at matching student and lecturer responses looking for potential for NM & NT, through similar themes.

Table J below explores examples of major themes which emerge from both student questionnaire and lecturers interview data (Chapter 4). The major themes can help plan potential for NM & NT in D and T Education.

Table J: Recurrent Themes for NM & NT in D and T Education from Students and Lecturers

<table>
<thead>
<tr>
<th>Lecturer Themes with NM &amp; NT</th>
<th>Student Themes With NM &amp; NT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental Efficiency: “Tools for staff student/engagement”; “a way of accessing easily a large repository of images”;</td>
<td>Departmental Efficiency: “mobile correspondence with tutors”; “sending text to tutors computer”; “daily updates in the design world”.</td>
</tr>
<tr>
<td>Module Administration Issues: “can use it [Learn server] for small tests but unless it’s marked</td>
<td>Module Administration Issues: “lecture time changes”; “lecture reminders” cancellations,</td>
</tr>
</tbody>
</table>
then the students won't go for it”. Sometimes emails are too late”

Student Learning Habits: I think sometimes students don’t use email; students still want to be told with a lecturer standing at the front of them and repeating exactly what’s on the learn server- infuriating;

Student Learning Habits: “collation of notes, and inspirational ideas; communicating for group work; - dont always have it [mobile device] on me; [if use NM & NT for learning]may not attend lectures;

Technical Issues: I would have to know how to do it [use NM & NT ]

Technical Issues: “no signal in my room” [for using mobile devices]

Lecturer Teaching Habits: Need to see good examples [using NM & NT]

Lecturer Teaching Habits: Need to see good examples [using NM & NT]

Lecturers suggestions for departmental efficiency, suggest the need for tools to foster staff/ student engagement. Students noted the potential for NM & NT to help with departmental efficiency, and foster this engagement. “Daily updates in the design world” would need to be managed by lecturers to ensure that students are not in receipt of irrelevant course material. One lecturer would even like to be able to control the content of the Internet resources which students see, to stop those using dubious sources from the web.

The response from lecturers was mixed in terms of using NM & NT for module administration issues. Potential exists for lecturers only if the NM & NT content linked to student assessment, otherwise students wouldn’t use them. It also revealed a lack of trust in NM & NT, where lecturers get “a load of confusing emails, that gets hard to manage”. Students also noted that emails are a problem. Lecturers themselves noted that some new media might help them. For example, RSS could help with module administration issues, Sustainable Design content AND, be a central repository of images.

Table K: Summary of Educational Potential from Staff and Students

<table>
<thead>
<tr>
<th>Educational Potential (Student Questionnaire)</th>
<th>Education Potential (Lecturer Interview)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most students would like to use their photo capabilities of their mobile phones</td>
<td>Lecturers want to control the content of the Internet resources, to stop student using dubious sources from the web.</td>
</tr>
<tr>
<td>70% of students have mp3 players and 40% would like lectures streamed.</td>
<td>students want lectures and that you cannot rely on NM &amp; NT on its own</td>
</tr>
</tbody>
</table>
Many students would like module administration issues to be texted to them. Lecturers receive lots of emails from students which need managed.

Although lecturers like **emails**, they receive lots of confusing emails from students which need managed. Students admit they do not check their email them often; - perhaps mobile phone technology can help?

The success of the learn server was qualified (by stating that students still need to be "spoon-fed" with face-to-face lectures), and that one cannot rely on *NM & NT* on its own. Mobile technology could have potential for reminding students to attend lectures. Students highlighted this as a major educational benefit. Many students would like module administration issues to be texted to them, as they do not always check their email.

This and previous chapters have reviewed student and lecturer data on the potential for *NM & NT*. The *NM & NT* which have been highlighted by students and lecturers are:

- Email
- Websites
- Discussion Forums
- Blogs
- Wikis
- RSS
- Mobile Devices and their functions (Text and photos)

The next things to find out are:

1. **Functions and Features of these new media and new technologies**: This is to match the potential from Table J above from student and lecturer to a particular type of *NM & NT*.

2. **Scenarios which will explore suitable NM & NT for D and T education**

**5.8 Conclusion**

*This section summarises this research and concludes on the content of this chapter. This chapter has looked at student potential for NM & NT and allows us to action plan the next stage.*
This chapter has reviewed the findings from a questionnaire on the potential for \( NM \) & \( NT \) in D and T education. The questionnaire was a useful tool in planning action in the diagnosis stage and forms some way to understanding student scope for \( NM \) & \( NT \) in D and T education. Analysing questionnaire data and survey data together provided insight into which learning scenarios were most appropriate to take to the next cycle, action-taking. A way of exploring these scenarios was to look for similarities between lecturer interviews and student survey. Thus stages 2C1 – 2C4 of cycle 2 action planning have been performed.

A more in-depth look at \( NM \) & \( NT \) – what it is and how it works- needs to be investigated to find out whether the technology identified here could be used to support student learning. The next chapter is 2C5 in the MDHM architecture, which is specifying learning. The potential which has been identified from students and lecturers will inform planning various courses of action which can be explored at action taking cycle (Cycle 3). The evaluation stage has revealed some similarities in what students and lecturers are looking for with \( NM \) & \( NT \) in D and T education. The next stage is to work out how they would work with D and T education. This is done through the tool of scenarios.
Chapter 6: Specify Learning Scenarios for Design and Technology Undergraduate Education

6.0 Introduction

In this chapter, the action-planning cycle for this research is completed; diagnosing a tool for developing NM & NT in D and T education, called learning scenarios.

The previous chapter reported results from a student questionnaire. This identified some potential for NM & NT in D and T education from students. Reoccurring themes identified from this data were linked to themes from lecturer interviews to find potential for NM & NT for D and T education. This chapter concludes the action planning cycle (2C5); specifying learning in Cycle 2 (action-planning). This takes all the available action-planning data and creates a model for their use in D and T education. This model takes the form of “learning scenarios”. This involves categorising types of NM & NT, and where they are used in design and technology education more generally.

6.1 Towards Achieving Research Objectives 5 and 6

Learning scenarios, as a framework for action-planning, emerge from tying NM & NT to potential identified by D and T lecturers and students. This section sets out how research objectives 5 and 6 are achieved by this action-planning stage. The action-planning cycle identifies:

1. Functions and Features NM & NT: This is to match the potential from student and lecturer to particular types of NM & NT. The research sub-question; “What kinds of NM & NT are available and currently used the Design School within Loughborough University?” is investigated. By doing this, this chapter aims to achieve the following objective: “Objective 5: To investigate the different types and features of NM & NT, and whether they are useful for learning activities within D and T undergraduate education” (see Chapter 1, section 1.2.3). Appendix XIV: Review of New Media and New Technology Literature and Projects in Education contains a tabular overview of m-learning projects carried out by other universities to get a sense of what is being used in particular contexts. This appendix demonstrates that there are many University projects, but there is no consistency in how they all apply within the separate organisations.
2. Scenarios which explore suitable NM & NT for D and T education. Thus this section fulfils Objective 6 of this research: “To develop learning scenarios for NM & NT for educational purposes within D and T education” (from Chapter 1, section 1.2.3).

6.2 Different Types of New Media & New Technologies

This section looks at different types of NM & NT investigated in this research so far.

Previous chapters reviewed student and lecturer data on the potential for NM & NT. The NM & NT highlighted by students and lecturer data are:

- Email (6.3.1.1)
- Websites (6.3.1.2)
- Discussion/ Web Forums (6.3.2.1)
- Blogs (6.3.2.2)
- Wikis (6.3.2.3)
- RSS (6.3.1.3)
- Mobile Devices and their functions (Text and photos) (6.3.1.2)

The following are therefore desirable features of NM & NT for D and T stakeholders

- Low Cost (Traxler, 2004);
- Easy to Use/ Maintain (as identified from student questionnaire data);
- Easy to Learn (as identified from lecturer interview, Participant 3);
- Useful for D and T education (Kimbell, 2005).

Section 6.3 will look for these desirable features in the functions of different types of NM & NT. In particular, previous examples where used in D and T education will be looked for.

6.3 Functions and Features of New Media

This section identifies various forms of NM & NT and where they occur with relevance to design and technology education, if at all.

This section provides examples of New Media. An ICT/ Media Content Analysis of each type
listed here, breaking each one down into its component parts. The results of ICT/ Media Content Analysis here will show features useful to learning D and T education; this includes school-based examples where no examples specific to D and T undergraduate education exist. Chapter 2 outlined the method of ICT/ Media Content analysis as performed by Taachi, Hearn and Foth, 2004. The different types of NM & NT will be identified, and analysed in terms of their pedagogic value for D and T education.

6.3.1 Email, Instant Messaging and Websites

The most commonly used New Media are email, instant messaging and websites. This section explores what they are. Generally, email is instantaneous communication regardless of geographic location. Instant messaging (IM) uses a software program to communicate text instantly to a computer with the same software installed. IM is generally a real-time chat program based on software program, although the two terms can be used indistinguishably to mean the same thing. Originally, it was text-based chat facility, but nowadays support exists for small graphics known as “emoticons”, VOIP sound and webcam video. Popular examples of (IM) programs include Skype and Windows Messenger. They have been used as tools for educational communication, but email is predominantly used by the Design School for communication. Email and Instant Messaging/ Messenging require these components:

• Email Application

• Computer/ Mobile Device

• Timestamp

• Real-time communication

• Input/ Output Devices peripheral hardware keyboard and microphone

The benefits are that it is free to other users using the same application. Email and IM is now available on mobile devices such as Smartphones. Whereas email is a communication technology, websites tend to form a kind of broadcast technology, although this distinction is not always the case. Barlex (2001), exploring new media for D and T education reports the use of a website to supplement teachers of D & T education. An ICT/ Media content analysis reveals the following components of websites:
6.3.2 Web Forums, Blogs and Wikis

The lecturer's interview revealed data on blogs, wikis and discussion forums. This section will identify what they are and how they work. A web forum is a website devoted to discussion on a particular topic or field. People post comments, questions or opinions in a particular area. Generally, users are required to validate their user identity, register and sign in every time. There is usually more than one user, brought together by the desire to share information/clarification on any given topic. There is a design and technology forum specifically for GSCE/ A level students in the U.K as noted in the screenshot below.

Figure 16. The D and T Forum Website (Screenshot from http://www.dtforum.co.uk)

Figure 16 above demonstrates a typical layout of a web forum within the field of design and technology. ICT/ Media content analysis: A web forum is generally on a topic, with many people contributing to it. It is made up of the components below:

- Forum administrator: this role is important to ensure that the forum is not being used for another purpose or abused.

- Post Date: When the post was written
Web forums sometimes have a feature to vote on whether one likes the post of another person (sometimes called an online poll). Generally, they do not have pictures, and all pictures are in the .GIF format. The previous section defined New Media, in new terms of wiki and blog technology; another technology available is the web forum.

Web forums provide a useful way for people to share knowledge and contribute on a topic. Possible pedagogic value for D and T students arises, as a number of different design and technology topics can be discussed. There is a departmental discussion forum accessible from the Design School homepage for members (accessible from the internal website). However, there are no posts yet, as of 2009. The fact that this medium is not face-to-face may give rise to confidence that students can ask questions with obvious answers that they might not ask otherwise; the anonymity which this medium affords could be useful to Design School students.

The term “blogging” refers to a type of website which resembles a computerised journal/diary. It works in reverse chronological order. Blogs can be public or private, and, generally these are websites with only one user, which can be seen by everyone on the Internet or only by people of one’s choice. Blogs are not collaborative websites in the same way as discussion forums or wikis (below), although people can comment on a particular blog posting.

There are many different types of blog. These are divided by media type or devices; so the media blog examples are Vlogs, (video logs), linklog (a blog of links), photoblog, (blog of photos); and an example of the latter is a moblog, blogging via a mobile device. There is also software available for microblogging called Twitter (2006), where the user texts a sentence as a status update to keep those informed of their progress. The screenshot below is from a typical design and technology blog associated with collecting information on design museums from around the world.
ICT/ Media content analysis: A blog is a collection of posts generally by one person, made up of the components below:

- Post Date
- Category
- Title
- Body
- Trackback: links back from other sites
- Comments: comments added by readers
- Permalink: the URL of the full, individual article
- Footer: usually at the bottom of the post, often showing post date/time, author, category, and stats such as number of reads, comments or trackbacks.

On Loughborough V.L.E. there is the blog facility for each user, staff or student. This feature is much underused, perhaps as it is difficult to imagine the pedagogic value to D and T students. One example; blogging is like an online diary which others can see to demonstrate interested in a topic. Previous literature suggests however, that unless the student is in habits of using a blog already and blogs are not linked to assessment then students are not likely to use these.

Wikis were invented as a type of website that allows users to add remove, and edit online
content. A well known example is "Wikipedia", an online encyclopaedia. Wikis differ from
discussion boards, web forums and weblogs in so far as they allow the editing of individual
entries. So thus, in the example of Wikipedia, a body of knowledge can change on a topic and
thus be edited to reflect that change. This is distinguishable from blogs and discussion
forums the information is permanent and static. A good example of a wiki used in design and
technology is Design Tech a wiki resource for D & T students and teachers from Cairo.

Figure 18: A Design and Technology Education Wiki (Screenshot from
http://www.ruthtrumpold.id.au/designtech)

This investigation has revealed that there has been no use of wikis by D and T staff for D and
T undergraduate education. An ICT/ Media content analysis reveals the following features
of wikis. A wiki is generally on a topic, with many people contributing to it. It is made up of
the components below:

- Post Date
- Category
- Title
- Body
- Trackback: links back from other sites
- Comments: comments added by readers
- Permalink: the URL of the full, individual article
- Footer — usually at the bottom of the post, often showing post date/time, author, category,
and stats such as number of reads, comments or trackbacks.

Wikis can be useful in education for group-work submissions. They can support images and video, but difficulties exist in the reliability of this technology, and for students being in the habit of using these.

6.3.3 RSS technology and Vodcasting/ Podcasting

The proliferations of mobile devices for entertainment have given rise to the phenomenon of podcasting, a type of technology for broadcast. Podcasting involves the wrapping up of audio/visual files in code known as Really Simple Syndication. Vodcasting is similar but with video data. Really Simple Syndication, - a type of "new media" - is a way of pushing information from the Internet to an application or website automatically. So, by supplementing or syndicating websites with an RSS feed, information/podcasts can arrive on a particular topic of interest to the user. The growth of new media, for example, podcasting and blogging, is in part due to RSS language, which is based on a computer language known as XML.

An RSS application has the ability to manage new content from blogs, podcasts and websites which one likes. RSS technology and podcasting are the same, the distinction being that Podcasting is typically audio/visual files which are delivered in series. RSS technology allows one to put all in a single place the latest new content or news from one’s favourite websites. It keeps track of them so one does not have to keep looking through bookmarks to browse your favourite websites, when they add new content. It is also useful for people who either create blogs (like an online diary) or readers of them. This technology is supposed to help with information overload from too many websites and not enough time to browse them. One uses an application to assist with managing RSS feeds and keep them all in one place. Feeds are individual subscriptions via RSS. Examples of RSS applications include:

- Technorati
- Newsfeeder
- Feedster
- Feeddemon
- Bloglines
Why has RSS been developed? Basically, there are too many websites now to keep track of easily, and the websites may change their content regularly or add new content. In addition, the nature of how people search using search engines creates an "Iceberg" around a particular topic. Thus often when users do keyword searches, they only check the first ten results on the first page.

However, due to the relative novelty of RSS, many people are unaware of how it could revolutionise traditional search and retrieval of different types of information, in different formats. The RSS technology is also suitable for use with mobile devices. RSS technology has many different features, but basically describes the act of copying and pasting the URL address of a webpage containing the appropriate RSS symbol, into an application that manages your information - the process of syndication. Syndication is accomplished by subscribing to feeds offered in RSS or Atom formats. RSS, based on Resource Description Framework (RDF), has multiple versions, which are incompatible with each other. Atom is more XML- based and was especially designed for managing information from blogs. These different terms and versions can make the process of designing and the process of using RSS confusing. Therefore, various Web- based interfaces have been developed to help with using RSS. The user subscribes to all websites which have RSS capabilities by identifying that the website has the RSS icon and clicking on the button which will either take one to their RSS application OR by manually copying and pasting the URL into an RSS application. Potential uses of RSS for education have been used although there are few working examples.

Podcasts are audio/ visual broadcasts using Internet technology. The technology used to access podcasts can be either computer or mobile device. The user typically sets up an RSS feed which delivers an audio/ visual file to the user’s machine. File formats of podcasts tend to be in mp3 if they are audio and mpeg4 or .wmv if they are video files. Vodcasting is a form of video podcasting; in an educational context, Vodcasting means the broadcasting of small videos students can use on their iPods® or similar video- enabled mobile device. The use of podcasting in education has give rise to the new term “Podagogy”, which is an emerging field of using mp3/ mp4 technology for education. Specifically, “podagogy” is defined as the “art or science of using podcasts for educational purposes” (IMPALA Project, 2006).
6.4 Functions and Features of New Technologies

This section looks at new technologies which this research is concerned with, namely the Virtual Learning Environments and mobile devices able to access them.

This section identifies the link between mobile devices and new media, and how they inter-relate with virtual learning environments.

6.4.1 Virtual Environments and Virtual Learning Environments

If the term virtual environment crops up, often it is assumed to refer to 3D gaming engines and virtual reality environments. However, it can relate to collaborative virtual environments, more generically. This form of NM & NT can have the effect of simulating reality, but sometimes it can refer to an online environment. An example is the latest move by the New Media Consortium, a not-for-profit group of organisation exploring use of NM & NT. NMC has now moved to a Second Life 3D environment where they can explore learning within virtual worlds. Three dimensional virtual environments have arisen out of gaming engine platforms. “Games for learning” is a new research field using new technologies to mix play with learning.

6.4.2 Mobile devices and new media

The term “mobile device” refers to electronic devices, such as mobile phones, digital cameras and other small devices for sound and video. Despite the proliferation of free telephony with instant messaging, and their arrival on mobile devices, many people still pay for and use mobile phones. These are many forms of mobile device. Many of them today can include the following features as standard:

(a) Telephone calls;
(b) Text function: A recent survey by Mori found that this was the predominant means of communication between 16 – 19 year olds (Haste: 2000);
(c) Photo: functions for capture, send and view images;
(d) Audio: sound files (e.g. Mp3);
(e) Video: The ability to record and playback with devices and;
(f) Applications: New phones have applications like the digital spirit level which would be useful to D and T students.
Other mobile devices include Personal Digital Assistants (PDAs) and Smartphones. These have been explored with limited success for education (Trindler, Macgill & Roy: 2002). These devices can also access the Internet and new media sites, like Facebook and Youtube. In society, there has been a surge in mobile devices for entertainment purposes, one example being the iPod® from Apple. These devices play sound files and some play/record videos. Thus there are attempts to use them in education; the success of this very much dependant on standardizing the mobile technology, so students have equal access across the board.

### 6.4.3 Concluding on Types of New Media and New Technologies

This section has introduced the reader to some of the NM & NT, with examples relevant to design and technology. A brief understanding of the different types of NM & NT will clarify where there is potential for D and T education. New Media are typically accessed on new technology such as computers. But increasingly, new technology such as handheld devices such as mobile phones and PDAs are being used to access New Media. The use of mobile devices for learning has been called for (see www.handheld-learning.co.uk). Diagnosing the terminology and types of NM & NT is crucial to fulfil one of the objectives of this research; **Objective 3: To investigate the different types and features of NM & NT, and whether they are useful for learning activities within D and T undergraduate education.** Thus the problem appears that there are many types of NM & NT, which are already used in educational settings. This thesis cannot explore the potential for ALL of them, thus an assessment of which type is best for D and T undergraduate education will be made. This will be achieved through “LEARNING SCENARIOS”.

### 6.5 Developing Learning Scenarios as a Tool for this Research

*This section looks at developing learning scenarios or design and technology undergraduate education.*

How to assess the potential for specific types of NM & NT in D and T education? The question or problem is related to whether the D and T stakeholders are “Digital Natives” (Prensky, 2001). **Thus the problem at this stage is which type of NM & NT is most suited to D and T education.** A number of alternative solutions are offered in the form of learning scenarios. Action planning involves the identification of various solutions to diagnosed problems, thus different learning scenarios were created and reviewed. This section illustrates
what learning scenarios are, previous examples of them in research and justifies their use within this research context.

6.5.1 Introducing the concept of learning scenarios

Learning scenarios are a good way to plan out the action taking cycle of an action research project. Scenarios are used in software engineering. Learning scenarios allow action planning of the types of user interactions that educational systems can afford. Scenarios are classified as;

“a concrete description of an activity that the user engages in when performing a specific task, a description sufficiently detailed so the design implications can be inferred and reasoned about” (Carroll, 1995; p45).

Learning scenarios are an extension of this where the specific task is learning. The purpose of introducing learning scenarios is to provide a clear map for how NM & NT can be used within the Design School education, and then select which learning scenarios would be most appropriate to introduce to stakeholders.

Learning scenarios with NM & NT will be developed. One of the drawbacks with technology-mediated learning is that it can involve students sitting in front of a screen for long periods of time. As pointed out by lecturers in interview, this does not fit with current D and T education practices. However recent advancements in mobile communications technology could have revolutionary potential for learning in higher education, but no blueprint exists to guide the research.

6.5.2 Previous Action Research Examples Using Learning Scenarios

This research uses the concept of scenarios to describe the client-system infrastructure highlighted in diagram X above. The concept of scenarios is useful to map out how NM & NT are useful to D and T education. Derntl and Motschnig-Pitrik (2004), describe the importance of scenarios in modelling a personalised e-learning system, (PCeL) in their blended-learning model. They use action research to investigate these scenarios. Similar to this research, learning scenarios appear second in their five-layered methodology.

Scenarios in mobile learning applications can provide a blueprint for this research. Danielsson, Hedestig, Juslin and Orre (2004), also use the concept of scenarios in
participatory design in mobile learning environments. They discuss various NM & NT scenarios with the students. The students discuss the issues presented in a matrix on whether technology scenarios were public or private. Focussing on the need to integrate private use of personal technologies into public learning settings, this research concluded that learner-centred design was most effective when the goal is to help learners learn new practice. Also Danielsson et al., (ibid), provided authority for consulting with the learners to develop learning scenarios, worthwhile for investigating the potential for NM & NT in D and T education.

6.5.3 Introducing Learning Scenarios for D and T Education
Why develop scenarios? The Gothenburg Conference (2001) called for pilot experiments and applications for the broadening of innovations in mobile technologies. Implementing the “Mobillearn” project, Bormida (2001), notes that this need has become urgent. This is especially true for Universities if they are to remain competitive in Europe and the rest of the world. But it is argued that these cannot move forward without clear learning scenarios of how they affect the stakeholders in D and T undergraduate education.

6.6 Creating “NM & NT Learning Scenarios”
This section identifies some “NM & NT learning scenarios” for D and T undergraduate education. It discovers alternative courses of action which allow the research to the action-taking cycle.

Learning scenarios are a way of mapping out the interactions between the learner and the technology, in this way technology mediates learning. Learning scenarios are used in the field of computer science, action research and education (Derntl & Motschnig-Pitrik, 2006). It is typically a way of taking the learning objects and learners, and providing specific user and task analysis outputs. Thus, diagrams have been used to support the development of the learning scenarios (see Appendix XV: In-Depth Development of Learning Scenarios).

6.6.1 Learning Scenarios for Design and Technology Undergraduate Education
Exploring the potential for NM & NT in D and T education depends on the development of learning scenarios. Learning scenarios are a technique for developing learning objects based on stakeholders’ requirements and technological capabilities identified in previous chapters.
Incorporating “learning objects” as part of the way D and T students use NM & NT, such as mobile devices has yet to be researched. A definition of learning objects is provided by Institute Electrical and Electronics Engineers. The IEEE Learning Object Metadata standard defines a learning object as “any entity, digital or non-digital, that may be used for learning, education or training”. The “NM & NT Learning Scenarios” have emerged from this research as part of 2C5 in the MDHM methodology. The scenarios developed are highlighted below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Student/ Lecturer Themes</th>
<th>Specific NM&amp;NT Issue</th>
<th>Learning Scenario Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Student Learning Habits</td>
<td>54% of surveyed students respond that using mobile phone photos for groupwork might be a good use of NM&amp;NT</td>
<td>Using Photo capabilities Of Mobile Devices for D and T Undergraduate Education</td>
</tr>
<tr>
<td>2</td>
<td>Student Learning Habits</td>
<td>38% students surveyed responded that streamed lectures might be a good use of NM&amp;NT</td>
<td>Using Audio/ Video capabilities Of Mobile MP3/ Mp4 players for Design and Technology Lectures</td>
</tr>
<tr>
<td>3</td>
<td>Module Administration Issues</td>
<td>One lecturer noted the success of email and instant communication for universities</td>
<td>Design &amp; Technology Modules Text and Email Messages for Students</td>
</tr>
<tr>
<td>4</td>
<td>Lecturer Teaching Habits</td>
<td>The lecturers were mostly unfamiliar with different types of NM&amp;NT and how they could be used in modules. They wanted to see some good examples</td>
<td>Encouraging NM&amp; NT for D and T lecturers</td>
</tr>
<tr>
<td>5</td>
<td>Module Administration Issues</td>
<td>Using wikis could help students to compile groupwork on a specific topic.</td>
<td>The Use of Wiki Technology in D and T Education</td>
</tr>
<tr>
<td>6</td>
<td>Module Administration Issues</td>
<td>One lecturer wanted to stop students using dubious sources from the Internet.</td>
<td>Mobile RSS for Sustainable Design Research</td>
</tr>
<tr>
<td>7</td>
<td>Lecturer Teaching Habits</td>
<td>Lecturers wanted a way of managing large repositories of images that they had to mark.</td>
<td>DigiDT: Using Mobile Blogging for Assessments</td>
</tr>
</tbody>
</table>

Table L: Matching Student/ Lecturer Themes to Learning Scenarios
6.7 Linking “NM & NT Learning Scenarios” to Student & Lecturer Themes

A number of scenarios have been explored which link to the themes identified by students and lecturers. Linking learning scenarios to potential identified by student and lecturers solves the issue of which NM & NT would be useful for D and T education.

Table L above contains learning scenarios of NM & NT for D and T education which tie into the potential identified by students and lecturers requirements. They were derived from the previous chapters which diagnosed the potential for NM & NT in D and T education. Appendix XV contains a full rundown of how each of these scenarios operate in a D and T education context.

6.7.1 Departmental Efficiency

The key to developing the scenarios comes from mapping the themes which arose from previous chapters. For example, with regard to departmental efficiency in the interviews, the lecturers identified that they would like to use more images more effectively (Chapter 4, section 4.5.1). Thus using students’ own mobile phones to take photos of their design projects might be a useful scenario. Also, students in the questionnaire identified that they would like a way to incorporate mobile devices into their D and T education. In Chapter 5, we saw that 54% students thought using mobile phone photos for group work would be a good learning scenario. This justifies the creation of Scenario 1 in the table above.

Another theme from lecturer interview which arose was that lecturers do not have enough time to explore new teaching habits with NM & NT. Thus Scenario 2 arose from the desire to provide additional support materials to D and T lecturers accessible on an mp3/mp4 player. Students also liked the idea of streamed lectures, 38% stated though streamed lectures were a good learning scenario.

6.7.2 Module Administration Issues

Module administration issues were seen as a priority for lecturers and students, thus ways of using text messages where described in the formulation of Scenario 3. This scenario was developed as 42% of students said they wanted to be texted when there has been a timetable
changes, such as cancellations. Examples of comments made on this topic include; “sometimes emails are too late”.

More than one lecturer described using email as a successful use of technology in D and T undergraduate education. Thus Scenario 4 was developed based on email technology to encourage NM & NT for D and T lecturers. Scenario 5 explores the use of Wiki technology for D and T education. The literature review (Duffy and Bruns, 2005) suggested that there was much educational potential for wikis in education. However their potential is not clear for D and T education, which is more workshop- based education.

6.7.3 Other Emergent Themes
The investigations into learn@lboro V.L.E suggested that this system could support three types of new media: blogs, wikis and RSS. A major interview theme suggests that RSS was seen as useful to lecturers, where there is a lot of information and new information appearing on a D and T module. Scenario 6 was created which suggested the use of RSS in the Sustainable Design module. However lecturers need to be able to use NM & NT too.

Scenario 7 developed the idea of design blogs for the students’ learning, as the potential for these types of new media was already present on the learn@lboro server. Although students did not like this idea as much as streamed lectures and mobile photos, 26% of the students surveyed thought that using mobile technology for blogs were a good idea. Also blogs are seen as a way of developing an e-portfolio.

Appendix XV describes the learning scenarios in detail. The purpose of learning scenarios is to explore the educational potential and benefits of NM & NT in D and T education. This section allows us to plan which of the learning scenarios will be most feasible to perform action in this research (Cycle 3).

6.8 Specifying learning at the Action Planning Cycle (2C5)
This section describes what was found out in terms of specifying learning outcomes for using NM & NT in D and T education.

Specifying learning within this research involves creating a model describing the situation under study (Kock, MacQueen and Scott, 1997, p.9). It describes how learning scenarios
emerged from the action planning cycle, which includes interviews and questionnaire data as a way of assessing which NM & NT learning scenario has educational potential. The action-planning cycle has involved the following 3 areas:

1. **Lecturer Interview**: potential exists for a NM & NT tool which makes better use of the Internet for both staff and students;

2. **Student Questionnaires**: potential exists for NM & NT tools which incorporate mobile technology and;

3. **Developing Learning Scenarios**: potential exists for NM & NT tools where learning outcomes from modules can be realized.

The action planning stage allowed this researcher to build a model of the appropriate modules, system of learning and stakeholder requirements. So for example, the types of Intended Learning Outcomes from the modules where NM & NT are proposed are investigated. Also the design of the tools was also highlighted using the ICT Content Analysis method. Next, in the action-taking stage, these tools which make better use of the Internet and mobile devices will be explored.

### Summary of Action Planning Cycle (2C)

1. Data collected from students and lecturers
2. Findings from students show they would like mobile learning
3. Lecturers would like students to stop using dubious sources from the Internet
4. Mapping stakeholder data to learning scenarios to identify potential further
5. Towards achieving research objectives 3, 4, 5 and 6

### 6.9 Concluding the Action Planning Cycle of this Research

*This chapter moves the research forward to develop a plan for the action-taking cycle which is contained in the next chapter.*

Action planning (cycle 2) has used all available information from:
- Diagnosis Cycle 1 (information from the literature review);

- Action Planning Cycle 2 (chapter 4 on lecturer interviews, chapter 5 on student questionnaires).

This information has been used to create learning scenarios which are developed into alternative courses of action. Potential lies in innovative new methods of supplying learning content to university students studying design and technology; learning is now possible with the range of mobile technology and devices available to them. However it is essential to develop these new methods from the stakeholders’ context of use and workable learning scenarios. A particular problem becomes apparent: different universities have different curriculum content, methods of teaching and user requirements which make this process of implementing learning scenarios large and slow.

This chapter identified learning scenarios. It performs a detailed analysis on the ways in which technology can be used to support learning activities. From these learning scenarios, it is possible to identify prototype content of these interactive learning objects. The action-planning cycle has revealed that, for example, students want a way of keeping up to date with module administration issues, such as timetable updates. Also lecturers want a better way of managing information which students use from the Internet. Some scenarios have been developed to try to combat these issues. The next cycle is ACTION – TAKING; to implement these scenarios and further explore potential of NM & NT in D and T education.
Chapter 7: The Action Taking Cycle: Piloting New Media & New Technologies in Design and Technology Undergraduate Education

7.0 Introduction

This chapter provides an introduction to the action-taking cycle. The potential for NM & NT is investigated through piloting learning scenarios to find out which the Design School could support.

NM & NT capabilities of the Learn@Lboro learn server are reviewed to find D and T education examples. Technological feasibility of learning scenarios will also be identified. The aim is to look for potential for NM & NT in D and T undergraduate education. The previous cycle revealed:

1. Educational potential for NM & NT tools to encourage and improve staff and student use of the Internet and;
2. Educational potential for NM & NT (especially mobile technology) to help staff and students achieve learning outcomes and improve communication and engagement.

Thus some NM & NT tools will be piloted with staff in the first instance; namely an email newsletter and a video podcast. One of the benefits of action research is the flexibility for performing institutional review. This is through investigating what NM & NT are and how they are used; this will help to formulate the next stage of the research. Conducting ‘action’ in this chapter is by way of interventions in education systems, through testing the scope for NM & NT on the Learn@Lboro server, (Baskerville: 1999).

7.1 An Overview of the Action-Taking Cycle

Within the action-taking cycle of this research, an iteration of the five cycles, diagnosing action planning, action taking, evaluating and specifying learning is performed.

The results from Cycle 1 (diagnosis of research problem in Chapters 1-3) suggested potential for:

1. Just-in-time delivery of learning resources: a major benefit to Design and Technology undergraduate education (see Chapter 3, section 3.19.1) and;
2. Using NM & NT could provide an extendable model for Design and Technology education.

Results from Cycle 2 (action planning) matched this potential to some stakeholders’ requirements for NM & NT in D and T education. A set of learning scenarios were developed. Learning scenarios were based on data collected from students and lecturers on the potential for NM & NT in D and T education.

The action-taking cycle (Cycle 3) follows on from action-planning cycle (Cycle 2). This cycle takes action to develop learning scenarios. Cycle 3 (action-taking) involves the following 5 action taking steps:

3C1 – Diagnosing the action to be taken: deciding on the nature of suitable learning scenarios with NM & NT, and whether the institution can support them;

3C2 – Action-Planning: Pilot learning scenarios with staff (Chapter 7);

3C3 - Action-Taking: Implement Learning Scenarios (Chapter 8 and Chapter 9); Two scenarios were looked at in depth with students, using RSS and Vodcasting for educational content with mobile devices.

3C4 - Evaluate Action Taking: Once all the findings from 3C1 - 3C3 have been gathered and organised, they were evaluated (Chapter 9) and;

3C5 - Specify Learning: Specifying learning assesses the practical and theoretical outcomes from the action-taking stage, in particular in relation to future directions of RSS and Vodcasting.
To assess potential for just- in- time delivery of learning and mobile learning, stakeholders were consulted on perceived competencies with NM & NT. Findings will be:

a) **Pedagogic:** Is there NM & NT potential to be realised in the teaching and learning of D and T education?

b) **Technological:** Is potential realisable in the technological competencies of the stakeholders? What are those competencies?

Thus potential for just- in- time delivery of e-learning and mobile learning with D and T students can be explored.

### 7.2 Diagnosing (3C1): Technological Scope for Learning Scenarios at Loughborough University

*This section provides the background to the technological requirements for implementing the chosen learning scenarios.*

This section reviews Loughborough University’s technological capabilities, to diagnose how to implement learning scenarios (3C1). When Universities use new media there is a distinction in whether Universities make use of external popular new media, such as Facebook, or whether the University institution develops and hosts their own NM & NT architecture for knowledge sharing, such as within a Virtual Learning Environment (hereafter VLE).

#### 7.2.1 Loughborough University Internet Capability

Loughborough University is a mixture of the client- server model and peer- to- peer. It is useful to know the functionality of the Loughborough University system to assist with maximising the potential for new media and new technologies in design and technology education. Thus, Loughborough University provides support for the following:

- File sharing
- Wireless networking
- Computer Security
- Connecting mobile devices to the network
- Elearning through Learn@lboro
There is less support for m-learning in terms of provision of learning content for mobile devices, although with the proliferation of internet-capable mobile devices, the possibility is there. Recently, Loughborough have completed a successful rollout of a Wireless Campus. Computer systems and devices which wirelessly connect to the network are part of the “The Wireless Fidelity” (Wi-Fi) certification program (commonly called Wi-Fi), which ensures that all products with this certification are interoperable. If a product passes certification tests, it is certified as a Wi-Fi product. Many University campuses employ this technology to allow users to connect to the Internet and virtually to their campus network. It has greatly improved the flexibility of location in which the learner can study on campus.

7.2.2 Loughborough Virtual Learning Environment (V.L.E)
VLEs are one major way that NM & NT are currently included in students’ learning experiences. Typically, they provide a way for lecturers and module leaders to map out the curriculum for their degrees and modules, and add content in the form of podcasts, PowerPoint slides and handouts students can then access. They also provide a forum for online support and discussion through threaded discussions, email and chat, as well as links to other useful resources. A few years ago, Browne and Jenkins (2003) put the figure at 86% of UK higher education institutions who responded to the survey now having at least one VLE in use. Currently, Loughborough University students access New Media on the “learn@lboro” server, which is a method of delivery of module information. Universities have led the way in the development of virtual learning environments. These environments currently are being extended to m-learning with the introduction of podcasting. A review of use of the V.L.E by Design School staff was thus conducted in Appendix XVI Current Review of Learn Server NM & NTs Used in Design School.

7.2.3 Testing Scope for Elearning and M-learning on Learn@lboro
The researcher attempted to log onto the Learn@lboro server with three mobile devices known as smartphones, to see if it was possible to access learning resources on the learn@lboro server. The smartphones were top range mobile phones with internet capability; first it was attempted with an MDA Vario smartphone.
Figure 20: Testing Mobile Learning Applications on Smartphones

In Figure 20 above, the reader can see the user interacting with a web based feed reader. Then, it was attempted on an HTC Touch Elf. A G1 phone was also used to go online. This was the latest model with more functionality and 3G capabilities so it outperformed the other two. What was found was:

- Most of the links worked on the pages retrieved with mobile devices.
- However, page loads were so slow it hampered any real use
- Video on the learn@lboro server was not viewable – mobile phones are only just now being capable of viewing flash video online.
- Downloading learning resources is a problem due to the limited amount of storage capacity on mobile devices, and often it did not work.

Also, an attempt to access Learn@lboro was attempted via the “Mobile Moodle” application available for mobile phones, capable of web browsing, however this was unusable to access Loughborough’s V.L.E. Appendix XVII. Mobile Devices, Media Applications and File Formats contains further research which enabled this researcher to get a sense of what the issues might be.

7.3 Reviewing Current New Media & New Technology Available to the Design School

This section reports activities conducted to identify the research gap and where novel uses of NM & NT might be of use to students and lecturers in the Dept of D & T.

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Other Universities have adopted more generic e-learning software on the market, such as Blackboard© or WebCT© (http://www.loughborough.ac.uk/computing/students.html). A brief review of all the modules and programmes within the Design School which have resources on Learn is contained in Appendix XVI. This is relevant to providing an insight into the types of new media learning resources, (e.g. video or pdfs) and types of learning these resources are designed for. This provided understanding of the use which the Design School makes of NM & NT for learning.

The research stakeholders, - researcher, students, lecturing and teaching staff- will all possess different competencies and levels of engagement with NM & NT. The primary method of immediate communication between departments, students and staff is email. However, since 2007/2008 Loughborough University has used an e-learning platform known as “Moodle”. Moodle is an e-learning software architecture, where learning objects can be stored. On this learn server, are learning resources defined as an entry in the Moodle resource database available. As of 2008/2009, there are currently **1849** modules with resources available, out of a total of **2921**, which equates to **63%**. This information was obtained by an in-house document from IT Services at Loughborough University.

### 7.3.1 Supported Activities Using NM & NT on Learn@lboro

This section identifies current New Media learning Activities available on learn@lboro. Figure 21 indicates the type of new media on Learn@lboro V.L.E.

| **Assignment** | Submit coursework online |
| **Certificate** | Whether the webpages have web certificates |
| **Chat** | This is a form of instant messaging |
| **Choice** | Lecturers question with multiple choice responses |
| **Data** | Database function edited by learner and lecturer |
| **Feedback** | Coursework feedback online |
| **Forum** | An online discussion tool for a module or topic |
| **Glossary** | Stores definitions |
| **Hotpot** | Quiz where statistical trend in scores |
| **Label** | Label, links and images have |
| **Learning Diary** | Two types, guided and user |
| **Lesson** | ends with a question, cannot progress until correct |

**Figure 21: NM & NT Learning Activities on Learn@lboro**
Ouwiki: A set of users can edit pages, good for timetables
Podcast: Best to individually add each one
Quiz: Multi choice, true or false or short answer questions
Resource: Module content, .pdfs. It is possible to upload a video or audio as a learning resource, by linking it as an activity.
Scorm: Upload any SCORM compliant package
Slideshow: Uses jpegs to create a slideshow
Survey: Assessments or opinions
Workshop: peer assessment activity with lots of options

Testing scope for mobile and elearning within the Dept of D and T required a review of different D and T module specifications to see which NM & NT is most suitable for the learning outcomes identified. Please see Appendix XVI for a full breakdown of the different modules and the type of NM &NT learning resources, if any. This information helps us reveal the current state of the art in using new media learning resources within the Design School. Also, it assists with reviewing which might be the most appropriate module to think about implementing learning scenarios upon. This section reports results of a review of NM & NT, looking for evidence of its use by stakeholders. It then reviews some of the issues staff have had with the learn server to help explore the potential of NM & NT in this area.

There is forum capability on Learn for staff and students. As observed from Figure 21 above, apart from labels (links) and generic resources, forums are the most widely used educational tool. An example of where blogs are being used currently within Loughborough University staff is on their profiles. These can be used as a didactic resource for students or they can keep them for personal use.

A web-based way to manage your RSS data online would be more suited to student context where they may be studying in a variety of locations e.g. a library, their home, and their halls of residence. Web-based ways of managing all websites and data provide for a more convenient frequent use of that application. There is the capability for adding an RSS feed to the front page of the module page.

7.3.2 Review of Learn@lboro usage by the Design School
The capability of lecturers to review which learner has logged onto the module, when and how often could provide essential feedback on use of NM & NT learning resources.

Figure 22. Log Functions Available to Staff on Learn@lboro

The method for investigation involved investigation of lecturers’ queries in the Learn@lboro Q & A forum called “Staff room”. The results from this enquiry provided some information which would be useful to assess the potential of the learn server to deliver NM & NT (see Appendix XVIII Staff Forum V.L.E questions). Revealed in this Q & A, especially important information for D & T education is the problems with sizes of files, in relation to CAD.

This researcher requested the following information from IT personnel within Loughborough University.

1. How many D and T staff uses blogs? Four members of staff have used the blog facility on the learn server.

2. How many staff use podcast function? No members of staff use the podcast function.

3. How many staff use the Report function, perhaps to check whether students are downloading the learning resources? Five staff members use the reporting functions

4. How many of the D & T staff use wiki function on learn? No members.
There are some 87 modules for the Design School registered on the learn server. Out of those 87, 34 of these modules do not have any resources on them. Appendix XVI provides a review of all those modules and indicates all of the ones which have some resources on them, looking at which ones have new media on them, such as links from Youtube. In compiling Appendix XVI Current Review of Learn Server NM & NTs Used in Design School and evaluating it, it is possible to provide a current review of the extent of new media on the Learn@lboro VLE. It would help this researcher to assess levels of competence with NM & NT. Appendix XVI reveals the following:
1. **Extent of use:** Thus 39% of modules in the Design School do not have any e-learning resources on the Learn@lboro site.

2. **Innovative Uses of New Media for Learning:** There was some evidence of more multimedia uses of video and animation for learners of design and technologies.

3. **Use of external links to WWW:** any incidences where external sources have been used as learning resources have been reviewed.

A further review of Appendix XVI (2008/ 2009) identifies the main types of learning resources which lecturers from D & T have put on the learn server. They consist of the following in order of highest number of occurrences:

1. **Microsoft Office Docs: Word Docs and Powerpoint:**
2. **Pdfs**
3. **Zip files**
4. **Pics**
5. **Video**
6. **Animation**
7. **Programs Files:** associated with a particular type of simulation software such as Croc Tech or CAD
8. **Links to External Websites:**
9. **Other:** Contacts Database, Slideshows, Flash and Assessment tools.

So 34% of modules within the Design School contained *word documents* detailing module information. 26% contained *Powerpoint* presentations and *PDFs*, 24% contained *links*. There are 7% *excel files and only* 7% of modules contained *pictures*. *Video* and *animation* came in at 3% of modules which contained this type of new media. Modules which had a variety of miscellaneous resources on them came in at 15%. There were some modules which only had one resource available on the module outline, typically as a .pdf file or a word document. The most heavily used learning resource type was thus Word documents. This was a disappointing finding insofar as it would be tricky to encourage a lecturer to move to mobile technology when the resources were limited to text files.

7.3.3 **Evidence of Current Use of NM & NT among D and T Students**
This involved searching on new media sites, such as Youtube and Facebook for evidence of Design and Technology students already using these new media tools for learning. The explosion of new media sites like Facebook over last few years has been phenomenal. If educators within Design and Technology could tap into what makes this application useful and engaging, this could enhance D & T education greatly. Firstly, this account sets out to find some evidence that design and technology students are using \textit{NM & NT} through:

- Searching Facebook groups at Loughborough University on Design and Technology undergraduate education; looking for evidence of learning outcomes
- Identifying if they are they still in use or have fallen by the wayside
- Whether there is evidence for using New Media sites for their coursework.

There is therefore some evidence that design and technology students are using new media for their coursework. However one of the major drawbacks to using sites like Facebook is that one is using a private domain of the students’ life for educational purpose and there is evidence which suggests that students do not want this; the freedom of being able to use the internet. \textbf{Appendix XIX: An Investigation of Whether Students Use Facebook to Communicate Design Ideas} provides a table detailing the findings.

### 7.4 Identifying Which Learning Scenarios to Pilot

\textit{Chapter 6 identified seven learning scenarios. This chapter has investigated scope and current use of NM NT for D and T education. This section provides an overview of which scenarios might be feasible to pilot for D and T education.}

Seven learning scenarios were identified in Chapter 6 containing potential for design and technology education. The technological feasibility and other constraints on the operation of scenarios have been diagnosed. Thus action- taking cycles can move forward to implementation of the suitable learning scenarios. \textit{NM & NT} learning scenarios require \textit{NM & NT} tools which reveal educational potential:

1. To encourage and improve staff and student use of the Internet and;
2. To help staff and students achieve learning outcomes and improve communication and engagement.

So to summarise, stakeholders would like technology which can:

- Easily communicate Design and Technology module administration information changes to timetables;
- Keeps updated with new information from the Design School and the design and technology context more generally;
- Also using mobile technology, such as for video and photos.

Thus the following learning scenarios map onto these requirements:

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<tbody>
<tr>
<td>2.</td>
<td>Lecturer Teaching Habits: Using Audio/Video capabilities Of Mobile MP3/MP4 players for Design and Technology Lectures</td>
</tr>
<tr>
<td>3.</td>
<td>Module Administration Issues: Design &amp; Technology Email and Text Messages</td>
</tr>
</tbody>
</table>

If students as the expected beneficiaries were expected to use *NM & NT*, then lecturers would have to have some knowledge of it too. Thus Scenario 3 was identified as a way of stimulating lecturers’ use of the Internet for their own research. This is piloted in an email newsletter, Design View. Then Scenario 2 was piloted with audio-visual methods of delivering learning objects.

### 7.5 Pilot of Scenario 3: Creating a Departmental Email Newsletter “Design View”

*This section describes the actions taken to encourage lecturers to share new media on with other members of the Design School.*

Sharing new media links might mean the lecturers learn from one another, not just about their research, but about the available *NM & NT*, such as wikis, blogs and podcasts. This belief followed the socio–constructivist vein, and results from this action-taking would provide further insight into the potential of *NM & NT* for D and T undergraduate education.

It was envisaged that the previous proposal to integrate RSS technology into the Design School would be easier if the lecturers would share their links. This would indicate to the researcher how happy and comfortable lecturers were with using new media and information from the Internet. Promoting student/staff engagement with *NM & NT* was seen as central to exploring the potential for *NM & NT* in D and T education.

### 7.5.1 Why it is needed and how it solves a problem
It was envisaged that if lecturers/researchers within the Design School start using new media and sharing links, it would be easier to teach the students how to use this technology, and try to get students using RSS technology for themselves.

Action research methodology can offer improvisational ingenuity of acting on opportunistic events. One of the lecturers was keen to establish a departmental newsletter as a communication tool for members of the staff within the Design School; research students and staff. This was to communicate any design-related links which researchers and staff had found on the Internet recently. Because lecturers interviewed did not seem to use the Internet for their research, a way of encouraging them to do so was introduced. It was hoped that this would help and improve their skills when introducing undergraduate students to using the Web for their research.

This was a good opportunity to try to answer the further questions which arose in the previous cycle. In particular, a need was identified to get lecturers interested in sharing their new media and website links. Thus an HTML departmental newsletter was devised and this was trialled for a few weeks in the Design School. As a learning scenario, it was envisaged that in the future, the stakeholders could use RSS as a way of transporting the information directly to mobile or email, on designs which would be useful to know about for modules and research.

Design View was deemed useful and necessary to promote staff engagement with *NM & NT*. Specific aspects of Design View to be identified included:

- Lecturer evidence of using new media such as wikis, blogs
- Use of multimedia content related to their research interests
- Interest and enthusiasm for contributing to “Design View”
- Collaboration between researchers: “I found this link which relates to Xs research”.

### 7.5.2 Researcher/Practitioner Collaboration

Creating Design View involved assessing an email template which would have cross-browser compatibility, and low page load time. Figure 24 reveals the format for Design View.
7.5.3 Participants, Materials and Procedure

The participants were the lecturers, research students and research staff as primary stakeholders of this research: The materials required for this stage were Aptana open source HTML software for developing the HTML template and an HTML newsletter template. The step by step procedure involved:

1. Collaborating with a lecturer on moving their ideas for “Design View” forward;
2. Internet search on HTML newsletter templates which were accessible on multiple browsers and email clients and conformed to W3C standard and;
3. Discussions face to face and over email on how to get the first “Design View” out to research staff and students.

7.5.3.1 Action Taking: Design View goes live!!

After deliberation on the format of Design View, a version was sent out. Although Design View was proposed to occur at two week intervals, the dates it was sent out were:
These dates demonstrated the frequency of issue of the newsletter. These newsletters were emailed out to staff and research students. There were 13 collaborators supplying a total of 58 links. It tended to be the same people who contributed. The topics of the links for Design View were very wide, ranging from Sustainable Design to robotics and proved a promising method of building up a list of bookmarks which could be used in the RSS scenario.

The act of forwarding on the new media information to interested parties has the effect of making it more memorable, and it was expected that this technology would be more heavily used in the Design School. Aggregating new media information for the benefit and interest of the whole School should have been a fun, collaborative way to demonstrate what in the design world has provided inspiration. Therefore further data on why the lecturers’ uptake for this was slow or non-existent is needed in future research. It is hoped that this tool for learning and sharing will be more widely used in future. Scenario 2 was piloted as a way to develop lecture content for design and technology modules. The next section describes the first attempt to make a video podcast for Foundation Technology as per Scenario 2.

7.6 Pilot of Scenario 2: Developing Prototype Learning “Vodcasts” for a Foundation Technology Module

This section reveals the pilot development of a learning video podcast (vodcast) for a mp4 player mobile device. The vodcasts are all on basic electronics for first year undergraduates studying design and technology. It was envisaged that if the lecturer could provide the student with the lecture content for them to view themselves then they could spend more time on problem-based activities.

7.6.1 Why it is needed and how vodcasts solve learning problems

Question 9 of the student survey (Chapter 5) revealed the attractions for mobile technology for learning. The benefits identified by the students in questionnaire include, on-hand access, remote learning, ease of access and the value of having a permanent record. The NM & NT
which possesses all of these requirements are podcasts/vodcasts. Thus this technology could be needed very much.

7.6.2 Recording Lectures and Learn@lboro: Materials and Procedure

Five audio files and five PowerPoint lectures for basic electronics were supplied in 2006. These were made into Vodcasts, then trialled on an iPod®. The titles of the lectures were:

1. Printed Circuit Boards
2. Integrated Circuits in Monostable and Astable Modes
3. Microprocessors
4. Binary
5. Binary and Logic Gates

Various items were used to create a podcast. These are:

- 30gb iPod® for testing the video lecture on;
- Software for creating the video lecture;
- PowerPoint files of the lecture slides;
- Audio of the lectures;
- Camtasia software for putting it all together;
- Audio software to improve sound quality and;
- Videodora to convert Camtasia files for iPod®;

Procedure for Creating Vodcast:

1. Modify sound quality of audio lectures through audio software so it got rid of the background interference from recording. When the lectures were captured there was much background noise. (Note newer versions of Camtasia now do this automatically).
2. Load PowerPoint of slides and reworked audio file into Camtasia. See Figure 25 of an example slide below.
3. Go through the lecture and audio to sync them together
4. Save output as .AVI
5. Convert through Videodora program to Mpeg4 file format suitable for iPod®.
6. Test on an iPod®.
7.6.3 Problems and Pitfalls
Some initial problems identified with trialling Scenario 2 were:

- Researcher spends a long time creating the Video Podcast with slow computer and long video render times
- If the lecturer changes the module structure then the material which took a long time to create becomes defunct
- Learning materials can go out of date, although this is less of an issue for basic electronics
- Long lecture of slides (40 minutes on average) does not grab the student being educated.
- Only creating the Vodcast in Mpeg 4 file format made the learning object dependant on Apple mobile technology, i.e. iPods®.

This action planning stage allowed this researcher to become familiar with Camtasia software and the art of creating a Vodcast. However, the rendering of video took a long time; it seemed that the length of time this process took outweighed the benefits of it; the technology was not up to the task. (It was not until an upgrade to Camtasia 6.01 was purchased by the School that this became a viable option).

7.7 Results from Piloting Scenarios Used to Plan Action
This section reflects on the lessons learnt from the pilot and how this informs the next stage of the research.
Vodcasting provides promising technology for undergraduate students; however, it is very time consuming to develop and whether students will watch a whole lecture on a small screen is debatable. An email newsletter “Design View” ended up with a random monthly collection of links from different new media, which did not give a good picture of development of research goal. Plus hardly anyone contributed. A better way of managing links is suggested, and further developments for vodcasting explored.

7.7.1 Vodcasting Learning Information
From the pilot vodcast in Scenario 2, the following results could inform a larger study. The findings which were relevant include:
1. Smaller size of learning objects would be better for students, the 40- minute lecture style was too long;
2. Different mobile devices possess different proprietary file formats, so any learning objects made for D and T undergraduate education would have to be made into different file formats, e.g. .MP4 or .wmv.
3. How is it possible to integrate vodcasts into the Learn@lboro existing V.L.E in a way understandable and familiar to students.

The scenario using mp3/mp4s was implemented for Foundation Technology. The materials were provided by the lecturer allowing prototype content to be made. The first task was to name these new types of Learning Objects. The name “ModVods” was chosen as it is a mix of the words “module and “vodcasts”. Then the development of vodcasts was undertaken. If this was to become a viable delivery of lecturer content, the files would have to be more closely related to the learning objects of each lecture. A plan was made:

1. Collect video from various sources of Foundation Technology workshops and lectures
2. Edit them into smaller parts and upload them onto mobile devices
3. Collect data by consulting with a small group of students on whether students can use them for learning how to do Foundation Technology learning activities

7.7.2 A Better Way to Manage Links - RSS: a New Technology for Higher Education
The results from the Design View were disappointing, but they did indicate that some lecturers were using interesting internet resources for their research. The issue arose of how to then disseminate that research information to students studying their modules. The major
drawback seemed to lie in the format and technology; emailing a newsletter became like spam email which was not read, and not contributed to. Many of the lecturers interviewed seemed to be mistrustful of the internet, so this may explain why Design View was not so popular.

A better way of sharing links exists with something called RSS technology. A study is suggested which uses RSS instead of email to disseminate links related to design and technology to students. One issue lecturers have with students research is the constant use of Google and the Internet for their research. To actively discourage this, a study whereby students learn to use RSS would alleviate this; Lecturers would have some measure of control over the links which students found and used.

Vodcasts use RSS technology so this links into the other piloted scenario. The second question arose on which module RSS would be most suitable to try out. As the lecturer/researcher using Design View was in Sustainable Design research, it was proposed to use “Dynamic Mobile RSS for Sustainable Design Research”. The field of sustainable design is changing very much, so this technology seemed ideal to keep up with the latest design and technology information.

7.8 Conclusion

This chapter has described the first part of the action-taking cycle, where scope for NM & NT in D and T undergraduate education was revealed through consultation with V.L.E administration staff. Then two pilots were conducted which aimed:

1. To encourage and improve staff and student use of the Internet, NM & NT and;
2. To help staff and students achieve learning outcomes and improve communication and engagement.

These pilots looked at encouraging staff to use the web through an email newsletter, and how to create a learning object (called a vodcast) intended to achieve learning outcomes. The results of these pilots demonstrated where improvement could be made on these aims. The subsequent two chapters make further more in-depth investigations into these aims.
Chapter 8: The Action Taking Cycle: An RSS Learning Scenario in Design and Technology Undergraduate Education

8.0 Introduction

This chapter describes results from introducing Sustainable Design students to accessing NM & NT through an RSS application. This introductory section introduces the technology RSS, and briefly describes the steps taken to use this technology in a learning context.

The growth of action research using new media in the area of Sustainable Design has highlighted the importance of learning collaboratively (Allen, 2001). The potential for learning collaboratively can be realised through RSS (Harssch, 2006). Thus it can be a useful way for D and T staff to keep track of large amounts of new information on a particular subject or a students’ online presence, such as a blog. It can also provide staff with more control over students’ overuse of dubious websites, and provide students with a much richer set of resources for their own learning.

In previous chapters, interview data from lecturers describes a major problem with students using dubious sources from websites; it also looked at ways of encouraging D and T staff to develop more engagement with NM & NT. Questionnaire data investigated different learning scenarios with NM & NT, and found some requirements which, according to the literature survey, RSS technology and Vodcasts have the potential to help in D and T education. An overview of those requirements:

- Stop students using dubious sources from the web (from interviews)
- Help with module administration issues (from questionnaire data)
- Provide no cost and little or no work to the D and T lecturer to implement (ICT/ Media Content Analysis)

Chapter 8 and 9 attempt to explore the potential through introducing RSS and Vodcasting to a small number of D and T students and reviewing the outcomes through using Observational methods. This fulfils the research aim of the creation of multimedia learning resources available on new technologies, using mobile devices in both studies.

8.0.1 Linking the RSS Learning scenario to Research Aims and Objectives
This stage of the research fulfils research objectives below:

**Objective 7. To investigate new forms of learning D and T subjects, through the delivery of New Media through mobile devices, mlearning and elearning.**

Thus new forms of learning are tried out with RSS. RSS technology is akin to a broadcast technology, and forms the technology behind podcasts (and vodcasts). RSS is a way of managing new media which can be accessed via new technology, such as mobile phones. This chapter aims to find out if it can help with learning Sustainable Design module in D and T education, and identify possible obstacles to achieving this. Also the following research sub-questions (contained in Chapter 1, section 1.1.2) are tackled:

- What are student/lecturer’s level of knowledge of NM & NT?
- What are the students’/lecturers’ perceptions of using their mobile devices for learning
- How to teach students to make use of online tools for their D & T education;
- Can mobile devices help students as a tool for D & T education and communication?

This chapter describes Cycle 3, - “Action Taking”- of this action research project; overall this cycle tries to find potential for NM & NT in D and T education through promising NM & NT, RSS and Vodcasts. Previous development in the action-planning stage step (3C2 in Chapter 7) gave this researcher an insight into how to develop email and Vodcasts. The problem with email is that module information and content may not reach the student. To address the issue of students’ lack of sophistication in searching the web, RSS was introduced to six student participants. They were taken through the process of accessing RSS first on a computer and then on a mobile device. To capture important details of any problems encountered, the sessions with each participant were video-recorded. Then, the video recordings were analysed, providing educational feedback to inform the next cycles.

**8.1 Investigating Student Competencies with RSS in Education**

This section illustrates the benefits of RSS and mobile learning. This section selects the appropriate Design and Technology module for RSS technology and identifying how it solves a particular problem in this module.
This section describes how the learning scenario of looking at RSS was deemed appropriate, through looking at the benefits of this technology. This section concludes by mapping the benefits of RSS to a learning scenario appropriate to Design and Technology education.

8.1.1 Introducing RSS in Education

RSS was invented to assist with keeping track on the latest content on the Internet on a given topic. Thus a case study was proposed to try to enhance students’ m-learning potential and use of NM & NTs for learning generally. The results of this learning scenario allowed insights into how RSS could be useful to learning design and technology related modules. The learning scenario investigates teaching students to use RSS for students’ Sustainable Design module. Designed to support informal learning of the sustainable design module, this scenario encouraged students to use RSS on mobile devices. Once the benefits of RSS were assessed, the researcher sought to identify where, within the Design School, RSS could potentially be of most use. RSS terminology includes the following terms:

- Feeds: Dynamic content pushed to a feed reader
- Directories: a collection of feeds on a particular topic e.g. Sustainability
- Podcasts: an audio file wrapped up in xml code which specifies how it is downloaded
- Subscriptions: The learner collects subscriptions to feeds
- Clippings: A way of saving the post to your blog or webpage

Thus, learning to use RSS requires learning new terminology.

8.1.2 Previous research on RSS in undergraduate education

Leicester University (within Media Zoo) and the Open University have attempted to use RSS for education delivery, although this work is not discipline specific, whereas ours is. The aim in this research was to develop architecture for introducing RSS to a Sustainable Design module in D and T education on the basis of need. The content of the RSS feeds would be specific to the module.

Previous research in RSS in education has identified potential but also some drawbacks (Duffy and Bruns, 2006; Richardson, 2005; Atkinson, Buntine, and McCrohan, 2007). This research will look for the potential for RSS, through introducing students to it. Harrsch, (2003), makes claim that average person can enrich their lives with RSS technology; that is therefore the next “killer app” for education. Harrsch (2003) identifies six potential uses of RSS such as the potential for RSS to be better than email. This research will investigate
claims it is a better solution than an email subscription list (such as “Design View”), as it could avoid spam emails, and instead of hunting on portals to pull down information, with the RSS model users can have information ‘pushed’ to them that is customized to their personal interests.

Sampson, (2005), notes some setbacks to launching their podcasts, such as bandwidth issues. They set out to create podcasts for the library and examine log files to monitor usage patterns. Glotzbach, Mohler & Radwan (2007) sought implementation of RSS to provide students with another way of getting module announcements. Students in this research stated they wanted a better way of keeping track of module announcements (Chapter 5), so RSS and mobile devices were looked at as a way of changing education communication patterns.

8.1.3 Rationale: The benefits of RSS and mobile learning
The benefits of using RSS are that the information comes in short bursts; the student can decide whether the information is useful to helping them to design sustainably. Other benefits include:
1. - RSS is all-encompassing of new media and new technologies! RSS keeps track of many different types of new media, (blogs, podcasts and websites).
2. - RSS can be used with different types of mobile devices for learning (mp3 players and mobile phones).
3. - The benefits of being able to access this information whilst mobile are that design students are often based in practical workshop settings, not sitting at a computer.

8.2 Learning Scenario using RSS for the Sustainable Design Module (Accessible on a Mobile Device)

This section describes the stakeholders for using RSS for Sustainable Design Module and describes the process for looking for learning outcomes, using a computer and a mobile device.

This section sets out the process for introducing learners to a new way to gain learning through RSS technology, to see if it is suitable to attain learning outcomes for a Sustainable Design module. The learning outcomes from this module are contained in Appendix XX Sustainable Design Module Learning Outcomes.
8.2.1 Stakeholders: Who benefits and how
Three stakeholders from this research stand to benefit from introducing RSS as a NM & NT to learning. Investigating RSS was beneficial to this researchers’ own understanding of how this technology could be used to teach. Benefits to the student include being kept up-to-date with the latest Sustainable Design information whilst on the move or at the point of need. Thus the lecturer can share useful information with the students, and can stop the students using dubious sources. Once a pattern of lecturer to student communication with RSS has been established, it is possible to look into how it can be used for student- to- student work.

8.2.2 Using RSS for Sustainable Design Module
“The action research participants begin with little knowledge in a specific situation and work collaboratively to observe, understand, and ultimately change the situation, while also reflecting on their own actions.” (Dickens and Watkins, 1999, p.8)

This quote puts into context this investigation with RSS for Sustainable Design; none of the stakeholders to this research (participants or researcher) were particularly experienced with using RSS. There was no guarantee that it would be usable for the learning tasks, let alone whether it would solve the problem and change information- searching habits in relation to learning. Working together through learning tasks on an RSS application for Sustainable Design allowed observations and understandings on whether it was possible for students and researcher to use an RSS feed reader, “Bloglines” for obtaining “new research skills” (Dickens and Watkins, 1999, p.8), and cure the problem highlighted by the lecturers in relation to NM &NT and their modules.

Chapter 7 revealed that the learn@lboro learn server has the potential to add individual RSS feeds to the main interface for a module. The Sustainable Design module was one of the few modules within the Design School making use of this type of new media (see Figure 26 below), after a discussion with the lecturer on this. So Figure 26 below details the new RSS feeds on the right hand side of the interface. As an extension of this current use of RSS on a Sustainable Design module, it was proposed to teach stakeholders how to use RSS for NM & NT.
The reason this module was chosen in particular, is that there are many different types of new media on the Internet, websites, and blogs on sustainable design issues. Also, the Sustainable Design lecturer in an interview had expressed a concern that students for their sustainable design module kept …“they put sustainability into Google and use anything from there without checking the quality of the source” …, (see Chapter 4, Participant 3, Section 4.7.3), and using those dubious links which appeared from the search engine results. RSS was invented to assist with keeping track on the latest content on the Internet on a given topic, but it can also cure information “icebergs” around a topic; where users of search engines only check the first ten results on a web page. Therefore, the use of RSS for Sustainable Design seemed logical learning support already in use for an ever-expanding area of design.

8.2.3 Conclusion: Looking for Learning Outcomes
Previous interview data from D and T lecturers (see Chapter 4), established an educational problem, where students persistently used search engines (especially Google) as their main source of university research. This resulted in the undesirable outcome where students were using dubious sources for assessments. RSS seemed to have potential for addressing this. Not only that; but student learning outcomes seemed to be able to be supported. Specific Sustainable Design module learning outcomes (Appendix XX) which RSS could assist with include:

1. **Knowledge and Understanding**
   
   “- demonstrate knowledge of and understanding of
   
   - applications of sustainable design”
   
   - the application of methods and tools for sustainable design;”

2. **Subject Specific Skills**

   - take into account the effect of emerging legislation in their designing.

3. **Key Transferable Skills**

   “- source, navigate, retrieve, evaluate, manipulate and manage information from a variety of sources;”

   “- employ communication and information technologies;”

Another issue particular to this module was that the area of Sustainable Design was ever-changing; thus it was hard to keep track of useful information in the research field. Thus action research with six participants helped investigate the potential of RSS for solving this problem. RSS has the potential to stop students using dubious sources AND help keep track of new media and new technologies. So to conclude, this research into RSS aims to look for the following learning outcomes:

1. - Get students using a different application than Google for looking for module-related information (i.e. stop them using dubious sources from the web);
2. - Find out how competent they are with new media and new technologies;
3. - Uses one-on-one method to find out more in-depth, what they have a problem with, so that a clear way of teaching students with RSS may emerge which addresses the above problems.
8.3 Video Observation of Students’ Learning with RSS

This section identifies how this researcher approaches collecting data on RSS in education to deliver the aims above.

The purpose of this stage was to identify whether student participants had used RSS before, whether student participants had surfed the internet on a mobile device before, and whether they knew what the various new media examples were, (such as podcasts/ vodcasts) and how to use them. The literature review made certain assumptions as to the digital literacy of this generation of students (Prensky, 2001). This investigation sought evidence for it.

The research aimed to assess four aspects of the RSS learning scenario:

1. Data on student competences with RSS and new media and new technologies;
2. Training the researcher to teach people about the benefits of RSS for new media; how to communicate this to stakeholders in future;
3. Data on students’ using different new media e.g. podcasts and websites on Sustainable Design and;
4. Training students to transfer their searching and information habits to a mobile device

8.3.1 Selecting Appropriate Methods for Data Collection: Video Data and Action Research

RSS is a new technology and there were not many examples in literature of how to use this technology effectively with learning. Thus embedding RSS technology as an intervention was considered a gamble until the researcher felt that there was educational data on how it could be used. Also due to the inexperience of the researcher, it was decided not to embed this technology on the Sustainable Design module until a case study had run to answer the questions in 8.2.1 above.

Susman and Evered (1978) advocate change being made with small numbers of participants face-to-face, to maintain tight control of the ethics and to monitor those changes more effectively. Therefore, a one-on-one case study approach to introducing students to RSS would reveal potential problems which different students would experience. This would provide useful information in the future for teaching a class of students about using new media through RSS with new technology (mobile devices). A small pre-task questionnaire
was handed out to students, to find out whether they had used the Internet on a mobile device and whether they had used RSS before.

**8.3.2 Rationale for Video Observation Method**

Video data has been used with action research before. Rosenstein (2002) reports the use of video data for research in 3 terms; observation (collecting data and analysing), a means for providing feedback, and a way for distance learning. Carraher, Nemirovsky, DiMattia, Lara-Meloy, & Earnest (1999) use video data in their action research project and found it very useful for feedback for situational assessment. They argue that video data has the potential to bridge the gap between classroom research and practice by providing rich and detailed data for grounded discussions about teaching and learning. The authors attempt to use digital video technologies to increase collaboration between researchers and practitioners. Wright (2009) and Cunningham *et al.*, 2002 describe the benefits of collecting and analysing video data on how one teaches students. They both use thematic analysis to analyse the video data transcripts.

Employing observational techniques through collecting video data allowed for a collaborative technique, where the researcher and student participant could move through and discuss the tasks. Later, video transcription would provide educational data helpful for embedding RSS into Design and Technology students’ learning practices. This allowed the researcher to collaboratively work through tasks with students using RSS technology. It taught how to teach students about researching through the Internet in a different way to the normal way they used the Internet. One attribute separates action research from other types of research. Primarily its’ focus is on turning the people involved into researchers too - people learn best, and more willingly apply what they have learned, when they do it themselves. This rationale led to observational study on getting students to use RSS for their sustainable design module.

**8.4 Video Observation: Set Up and Materials**

When the students came to the location for the case study they were asked to read an *Introduction to the Research* document which contained some of the definitions for the terminology they would be using, such as podcasts and feeds. Then the students were seated at a computer first to perform some tasks using RSS, i.e. Bloglines. Then they were asked to
perform some tasks on a mobile device, an MDA Vario Smartphone. As they moved through tasks on the computer and on a mobile device, the researcher asked questions to assess how they were coping, what they were having difficulties with understanding.

A strategically placed video camera was positioned so that a clear view of the interface, from a distance of approximately two feet, was obtained. There were tasks on the selected computer interface and tasks on the mobile interface for the participants to perform. A pre-task questionnaire assessed various criteria, for example, whether the student had used the site before.

![Figure 27: RSS Computer Interface with a Video Recording of Participant](image)

A video recorder was used to record their interactions, so the lecturer did not have to take notes and could focus on the students. Camtasia software was used which collected video of what the participant was doing as they moved through the tasks on the computer and mobile device. Vidya screen capturing software was installed on the mobile device which collected screen dumps as .jpg every 2 seconds. The idea was to put these screenshots together in a
program to create a video file which could then reveal data about the participants’ problems with using mobile technology.

Figure 28: Participant Logging onto Bloglines on a Smartphone

The screenshot above is an example of screen captures which the software Vidya collected from the device. This was put together into a video clip indicating the problems which participants had. Vidya could not be used with each participant as the mobile device ran slower or ground to a halt when this application ran. The materials used in the case study were as follows:

- Pre-task questionnaire (Appendix XXI: Pretask Questionnaire)
- Introduction to the Research document (Appendix XXII: Participant Introduction to Research)
- Consent form (Appendix XXIII: Sample Consent Form)
- Tasks to perform by the participant (Appendix XXIV: RSS Tasks Schedule)
- Camtasia to record the computer screen
- Video recorder to capture the interaction between researcher and student
- MDA Vario smartphone
- Vidya software to try to record the screen of the mobile device

The tasks were developed by the researcher who piloted them to ensure they could be completed.

8.4.1 Selecting Materials: Choosing the RSS Application, Bloglines
First a collection of RSS applications or aggregators were collated. Then the interfaces were evaluated to assess how to incorporate learning scenarios. Examples of RSS applications include:

- Technorati
- Newsfeeder
- Feedster
- Feeddemon
- Bloglines

Through the combination of interface use and forum research, it was concluded that the Web based RSS application, Bloglines was the most suitable. As it is a web-based application, the student can use it from any computer with Internet capabilities. Why was RSS web application chosen for the intensive studies? A web- based way to manage ones’ RSS data online would be more suited to student context where they may be studying in a variety of locations e.g. a library, their home, and their halls of residence. Web-based ways of managing all websites and data provide for a more convenient frequent use of that application.

"[A]s Amazon, eBay and Google have demonstrated over the last few years, providing a Web services interface to your core data opens the door to many new creative applications", (Lerner, 2004, p.6).
Cold (2006) identifies Bloglines as the most suitable for bringing RSS data into one location for the purposes of individual student research, on the basis that it is a free web-based application. Thus, the application chosen was Bloglines because it was web-based, could be accessed from anywhere and worked best on a mobile device. This decision was informed from this research into new media applications which could be useful for learning.

### 8.4.2 Selecting Materials: Choosing the Mobile Device

The lecturer supplied her own device for the tasks as most of the students would not have a mobile phone which can access the Internet. The lecturer tested learning resources through a MDA Vario® smartphone.

### 8.4.3 RSS for Sustainable Design Module on a Mobile Device

In investigating the potential for NM & NT for design and technology undergraduate education, this research looked at RSS for a Sustainable Design module on a mobile device. The learning outcomes of using RSS in D and T education were envisaged as:

- **Teaching Experience of Introducing RSS**: Before suggesting to lecturers a learning path/user guide with RSS technology, this researcher got firsthand experience of teaching to students through this scenario.
- **Good Examples**: Hopefully, some good examples of the students finding relevant websites related to sustainable design.
- **Data on Student Understanding of RSS**: Existing competencies with new media, such as use of new media such as podcasts.
- **Data Collection Method Testing**: Recording video of learners using the site on a computer and a mobile device, did this yield good data for education and assessing learning potential of NM & NT.

### 8.5 Video Observation Data Analysis

*The following section identifies participants and procedure followed in discovering the potential for RSS technology for the Sustainable Design module.*

This section provides insight into how thematic analysis was performed on the video data and how the codes were developed. Six video observations were transcribed and analysed on using RSS for a Sustainable Design module.
8.5.1 Applying Thematic Analysis to Video Observation Data

Once the video data was collected, the researcher transcribed them and then thematically analysed the results looking for potential in the area of NM & NT. Codes were developed from the previous cycles. Then instances of those codes were looked for. The number of codes determined whether any themes emerged from the data. The results from thematic analysis were divided into major and secondary themes. The following steps were undertaken;

Step 1 - Familiarise with data: The first step involved transcribing the video data in Word and adding columns on the left and right margins for line numbers and codes.

Step 2 - Generating Codes: The second step involved deriving 28 reusable codes; these were derived from various sources;
1. The literature review
2. The learning outcomes identified from Diagnosing and Action Planning Cycles

Appendix XXV: List of RSS Thematic Codes contains a full list of the codes generated for video analysis, for example “CLS” code was used where a participant referred to the content of learning resources with NM & NT tools.

Step 3 - Searching for themes: this search applied the codes to the transcripts (Appendix XXVI: Transcript of Video Data from RSS Study (Participants 1 - 6). Next to comments made by the lecturers a code was placed on the transcript page, Please see Appendix XX for a rundown of the full transcripts used. The codes were collated in Excel and searched for a number of themes. The more instances of a code the more likely it would form part of a theme. Whether a major theme was apparent was based on the number of instances of particular codes in the transcripts.

<table>
<thead>
<tr>
<th>No. of Codes</th>
<th>Meaning of Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 and above</td>
<td>Major Themes</td>
</tr>
<tr>
<td>10 – 20</td>
<td>Secondary Theme</td>
</tr>
<tr>
<td>0 – 10</td>
<td>Not a Theme</td>
</tr>
</tbody>
</table>

Step 4 - Reviewing themes: A concept map was drawn up from the findings. Some codes did not relate to a theme but instead related to a particular thing we were trying to find out, such as was screen size an issue. Some themes were more prevalent than others, for example,
in terms of student learning habits; they still used Google for their search practices. Specific examples of these themes were ones which were related to technology for learning in some way.

**Step 5 - Defining and Naming Themes:** Drafting an overall story from the themes, paying particular attention for where there are problems in D and T education and/or room for improvement where NM & NT can be used.

**Step 6 -** Finally, useful excerpts were extracted to help understanding of the potential for NM & NT in D and T education.

**8.5.2 Conducting the Research: Participants and Procedure**

This section highlights the participants and procedure used to collect data. Data was collated as video observation, and questions were asked of the learners’ previous use of RSS. The student participants for the study were sourced by going into a Sustainable Design lecture, explaining the research and getting the interested students to sign up to a time when they would be able to take part in the study. In the end, there were six participants who volunteered to take part in the study.

This scenario provides a minimal cost outlay to the participants, maximising the use of new media within an RSS application and teaching the students to be organised in their web searching. The participants were asked to come to an office specifically for data collection within the Design School. Explaining to the students’ one on one how to use RSS was done in a separate room as the department was very noisy. Having a data lab where participants could ask questions and have time to respond in a private place where they could feel uninhibited, was very useful for understanding the pedagogic issues and challenges that this learning scenario presented for students.

The procedure involved the participant in a small room, to allow for video recording of the data from getting the participant to perform tasks. The practical procedure followed by the researcher once the participant arrived was as follows in Table M below:

<table>
<thead>
<tr>
<th>Procedure for computer part of study</th>
<th>Procedure for Mobile device</th>
</tr>
</thead>
</table>

175
1. Turn on Camtasia

2. Turn on video camera to record

3. Recite what the research is about

4. Provide Introduction to the Research document

5. Give Consent form document

6. Assist on Computer tasks

Table M: RSS Research Tasks Procedure

Figure 30. Camtasia Interface with Video Recording of Mobile Device

Figure 30 above shows the video editing software Camtasia with some video footage of the type of mobile data used. The research sought to assess whether the students taking part in the observational study would pick up how to use RSS quite quickly.

8.5.3 Describing Relevant Data Sources

Employing an ethnographic collaborative technique, it was possible to identify the following data sources and the types of data revealed by this study:
1. Educational Intervention on the students’ use of new media technology for learning;
a) Whether the students have used RSS and other new media before;
b) Whether it is effective intervention for the purposes of research;
c) Whether the promotion of RSS technology will help them with their research on sustainable design.

2. Issues Lecturers may need to be aware of before using RSS onto their modules
The second type of data which can be collected included any user breakdowns or unexpected occurrences which students experience so lecturers can anticipate where students’ gaps in understanding might lie.
A summary of the procedure is as follows;

1) Recruiting Student Participants: this has involved devising some tasks and approaching a user participant for the pilot study. Findings from the pilot were analysed and tasks refined, before further preparation of tasks for participants.
2) Interacting with the learner, new media and new technology. Video recordings of how they use the technology.
3) Summarising the observations (see results section and five emergent issues)

8.6 Results from Introducing RSS on a Sustainable Design Module
This section identifies results of implementing the learning scenario on a Sustainable Design module.

In this section, the results from the thematic analysis of the video observation transcript will be reported to identify themes to derive some understanding on the potential for NM & NT for D and T education. Appendix XXV and Appendix XXVI show the thematic codes and the video observation data transcripts. It was shown from previous cycles of investigation that RSS and Vodcasting showed promise, and two learning scenarios were piloted. This section reveals the results of trying to use RSS to:

1. To encourage and improve staff and student use of the Internet, NM & NT and;
2. To help staff and students achieve learning outcomes and improve communication and engagement (as identified from Chapter 7).
8.6.1 Themes Arising from Video Data Observation

As per Step 3, of the thematic analysis, codes were grouped together where relevant to form overall themes as shown in Appendix XXV: List of Thematic Codes for RSS Study. Then the total occurrences of the codes throughout the transcript were identified, then they were totaled according to which theme they belonged to which gave a larger total. Codes were grouped together as themes were given to indicate a priority of themes which could indicate potential. The themes in order from highest to lowest are:

**Major Themes**

1. - Researcher is relied on to provide understanding (130 occurrences)
2. - Problems arise due to technology not up to the task (128 occurrences)
3. - NM & NT learning resources identified by student (59 occurrences)
4. - Student uses own initiative to achieve learning outcomes (44 occurrences)
5. - Student lack of familiarity (20)

What the major themes appear to indicate is that using RSS for student research is still not understandable for students, and that the technology is not available or reliable enough to achieve learning outcomes. The major themes show some indication of potential but student lack of familiarity with the technology seems to contradict where students use their own initiative to achieve learning outcomes.

8.6.2 Overall Results: Report on video data collected from student participants

This section evaluates the overall results from introducing six participants to using RSS on a computer and a mobile device to find out information for Sustainable Design module. Using the themes above and referring to the transcripts, some interesting findings emerge.

Some interesting findings:
• P2 searches for posts within the application compared to the other participants who went into Google through another browser. Trying to get students to break the habit of using Google was unsuccessful.

• The different ways RSS is used on websites is really confusing for the participants. For example, participants got confused between directories and the list of posts feeds. Also confusing websites, for example, one clicks the RSS button and it comes up with a page of indecipherable xml code;

• Similarities amongst participants were that none used the help files. This is a surprise as there was an assumption that D and T students would use manuals where possible.

• All of them use MSN mail not their Loughborough university email, which is not good for learning communication.

The point of the exercise was to introduce some students to RSS for the Sustainable Design module, to finds out what and how to use RSS for Sustainable Design. The benefits of RSS are that they can manage all new media new content in one place, thus saving time and energy. A thematic analysis organises the transcript into themes surrounding whether RSS is can achieve this benefit.

• On the whole, RSS is a beneficial tool to get them to think about how to search through news feeds and how to search on Sustainable Design projects. However, it needs to be clearly explained to them in a session.

• Despite research suggesting most people had surfed the internet on a mobile device, the participants were all 1st time learners of surfing on a mobile device for learning; this had an effect on the ability to complete tasks on a mobile device.

• Websites have inconsistency in how RSS works and is viewed. Therefore, it is difficult for participants to make judgements on how to use the RSS information, and thus whether it is relevant to their project and Sustainable Design studies.

• Confusion over terminology: This is by the participants but also by website builders themselves over distinction of downloading an mp3 file and subscribing to a podcast. This makes it very confusing for the student who is using a podcast for a first time (which most of the student participants were).

• Student participants go back to search engines they know rather than using the search functions within the application. The point of the exercise was to assess how to stop students using Google all the time. Changing these habits will be hard work and
requires at least a session and planning with the lecturer. Thus a user guide is proposed. Participants do not have a set of strategies for finding things on the browser. Eg. p1 did not use “find” or CTRL F on the browser. Other participants did not know how to search using CTRL F or “Find on this page” button in Edit in their browser.

The following technical issues really hampered the progression to m-learning of the participants in this research.

- Problems emerged for participants with the directories task, and Bloglines developers have got rid of this link more recently. The assumption was that this higher level of categorisation of feeds into directories could provide a quick way to access all of the latest content on a feed.

- Using RSS has not been consistently deployed on websites. Website designers use differing RSS buttons and the different webpages it can bring up, from one website to the next, can be really confusing for the participant. When pressing a RSS button, instead of it updating your feed reader, a page of XML code would appear. Sometimes a page of code is really confusing for the novice learner. If there are different websites with inconsistent ways for subscription to their site and feed, it becomes a nightmare for the student to subscribe. Not good for forming habits of use required for a learning task.

- Issues of the novice learner being able to remember how to interact with RSS while they are searching on the Internet. Participants were unsure how to subscribe to podcasts and no standard way of doing this. It was unclear with podcasts, what symbols are used, whether it the same as for RSS. To compound the issue, if one has an xml podcast link which has an itunes address then it will not work automatically with Bloglines. It returns a message “No feed were found.”

- Titles of subscriptions can be confusing

- Participants tended to find what they were looking for but forgot to hit subscribe, which meant the feed/ directories were not there.

- Researcher making assumptions that they are all advanced users of the Internet, e.g. that they know how to use CTRL F.
• Despite there being a left hand navigation link to directories in front of them on the homepage, students had to be prompted to look there, and often didn’t see it. Was this due to confusion over terminology or because the interface was designed badly?

Where there was room for improvement; logging on to a mobile device was a real problem, thus learning was difficult due to interacting with the device. At the time of data collection it was not a simple and easy task to locate a podcast from a website and know how to subscribe to it. Also the instructions once the participant had registered for the first time were not very clear from the websites investigated with the participant.

8.6.3 Conclusion: Mobile Technology Hampering Mobile Learning
The participants had real problems with logging onto the mobile device, so often tasks were abandoned. Students had difficulty distinguishing the meaning of small icons on a small device, and their functions. Students also seemed to have limited patience for searching, as it took a long time. Generally, students were getting used to searching on the Internet on a mobile device for the first time and liked it. However, using new forms of interaction, with a stylus, small screen and small keyboard, make learning tasks nearly impossible.

Even logging into Bloglines was very difficult, however mobile devices have now got much better and this should not be such a problem in future. There was a sense that this type of trial was a little ahead of the technological feasibility at the time; however, devices like the iPhone had not been released. So students had big problems typing on a mobile device; even though the mobile device used for the trial had a QWERTY keyboard, the participants struggled to use this, as they are getting used to using “shift” and “caps lock” to enter capitals and numbers. They have no way of telling what they are typing for passwords, - this was a big problem. (Note some smartphones have now cured this feedback to the user problem). This issue was further compounded by a small screen anyway; the Bloglines interface is split screen also on the mobile device! Conclusions from this study were:

• Students had to be shown how to use podcasts and RSS
• Lecturer training would also be useful.
• RSS technology a useful communication tool which could be used more heavily within the School to coordinate research on a given topic, but
lecturers would have to get into habits of using the Internet and new media.

8.5.3.1 A Summary of the Findings

To summarise the findings, student participants faced the following technological issues which do not make RSS suitable for learning tasks:

- **RSS inconsistency**: Websites have inconsistency in how RSS works on their site; this makes it very difficult for participants to use RSS.

- **Search problems**: Participants go back to search engines they know rather than using the application search functions. Thus the issue where lecturers want students to stop using the first ten sources from a search engine in their coursework will be a hard pattern to break.

- **Unclear terminology**: Confusion by website builders themselves over difference between downloading an mp3 file and a podcast and this makes it very confusing for the student who is using a podcast for a first time.

Logging on took too long and ate into the time the researcher should have been exploring new media for learning: Therefore the task of getting the users to sign up and log in is not a good one. Still, there seems little proof that RSS is the next "killer app" for education. More tasks will be introduced to explore new media for learning and the problems students and lecturers face with using the Internet for learning outcomes.

8.7 Conclusion

There are many websites and new media on sustainable design. Students performing research in this area have a hard job of keeping track of the new information on sustainable design websites. RSS applications can assist with the job of keeping track of them. Thus it was envisaged that the student could log on to the Bloglines application either on their mobile device or a computer to keep updated with the latest content on a sustainable design website. However, the technology, especially the smartphone for m-learning, was not up to the task. Students also found RSS confusing, which hampered its use for learning. This was surprising as it was assumed that these students would be technologically advanced than average, by virtue of the university subjects studied and by being “digital natives”. This concludes the investigation into RSS for D and T education.
Chapter 9: The Action Taking Cycle (3C4): Developing Vodcast Learning Scenarios in Design and Technology Undergraduate Education

9.0 Introduction

This chapter trials the learning scenario of using video – enabled mobile devices with students. This is to assist with learning electronics on a Foundation Technology module within the Design School.

Chapter 9 continues Cycle 3, ACTION TAKING, revealing findings on the use of Vodcasting for students learning design and technology. The Design School was keen to develop low-cost m-learning resources. Data from the student questionnaire suggested that the majority of students already owned video-capable mobile devices, thus costs could be kept down. It would be unfair to assume that everyone could afford a video- capable mobile device, so four School mobile devices were made available, which could be booked out by students to use in the lab. This stage of the research addresses the following research objective:

Objective 7: To investigate new forms of learning D and T subjects, through the delivery of New Media through mobile devices, mlearning and elearning.

The first step was to find out whether Vodcasting might be useful for Foundation Technology basic electronics. Hardly any resources were available on the learn server for the electronics part of the module. Given the size of the class, sometimes the lecturers and technician struggled to cope with demonstrations in the lab. One of the significant benefits of Vodcasting was the provision of video demos, on-hand to students designing in the lab. Providing students with the basic electronics video demos, in the lab when designing at the point of need, would help all the stakeholders.

9.1 Investigating Using Vodcasts in Design and Technology Education

This section introduces vodcasts in education and identifies previous research; it also identifies the benefits of using RSS, Vodcasting and m-learning.
The previous chapter looked at using RSS in Sustainable Design education to keep track of new media. RSS also is the technology which drives podcasting and Vodcasting. The word “Vodcast” is a combination of “video-on-demand”, (VOD), and “broadcasting”. Vodcasting is the provision of video files which automatically download into a content management program. The video enclosed in a vodcast can be stored on a web server in any file-based container and codec, or streamed from a server, such as the learn@lboro VLE.

9.1.1 Introducing Vodcasts in Education
The potential for using interactive video to help students’ design practices has been explored in D and T education (Hodgson and Norman: 1993). However, no examples exist of students using small screen mobile devices containing learning resources they need at the point of design. Thus videos of learning content were collected from a module, modified into vodcasts and trialled with four students on mobile devices. The results call for a need to extend this scenario onto other modules, known as the D & T MobileBasics programme.

9.1.2 Rationale: The benefits of RSS, Vodcasting and mobile learning
RSS and Vodcasting were chosen because the provided the following benefits:

- Low cost and cured information overload;
- Responsive to lecturer and student issues identified in diagnosing and action planning stages of this research;
- Easy to integrate with existing University IT infrastructure.

Results from trialling this scenario indicated some further requirements. Before RSS was viable to use for students, lecturers had to build up a set of feeds or bookmarks related to new media in their field. Thus this researcher collaborated to create a departmental newsletter to get a sense of how lecturers used web information, and new media such as podcasts (see Chapter 7). This scenario developed into creating Vodcasts with Camtasia software from the Foundation Technology module. The procedure was to sit in on classes, record the lecturer, and design Vodcasts for learning outcomes and trial with four students.

9.2 Previous Research on Vodcasts in Education
Vodcasting technology is being used more frequently now by educators (Lamb and Johnson: 2007), and is within a m-learning research field. Mobile learning has the capacity to deliver the following benefits for D and T undergraduate education:
1. Just in time delivery of learning resources and;
2. An extendible model for the introduction of NM & NT in D and T education.

Gkatzidou, Pearson and Bailey, (2007), argue for a relationship between the learner and the learning resource based on accessibility. The learning resource created in this research was a graphical animation of a concept of the JAVA programming language, which students had to learn. They report a case study, introducing Vodcasts as learning objects. They explore the rationale, methodology and outline the main findings of the evaluation of the learning Vodcasts, describing a framework for accessibility of learning resources based on Transformation, (learning object knows learner format requirements); Augmentation (support for existing format, e.g. text caption over video) and Substitution (different contexts of learning, on the move, would require substitution of different formats). (This researcher tested caption capability for Vodcasts within Camtasia when making Vodcasts. One of the problems is that the writing was too small for the iPod® screen and also the text colour was white so if there were any light colours in the video, the caption text was obscured.)

9.2.1 Similarities between Prior Research and This Research
Gkatzidou, et al., conducted a similar research methodology to this research; the first step was to put the Vodcasts in two different formats for iPod® and Windows- based media-player, made by a company called Creative. This involved elements of design of Vodcasts. The evaluation stage involved semi-structured interviews on an individual basis with participants. The results of this informed the development of Vodcast tools for the creation of adaptable learning objects. (Note this author’s research also contains semi-structured interviews and an observational element of checking whether students could use the video resource for educational purposes).

Gkatzidou et al., evaluated the animation as a web- based learning resource with 600 first year Computing students who liked the learning object and an improvement of the pass rates was noted. The Vodcast version of the animation was evaluated with 13 participants together with the potential for the Video Players as learning tools. The participants attended evaluation individually. After being briefly introduced to the case study, they were given an
iPod® with the vodcast installed and a set of headphones and invited to take as much time as they needed to work through the learning object (which is about four minutes long). Then they completed interviews or questionnaires. Results from their evaluation are similar to the ones from this research, such as students all said the Vodcasts were good quality and the Vodcasts were really useful for exam revision. The authors highlight the need for further research into Vodcasts to see if any pedagogic value has been compromised with a small screen. Also they propose a longitudinal study to see if any metrics for evaluation can be derived.

9.2.2 Effect of Vodcasting on Student Behaviour
Copley, (2007) in research conducted in Southampton University, produces cost-effective video podcasts combining lecture slides and audio. Examining log files and collecting questionnaire data, the author suggests there is no evidence that students will not turn up to lectures if they have these learning resources, and the students were keen to have more of these types of resources. Each video podcast contained typically containing around 40 slides. The average file-size for a video podcast of a 45-minute lecture was 13.7Mb.

But the major difficulty found in the study by Copley was that most of the students did not use these learning resources on mobile devices they were intended for, instead playing them on a PC. This researcher tried something similar but with syncing Powerpoint slides with the audio stream of lectures (Chapter 7). The major difficulty experienced with this was the next year, the module syllabus changed so the vodcasts were out of date after one year. Some research has revealed the extent of vodcasts in higher education, although not in design and technology undergraduate education. Issues faced with this research correlated to some extent with the finding from previous research.

9.3 The Problem: Emerging Issues
This section reviews some issues in D and T education where vodcasting can provide a solution. In particular, the problem is reviewed from the perspective of the benefits, the stakeholders and implements the learning scenario using vodcasting for a Foundation Technology module.
As students in England are suddenly asked to pay for their education, impetus will be for universities to provide education which is good value for money. One way they can do this is by providing module content on virtual learning environments that can be usable by students wherever and whenever they choose. Vodcasting module content is one way to provide value for money. With Vodcasting it is possible that the lecturer retains control of what learning materials are viewed and when, although some lecturers may be happy for students to have access whenever they wish. Many lecturers and students say they may not come to class if videos are available.

9.3.1 Benefits of Vodcasting for D and T Education

The first step was to diagnose whether Vodcasting might be useful for Foundation Technology basic electronics. Hardly any resources were available on the learn server for the electronics part of the module. Given the size of the class, sometimes the lecturers and technician struggled to cope with demonstration in the lab. One of the significant benefits of Vodcasting for this module in particular, was the provision of video demos on-hand to students designing in the lab.

Providing students with the basic electronics demos, in the lab when designing at the point of need, would help all the stakeholders. To highlight an example of where Vodcasting would be useful for lecturers and students; one of the concerns which faces the implementation of video lectures in Universities is that students will stop turning up to lectures. Vodcasting can cure this- the lecturer could make sure that only those who have come to class or have an excuse not to come to class can have access to the Vodcast feed.

9.3.2 Stakeholders: Who benefits and how

This section discusses matching Vodcast technology to student/ lecturer need within the Design School. Early on in the research, (chapter 5) questionnaire data was collected from a Foundation Technology module which suggested that 99% of students on the module owned mp3 players. Most of the mobile devices surveyed were capable of playing video. As noted, the Design School was keen to develop low cost mobile learning resources. If the majority of students already owned video-capable mobile devices, then learning objects could be created for them and costs could be kept down.
Recently in a Policy Review Magazine, (Streeting, June, 2009), the President of the NUS gave an insight into what future student generations will expect; “as the first generation of students willing and able to conduct themselves as digital natives and yet, where institutions are trying to catch up with virtual learning environments, too often the potential of virtual learning is limited to acting as a simple vehicle for downloading materials”. An assessment of the elearning materials from the Design School on the learn@lboro server would suggest that this does seem to be the case. However, as observed below, the placement of full lectures on the learn server is perhaps not the best use of learn servers and new technologies.

9.3.3 Learning Scenario with Vodcasting for Electronics

The pilot study in Chapter 7, revealed that there was much potential for this scenario. Questionnaire data suggested that students had technological capability and mostly would like streamed lectures for their mp3 player. A lecturer who wanted to put his lectures on the Learn@lboro server for his Foundation Technology module was identified, and a plan for a case study syncing the spoken word audio lectures with his Powerpoint lectures was devised. This could then be accessed by students at a later date.

However certain problems with this pilot emerged. To a certain extent, Foundation Technology relies more on learning- by- doing approaches rather than lectures. Thus this model did not seem extendible. Another problem with this scenario involved students not finding this as engaging as attending a lecture. Thus a better way of managing video podcasts (Vodcasts) was envisaged for electronics in the Foundation Technology module. The next section highlights a better way of making learning resources and identifies the methods used to collect data on potential for Vodcasts in D and T undergraduate education.

Questionnaire data was collected from Foundation Technology students. Now using Vodcasts for the electronics component of their Foundation Technology module would be investigated. **Appendix XXVII : Foundation Technology Module Learning Outcomes** played a part in deciding which type of new media should be used – Vodcasts- and also how the learning Vodcasts were managed. When scrutinising the learning outcomes, they seemed to contain different skills which would be acquired than the Sustainable Design module with more hands on “learning by doing” and handling of various instruments and components of mechanics and electronics.
9.4 Method: What was done and how

This section discusses the participants, the design and protocol for the study into Vodcasts for D and T undergraduate education.

The first part of this section details the design of the type of study, any expectations, and what was done with whom (participants, and how and why chosen), how many Vodcasts were created and collected. The second part highlights the protocol for data collection and exactly how the study was carried out so that someone else could replicate it.

9.4.1 Design of study

The design of this study involved recruiting participants, designing learning objects for many types of mobile and computer interfaces and this researcher using many new tools. This section will identify those tools required, comment on the participants and discuss the selection of appropriate methods of data collection for this scenario.

The participants in this case study were the lecturer of Foundation Technology and this researcher. The researcher held meetings with four students, the lecturer and the technicians within this module and collected data from them on using Vodcasts to help to learn to solder. These participants were volunteers who agreed to take part in the study. The reason four participants were chosen was because with a small number of participants there would be less researcher intervention, which provided a safer approach to use qualitative data. This is because if one wants to introduce NM & NT where you don’t know what the outcome will be, whether it is usable, for example, you want a small sample of participants to look in-depth at how they use those tools. Table N below details the appropriate equipment required in the design of the study.
This section highlights the methods selected to trial vodcasts for design and technology education.

<table>
<thead>
<tr>
<th>Devices/Software</th>
<th>Device / Software Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet</td>
<td>Accesses audio and video files for download to mobile device and/or publishing and subscribing.</td>
</tr>
<tr>
<td>Computer</td>
<td>To access the Internet</td>
</tr>
<tr>
<td>Video Capable MP3/MP4 player</td>
<td>To store files for future listening/viewing. Vodcasting requires both audio and video capabilities.</td>
</tr>
<tr>
<td>Microphone</td>
<td>For recording good audio</td>
</tr>
<tr>
<td>Editing software</td>
<td>For video Final Cut Pro, Adobe Premier, Windows Movie Maker or iMovie.</td>
</tr>
<tr>
<td>File transfer Software</td>
<td>To publish files to website or blog. Traditional file transfer methods include basic FTP/SFTP, HTTP upload.</td>
</tr>
<tr>
<td>RSS enclosure</td>
<td>To tag content via XML in RSS structure. i.e. Feedburner</td>
</tr>
<tr>
<td>RSS news Reader</td>
<td>To download pod/Vodcast – examples include ipodder, sourceforge.net. Others include IPodderX and PlayPod.</td>
</tr>
<tr>
<td>Content management software (CMS)</td>
<td>To sort and organize content into playlists. Allows for automatic synchronization with media player when you connect to your computer. i.e. iTunes, Windows Media Player, Sony MusicMatch, iPhoto, Adobe Album</td>
</tr>
<tr>
<td>Camera</td>
<td>For recording video content i.e. digital camcorder</td>
</tr>
<tr>
<td>Storage Website/drive/server to store files for future or ongoing distribution</td>
<td>Using the Learn@Lboro VLE to store the vodcasts for download.</td>
</tr>
</tbody>
</table>
a) Learning resources developed with digital media and mobile devices

b) Semi structured interviews (Appendix XXVIII - Lecturer Informal Interview Schedule on Vodcasting)

c) Video Observation Data: The purpose of video recording the students was to double check that they could translate using a video on an entertainment device for educational purposes. Also the researcher is looking for evidence of participants stopping/ starting the videos on the Creative Zen.

d) Participant Pre and Post Task Questionnaires (Appendix XXIX - Participant Pre and Post Task Questionnaire Schedule).

Learning resources were developed by sitting in on classes, video recording the lectures and practicals. After creating learning resources, the module leader was interviewed, and asked about where they would like videos to be played, and whether they liked the videos being broken up into learning outcome examples. The interviews ensured that all learning resources were developed with feedback from lecturers and helped formulate how to use these technologies.

The rationale for using observational video data was to find out whether learning outcomes could be achieved with Vodcasting, and whether this technology had potential in D&T undergraduate education. Using observational video data has 2 benefits:

1) The researcher can review after the trial where there are potential issues with using vodcasts in the lab and;
2) The researcher can focus on participants’ learning outcomes and not on note taking and data collection.

Students were given a pre- and post- activity questionnaire which assessed whether they had used mobile devices for learning in this way, and canvassed their views about them.

9.4.2 Protocol and Procedure for Vodcast Learning Scenario

First this section describes in step – by step detail the procedure. Then these steps are broken down and further explained in two stages. The first stage discusses the type of learning objects created. The second part discusses the Foundation technology video essentials and the final stage describes the overall procedure. A step – by- step guide to the procedure is thus:

1. Researcher Attends lectures for Foundation Technology.
2. **Collects 2 Video Streams of lecture/ workshop:** Modify sounds quality of the background interference from recording. When the lectures were captured there was much noise.

3. **Review with lecturer 4 things which students often get wrong then:**
   - Create script with technician for how to review them;
   - Trial twice;
   - Video record 4 learning resources.

4. **Load file** into Camtasia, edit and get down to a smaller file size where possible

5. **Make sure lecture- recorded material fitted with learning objectives!**

6. **Evaluate** with four students, video record them doing a mobile learning activity and supply pre-activity and post activity questionnaires. Figure 31 below details the final version of the Christmas tree which students were asked to solder the components for.

![Figure 31: Students Learned to Solder a Printed Circuit Board via a Vodcast](image)

7. **Save** output as wmv and mp4 and upload to learn@lboro server

8. **Ensure compatibility with mobile devices:** Figure 32: Electronics Vodcasts on Two Different Mobile Devices demonstrates putting the files onto two different mobile devices, the device on the left is an iPod® and required a mp4 file, whilst the device on the right is a smartphone with windows mobile and required a .wmv file with the H.264 codec.
9.5 Method Analysis: Outcome of the Study Design

Following this step by step procedure, a new way of introducing the students to the materials and procedure for learning was devised with Vodcast. Four students were issued with mp4 players, with Vodcast material from Foundation Technology module. They were video recorded to check they could operate the learning resources in the lab. The value and benefits were on- hand training at the point of design.

9.5.1 STAGE 1: D and T ModVods

The first stage was to collect video of this module from all of the lab sessions and workshops over one semester. Then these sessions were broken down into individual examples, tied to the appropriate work package session learning outcomes and put on the learn server. The mobile video files were made available for download as a .zip file, to be unzipped and installed on mobile device from the learners’ computer (see Figure 33 below).
Video was collected over a session in two ways; first, a recording of the computer screen, as the lecturer demonstrated in CrocTech, an electronics software package. Second, the same session was video recorded so when the lecturer demonstrated equations to the class on a whiteboard, the video recordings of these were collected too. Both the screen recordings and video of the lectures were broken up with Camtasia editing and screen recording software. Then the Vodcasts were created to support a multitude of devices and put on iPods® and mobile phones for testing. The following types of learning objects for iPods® and other mobile devices were created:

1. Lecturer demonstration on the whiteboard: It was necessary to get a side angle video of the lecturer to capture all of the information the lecturer is explaining. See Figure 34 below for an example.
2. Captured video of Croc Tech electronics software: Using Camtasia screen recording software, the lecturer demonstrations using the software for the module are captured and turned into video clips, (See Figure 35 below).
The potential for using Vodcasts was realised through the creation of learning resources for electronics component of a Foundation Technology module. The first action involved this researcher recording lectures or WORKPACKAGES and reviewing the information for the module on the learn server. The researcher then cut them up into small learning chunks. These learning resources are then evaluated with the student and lecturer.

A podscroll (a collection of pictures) was created by taking the electronics glossary on the learn server and creating a picture version of this glossary. The problem emerged with this as an education medium as some mobile devices do not support this technology, for scrolling through pictures. Figure 36 below is an example of images created from the podscroll.

Intermediate consultation was made with the lecturer to assess the educational value of podscrolls. The lecturer in this instance did not want a podscroll, as the glossary which he was using was created by another member of staff.
Stage 1 allowed this researcher to design how learning content for foundation technology module could be created to enhance mobile learning of students.

9.5.2 STAGE 2: Foundation Technology VideoBasics

The second stage; after consultation with the lecturer of what they thought about the mobile video recordings, (see Appendix XXVIII) the issue arose of how to make mobile learning more useful to lecturers and technicians. An interview identifying four learning hurdles in electronics which students face year after year, where lecturers have to repeat themselves: These hurdles were made into four mobile video clips lasting the maximum of six minutes each:

1. **Introduction to the Breadboard:** An introductory demo on how to use the breadboard;
2. **Moving from Circuit Diagram to Breadboard:** demo inserting components into the breadboard using a circuit diagram;
3. **Measuring V and R over a Circuit:** an introduction to measuring power and current over a circuit;
4. **Introduction to Soldering on a PCB:** this video showed them the rudiments of soldering;
Figure 37. Video of Participant 1 Complete Mobile Learning Tasks

Figure 37 above shows Participant 1 of the Vodcast Trial reviewing the material on the mp4 mobile device, while completing his learning task. The four video basics were trialed with four student participants. They were given a pre-task questionnaire to find out if any of them had used video podcasts before. Each student was given a Creative Zen 8GB mobile device. The four mobile videos identified above came preloaded on this device. As noted, this author was learning from the mistakes in the previous scenario; - the students were given the devices for a week to learn to use. Then they were video recorded using the Introduction to Soldering mobile video while soldering.

A post-task questionnaire revealed whether this was difficult to use at the same time as soldering (see results). The results from the four participants seem to suggest that mobile demos would be usable in the lab for helping students to design but they would need to develop habits of stopping and starting the mobile video at the relevant points. This could be done with one hand. It is about getting students to think about using mobile devices as educational tools rather than a broadcast medium. The next section looks more closely at the results of the Vodcasts and their potential for design and technology education.
9.6 Results from Creating Vodcasts for a Foundation Technology Module

This section reveals the results for introducing Vodcasts to all stakeholders.

The results from the following methods employed by this researcher for investigating the potential for Vodcasting in a Foundation Technology module will be discussed. What this researcher was looking for was some evidence that module learning outcomes could be achievable from the learning objects on the mobile devices.

9.6.1 Semi-structured interviews

The lecturer was interviewed to obtain feedback on what he thought of the development of the Vodcast learning objects for which he was the module leader. Also during the Vodcast trials the students were asked a number of questions, the answers to which are contained in the video transcript. This section highlights pertinent results which are relevant to the potential for vodcast technology in design and technology education. During the development stage of the Vodcasts (at Step 2 of the step – by step procedure), the lecturer was consulted on what they thought of the development of the digital learning objects. The first part of this section reveals the results from the questions which were asked of the lecturer.

The first question concerned graphically reworking the electronics glossary. Regarding this alphabetical walkthrough of all of the symbols, the lecturer was asked would this be a useful addition to the learning materials on the learn server and whether there would be any value for putting this glossary on iPods®. However, the lecturer did not want a “Podscroll Electronics Glossary”. Another limitation of this learning material became apparent, as it would lock the learning object to the technology, in this case the iPod®.

The second question which was posed to the lecturer required him to review the digital version of the Workpackages created, which were divided according to the appropriate lesson learning outcome. The lecturer noted there were four types of learning objects;

1. mobile video of the whiteboard and other lecturer demos,
2. mobile video of the captured screen with the electronics software the lecturer used for demo,
3. the DandTVedioBasics and
4. the podscroll.
A general question was which format would the lecturer expect students to learn best with and whether the lecturer expected this will be the same in Design Education in Schools? Then the lecturer was asked whether they were happy to include external sources of information from the web; – Youtube, for example, and whether they consented to having these videos put on the learn server.

The next question noted that Workpackage videos were broken down into 6 examples and gauged whether the lecturer thought this decomposition would help the students. Question 6 found out whether the lecturers wanted the video learning objects to be played on computer as well as the iPod®. The response was yes to this also, although the lecturer was not sure how this worked. Q7 checked that the lecturer was happy with the videos on the learn server, which he was. Q8 and Q9 were on the lecturer’s perspective of the mobile video design.

9.6.2 Observational Video Data Results
After the video observation was conducted with each of the student participants, this research asked some informal questions about the use of m-learning which revealed some interesting findings in terms of problems and perceived benefits for learning.

Four student participants on the Foundation Technology were video recorded to look for any behaviour which indicated they were able to stop and start and use the mobile instruction to take instruction from. The video data which was collected showed that all of the students used the mobile device to show them the correct way to solder. The video data was cut up into segments where the researcher could find evidence for some of the things looked for within this study.
STUDENT FEEDBACK FROM VODCASTS

1. Problems: It appeared that the problems of small screen which was apparent for learning outcomes with RSS was not so pronounced with video data from the students using Vodcasts. Sometimes however it was hard to distinguish what was on the small screen.

Excerpt 1:

R: So what part of using the device was hard or was it self-explanatory?

P1: Yes well there were certain bits where I didn’t know which capacitor went where, but on the whole it was good, it’s a nice idea.

Another problem identified by participant 2 included getting the order of the learning activity right first and commenting that they should have watched the task all the way through before doing it.

Excerpt 2:

R: So do you have any comments on whether you felt you could use these mobile videos for learning?

P2: Maybe I should have watched the whole video then done the task.

R: Yeh, you reckon?

P2: yes, coz then you would have a bit at the end where it says you do the flat components first.
STUDENT FEEDBACK FROM VODCASTS

2. Perceived Benefits to Learning: The participants did reveal some perceived benefits which this researcher had not considered. For example, the ability to replay learning which was missed in the group demonstrations was highlighted.

Excerpt 3:

R: Ok right was it hard to take instruction from the device, do you think? Or did you find it difficult to stop and start?

P1: Oh no that’s actually really helpful, coz if you miss a bit, in the group demonstration, [in the lab] you can’t go back and with this you can rewind it.

Another benefit identified included the ability to see what the lecturers hands; in lab sessions where the lecturer is doing a group demonstration, many students are crowded round one lecturer, so it is impossible to see what is going on.

Excerpt 4:

R: And where they a help, in terms of what you needed to know?

P1: Yes, I sort of had seen them already, but it’s useful as when you are in a group, you can never see exactly what’s going on with the hands, no matter how close you get really.

Finally, another perceived benefit arose as the researcher asked a direct question on whether the student would prefer to using the device rather than ask the technician.

Excerpt 5:

R: Do you think you would prefer to use a device rather than asking a technician?

P1: Yes I think so?

R: You would?

P1: Well, it doesn’t matter how stupid the question, you can just have a look.
9.6.3 Student Questionnaire Results: Pre and Post Task Questionnaires

Students who used the vodcast to learn to solder were asked some questions before the activity and afterwards. A pre and post tasks questionnaire was devised to get four students trialling Vodcasts to say what they thought about the educational value of such learning resources. The pre-task questionnaires were designed to elicit student responses to the four learning materials and compare it as a method of delivering design and technology education. There were 7 questions in the pre-task questionnaire which was designed to gauge participants’ technological competencies. Question 1 confirmed age of the participant, to ensure they were over 18.

Question 3 asked whether the participants own an Mp3 Device or iPod® which supports video, and whether the student participant knew the make and model of the device. Question 4 identified whether the students used RSS applications before and, if so, which one. Question 5 was more direct, and asked specifically whether the students used podcasts and vodcasts and which ones if so. These questions were designed to find out whether students were already familiar with using vodcasts and vodcast-related technology. Question 6 and 7 identified whether the participants owned mobile devices and contained a likert scale on which features they used. This question would provide a more general picture of their habits and uses of mobile devices which could be exploited for learning.

The post task questionnaire again used 7 questions to briefly identify the student participant views on using vodcasts as learning resources. Question 1 and 2 asked the student whether they thought the videos would be useful and at what point in the module they would find them most useful. Question 3 was a “yes/ no” question which identified whether the participants would use these and similar videos in the lab whilst designing and completing assessments. Question 4 was to find out whether the student participants have any comments about using videos on a small screen to help them design in the lab. Question 5 identified modules other than Foundation Technology where the participants thought mobile video resources would be useful. Question 6 was another “yes/ no question”, which checked whether the students used the learn@lboro server specifically for downloading D and T learning resources, how often and which ones Question 7, the final question required a yes/no response to whether the students thought other students would use these learning resources in
the lab. **Appendix XXX: Participant Responses to Vodcast Pre and Post Task Questionnaire** below details the student responses to using the vodcasts to learn to solder. Table X below summarises both the pretask and posttask responses:

<table>
<thead>
<tr>
<th>Qs</th>
<th>Issues for D &amp; T Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All of the learner participants found the ipods videos useful.</td>
</tr>
<tr>
<td>2</td>
<td>Majority think that they would be useful just before an exam</td>
</tr>
<tr>
<td>3</td>
<td>All of the learner participants said they would use these video podcasts whilst designing and completing assessments</td>
</tr>
<tr>
<td>4</td>
<td>Most felt that the quality was good! It was worth making the video sizes bigger and using the camera to zoom in was useful. Most felt that screen size was not a problem, however previous survey data from MH the students said it would be.</td>
</tr>
<tr>
<td>5</td>
<td>Two out of the four stated mobile video would be useful for CAD!!!</td>
</tr>
<tr>
<td>6</td>
<td>All of the participants are familiar with using the learn server.</td>
</tr>
<tr>
<td>7</td>
<td>All of the learner participants are familiar with downloading resources straight to their machine. Note Evans (2007) where 71% listened to podcasts on screen rather than on ipod.</td>
</tr>
<tr>
<td>8</td>
<td>They all think students would use them in the lab.</td>
</tr>
</tbody>
</table>

**Table 0: PreTask Questionnaire Results Summary**
Qs | Issues for D & T Education
---|---
1 | All were above 18
2 | All were male; previous survey data on mobile learning showed males were twice more likely to have mp3 players than women in the foundation technology modules.
3. a) | All surveyed owned mp3 players capable of video
b | Ipods more likely, however need to create video for both types of device
4 a) | 3 out of 4 do not use RSS readers. Learning curve
b | Only one participant used a reader
5 a) | 3 out of four used podcasts - not aware that podcasts are linked to RSS readers
b | Even split between those who had used video podcasts before
c | Mostly used for entertainment purposes
6 a) | 3 out of 4 owned an mp3 player
b | 3 out of four owned a mobile phone
c | 1 out of four smartphone
d | None owned pocket pc
e | 3 out of four had a digital camera
f | All had mp3 device with video
7 a) | All make telephone calls everyday
b | Matches with Haste mori poll 2005
c | Most take photos weekly
d | Most of them listen to music on mobile devices.
e | 2 use videos on mobile devices weekly, 2 monthly

Table P: Post Task Questionnaire Results Summary

To summarise Appendix XXX above, some interesting findings for D and T learning outcomes included that none owned pocket pc, but all had mp3 device with video. The students made telephone calls everyday therefore good communication was apparent which matches with Haste mori poll 2005 on young people’s use of mobile technology. These questions were designed to assess familiarity with video devices. 2 out of the 4 participants use videos on mobile devices weekly, the other 2 monthly. Most of them took photos weekly and most of them listen to music on mobile devices.

9.7 Evaluating Action Taking Cycle (3C4): RSS and Vodcasting for Design and Technology Education
This section looks at evaluating using RSS and Vodcasting in Design and Technology education. This section looks at matching student and lecturer data from the RSS and Vodcasting case study, looking for potential for NM & NT, through similar themes.

The previous section identified some potential from using Vodcasting. This section evaluates the potential for Vodcasting and RSS, two case studies performed at the action taking part of this research. As well as evaluating the potential, challenges faced and issues of practice will be identified.

9.7.1 Challenges for using RSS in D and T Undergraduate Modules

The challenges faced for RSS in Design and Technology education arose out of technical issues: The mobile internet seemed too slow to be usable for the learning tasks – this research conducted about two years before the iPhone® was released! The aim was to translate module learning outcomes using their mobile device as an educational tool, not merely an instrument for communication. However, technological unfamiliarity made the tasks too hard to perform on the mobile device used.

The second significant challenge concerns students’ ‘digital literacy’ (Prensky, ref): Most participants did not seem to know how to use RSS despite having a worksheet and had to be prompted. Also, only one of the six participants was familiar with subscribing to podcasts. Despite being shown how to use the application search function, students still used Google to perform educational tasks. The results indicated many challenges would have to be overcome to use RSS on a mobile device for Sustainable Design education. The practice of supplying RSS feeds to students raises a number of issues around:

- Tying the content of the RSS feeds to the learning outcomes of the module
- The lecturers further responsibility to add the RSS feeds
- Student ability to see the connection between the RSS feeds and their learning.

9.7.2 Challenges for Using Vodcasting for D and T Undergraduate Modules

Concluding thoughts; universities have to weigh up issues of supplying iPod® videos for learning with having devices in-School: The practice of supplying vodcast to help students raises a number of issues around:

- who should have access to lectures and for how long;
- How the recordings are to be stored and what policies will govern their handling;

- Who is responsible for providing the recording resources and;

- Who owns the intellectual property once the recording has been made; future lecturers might find that elements of module content become a point for contract negotiation under the heading of “courseware rights”.

The challenges of using RSS and Vodcasting have been evaluated; RSS can take the most relevant information on a module from the web and deliver it to the student; while vodcasting can provide D and T students specifically with a new mode of instruction which suits their learning styles and preferences. The difficulty is in the time for lecturers to create these as learning resources. For students, they are not really in the habit of using their entertainment devices for learning and new habits of use may be difficult to cultivate.

9.8 Specifying Learning (3C5): RSS and Vodcasting for Design and Technology Education

This section covers the model which can be built around the potential for RSS and Vodcasting in design and technology undergraduate education.

What became apparent to the researcher from the two case studies on m-learning with D and T students is that some NM & NT are more suitable than others for completing learning tasks. Getting students to use RSS applications seemed relevant to solving a problem identified by the lecturers, of students citing dubious Internet sources. At the same time using RSS on a mobile device anywhere and anytime allows the student flexibility to study wherever they are. However the students had to learn to use the mobile device before trialling RSS, and the University would have to teach students about RSS technology. Also potential for this type of vodcasting technology was identified by students; CAD emerged as the next module that could benefit from vodcast technology. However, learning materials were expensive and time consuming to produce.

9.8.1 Specifying Learning Outcomes Using RSS

On evaluation issues hampering integration of RSS for Sustainable Design include, the student having to learn the mobile device before trialling RSS, and the lecturer having to teach students about RSS technology and how to use it, as well as teaching the subject.
Before the students learn to use technology, lecturers need to be in good habits of using it too! They are the ones who need to decide on the feeds. Using RSS also seems to be out-with students “comfort zone” at the moment. The JISC Great Expectations of ICT for Education report (2008) describes how universities are shaping up in terms of student expectations and experiences and found that students expected a bigger role in learning Information Communication Technologies at Universities, but many of them still do not understand newer technologies. The results from this case study seem to corroborate with this. Thus, School policy has to dictate; and whether this policy depends on whether we want to take students out of their comfort zones and stretch them further or do we focus on a basic level of IT competency across the board. When this data was collected the iPhone and its counterparts were not released yet. Perhaps the technological competencies would be different a few years on, making RSS via mobile devices viable for the lecturer to invest time in using and teaching the students to use. Further research is proposed using mobile devices that students are familiar with.

9.8.2 Specifying Learning Outcomes of Using Vodcasts

Thus “ModVods” could be created which link directly to session learning outcomes. Lecturers have more of an overview of what the students get wrong year after year and thus four learning objects can be devised, called “DandTVideoBasics” for subjects such as electronics to ensure that students perform the basic tasks as part of a module. The benefits of m-learning have been identified by students who often feel like they cannot ask a technician, or where there is no technician available to help.

Four significant challenges were faced with creating and using Vodcasts for learning Design and Technology:

1. **Video rendering time**: Researcher spending a lot of time on creating and editing short clips, and editing the sound. Also, as it is a Design School, there will always be noise which has to be edited out – e.g. the sound of drilling in the background!

2. **Learning from a small screen**: Camtasia allows for automatic zoom and pan options but often these were not at appropriate points in the video, so manual editing of when to zoom in and out was necessary.

3. **Designing the learning object**: the consultation process was reasonably lengthy, as this was a first attempt. Designing the learning object in Camtasia worked well with
the export presets. But the file sizes were large and meant re-rendering the same video, playing with video codecs to assess quality and file size; an arduous task if one’s computer is slow!

4. **Institutional Support**: the students own a multitude of platforms and devices which will require support.

There are design issues with the small screen videos; it takes experience to figure out what works for D & T education on a small screen. Another important issue is the security of educational information – if the student’s own device is lost or stolen then the module information goes with it! Vodcasting may only be effective for learning, if the video content is directly related to learning outcomes of the module. Basic video demos may not be appropriate for all modules: further lecturer involvement and data is required to assess this. Another issue is that students may need a familiar interface that they associate with using videos, such as YouTube. Figure 38 below demonstrates putting DandTVideoBasics on Youtube.

![Figure 38. Example of DandTVideoBasics available on Youtube](image-url)
What was not clear was whether it was better for the student to use the V.L.E. for video dissemination or sites like Youtube and this would be an area for further investigation.

**Figure 38: Example of DandTVideoBasics on Youtube** demonstrates the creation of playlists on Youtube, where the student could play one or all of the videos. There are pros and cons to using V.L.Es versus Youtube, as identified in Table O, below.

### Table O – Pros and Cons of Using Youtube vs Learn@lboro

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost is minimal</td>
<td>Not clear how video learning objects could link to module and individual session learning outcomes</td>
</tr>
<tr>
<td>Students already using Youtube</td>
<td>No Loughborough University Brand</td>
</tr>
<tr>
<td>Playlist functions work more effectively than on learn@lboro</td>
<td>Setting may be confusing for lecturers</td>
</tr>
</tbody>
</table>

The results from the previous investigation can be summarized as follows;

1. Students were not the “digital natives” (Prensky) anticipated; none of the participants were familiar with Using RSS or Vodcasting in their web research habits.
2. Potential for RSS and Vodcasting technology investigated was evident, but it was not clear whether the outlay of time and resources justified a move away from traditional way of disseminating D and T undergraduate learning.

To conclude on specifying learning outcomes, using RSS and Vodcasting can be useful for D & T undergraduate education, so long as a reusable framework can be devised which is simple to use and fits with the existent learning technology architecture. Thus, D & T students’ use of multimedia for learning will be enhanced, providing on-hand access to learning resources at the crucial point of design.
9.9 Conclusion

This section concludes the investigation into the potential for RSS and Vodcasting for D and T undergraduate education.

If the Design School can identify learning information which creates large conceptual leaps for students, and streamline them into four basic learning objects for each module, then lecturer time will not be taken up with repetition. Four learning objects should be enough to get the ball rolling on providing some Vodcasting digital content for each module. Ny more would provide a large editing burden on those developing the Vodcasts. Students themselves identified some future areas where Vodcasing would be useful in particular modules, for example for learning CAD. Using RSS links effectively with dissemination of the Vodcasts also, as RSS is the technology one uses to distribute the video learning objects onto websites and V.L.Es. Using RSS for learning on mobile devices still hold much learning potential and could thus be incorporated as part of study skills, so that lecturers are not teaching students how to use this particular technology as well as the content of the learning.

This framework for advancing m-learning in D and T education shows much potential worthy of further investigation. To conclude the action taking cycle, this details the results of trials of two m-learning scenarios using RSS and Vodcasting. Future work needs to take into account the particular module that the mobile videos are created for. M-learning with RSS and Vodcasting should be able to assist students at the point of design. The results from adopting research methods through m-learning, has given way to new knowledge on how to match video learning objects to module learning outcomes, in a way useful to their education. The next chapter evaluates these results.
Chapter 10: Conclusion to the Research Project:

10.0 Introduction

This chapter describes evaluating the research into investigating the potential for NM & NT in D and T undergraduate education.

The definition of evaluation used in this research means a study of the outcomes of this research to look for strength, weaknesses and devise guidelines. This chapter assesses the results from Cycle 1, 2, and 3 and provides educational benefits of RSS and Vodcasts. These findings will help devise guidelines for the potential of NM & NTs in D and T undergraduate education. These guidelines are based on the previous research in this project. In an educational context, this is synonymous with exploring the research programme’s effectiveness by “...evaluating if the system supports the requirements of the educational setting and learning needs” (MacPherson and Nunes, 2004, p.100).

10.0.1 Linking Action Taking Results to Evaluation

Another dimension to evaluation requires the analysis of the programme of research’s “efficiency”; in terms of expenditure of time, resources and technical or educational support necessary. To summarise five major issues emerged from the previous cycle on the question of efficiency:

1. Students thought using Vodcasts were really useful for learning electronics and would like this method of learning extended to other modules: However, for this resource to be useful one needs to break the learning content into learning objects which correlate with the session learning outcomes. This is a very time consuming process, involving much video editing.

2. The devices for Vodcasts are not cheap (see Appendix XXXI: Review of Costs of Mobile Devices) but generally, students have compatible mobile devices which can be used. This means that all “ModVods” have to be converted into separate file formats for them to be compatible with their particular player. This would require technical and educational support over and above what is already available to students in Loughborough University.
3. The quality of the video images was very important. To get enhanced image quality for the *D&T VideoBasics*, the camera operator had to be in very close proximity to the person demonstrating the electronics to get a good view of the electronics demo. The mobile devices themselves only support 8GB. Thus it became important to edit out all unnecessary content per learning object to minimise the file sizes. This was a very time consuming activity, perhaps as the technology improves this will be less necessary.

4. RSS for learning on mobile devices was hampered by the technology and the terminology. Structure need to be put into place so that lecturers are not teaching students how to use this particular technology as well as the content of the learning, as this is very time consuming (See Appendix XXXII: User Guide for Staff and Students Using RSS for Modules).

5. Students in general were unfamiliar with RSS and Vodcasting which was a surprise finding from this research. Many papers identified students as “digital natives” with *NM & NT*, this did not seem to be the case.

This chapter describes the *formative* evaluations contained in the previous chapters (1C4, 2C4 and 3C4) and performs a *summative* evaluation where the educational gains of the research programme are reviewed against the aims and objectives of this research. The summative evaluation will address whether participants DID learn new skills of using RSS and Vodcasting. It will also explore whether it solved the practice problems or contribute to knowledge about what will or will not solve these problems.

**10.1 Devising an Evaluation Strategy**

*In order to proceed with an evaluation, a strategy will be developed.*

Chapter 10 evaluates the potential for *NM & NT* in design and technology education. Two types of evaluation are reviewed; the formative evaluations which occurred at each cycle, and a summative evaluation.

**10.1.1 Choosing an Evaluation Strategy**

This chapter evaluates the research process and reviews the formative evaluations at each cycle to provide a reflexive story of the research decisions were taken.
“In action research, truth is in the process of inquiry itself. Was it reflexive and dialectical? Was it ethical, democratic, and collaborative? Did participants learn new research skills, attain greater self-understanding, or achieve greater self determination? Did it solve significant practice problems or did it contribute to our knowledge about what will not solve these problems? Were problems solved in a manner that enhanced the overall learning capacity of the individuals or the system?” (Dickens and Watkins, 1999, p44).

10.1.2 Distinguishing Formative and Summative Evaluation

Formative evaluation is where evaluation is on the educational materials and process during their design, development and delivery. Within metacycles used to progress this research, formative evaluation occurred three times in this research (1C4, 2C4, and 3C4). Each of the different results from these formative evaluations helped to guide the research process, allowing the researcher to make decisions based on all available evidence. So for example through the formative evaluation performed in Chapter 5, the researcher was able to combine the significant results from the lecturer interview and the student questionnaire data to evaluate which NM & NT held potential to be implemented in the action-taking stage.

Summative evaluation focuses on overall delivery of the educational changes, their suitability to solve the problems identified. So for example, lecturer interviews (see Chapter 4) identified some themes where they wanted NM & NT to help with modules. These problems were acted upon; however, a summative evaluation would analyse whether the solutions posed were feasible for the modules identified.

10.2 Action Planning: Reviewing Formative Evaluations

This section reviews the formative evaluations to get an overview of the issues; it then evaluates the RSS and Vodcasting learning scenarios in more depth.

The results from this section assist the development of guidelines (in section 10.3) for using NM & NT in the Design School, specific to the educational setting. This section reviews the various alternative formative evaluations which were done at the different stages of research. The results of this section will highlight important findings which emerge to clarify the potential for NM & NT IN D and T education. There are many other technologies which this researcher would have liked to review within scenarios, such as video games for learning and
other new media and new technologies. However, the learning scenarios which were looked into were based on data obtained from students and lecturers in the action planning stage.

10.2.1 Evaluation from Diagnosing (Cycle 1), Action Planning (Cycle 2) & Action Taking (Cycle 3)

In evaluation section (S.3.18 above), the benefits and challenges for the research problem were diagnosed. A methodology was identified for reviewing these, and the literature review checked on findings from previous research. The results from this evaluation highlighted the benefits in terms of challenge is how to cater for the broad range in students' levels of access to, and encourage familiarity with new technological tools (Kennedy, Krause, Judd, Churchward, & Gray, 2006).

In the action planning stage, this researcher considered what the alternative ways to encourage lecturers to use technology more for learning would be; why are they not using it and how to encourage them to use it more. This researcher used interviews to find out whether lecturers had thought about using wikis, RSS, blogs for their learning modules in design and technology education. The researcher used questionnaires to identify the technological competencies of students with mobile devices and what they thought about using them for learning.

According to the previous section, it would be hard to introduce NM & NT to students of D and T education, due to the reasons for little uptake identified in interview. Thus the introduction of a staff School newsletter, where lecturers shared their website links, podcasts and blogs was perceived to be an easy way to solve the problem of little uptake of NM & NT by lecturers. Within the interviews, several references were made by lecturers about how successful they felt using email technology was for them. A newsletter collating links between researchers and lecturers seemed like a great place to start.

Also JISC (2008) provided some justification for why using a newsletter is useful. JISC (ibid) state that lecturers need support with NM & NT. Particularly, support can come in the form of newsletters and introductions to basic technology to get them to collaborate as a School. They conclude this point by noting that IT support overheads are inevitable. But what also should be done is get the early adopters of technology to help. Thus the idea of Design View a
departmental newsletter on design research in the School was explored. However, the problem emerged of how to sustain lecturer involvement in the project, Design View.

Other types of new technologies, such as iPods® and mobile phones were reviewed for their suitability for D and T undergraduate education. For example, these devices were used to test learning resources through a MDA Vario® smartphone and a video-supported mp4-player device, such as an iPod®. This was combined with using learning technology software such as Camtasia®, and the Loughborough University’s’ Virtual Learning Environment. This was a very time consuming endeavour.

10.2.2 Evaluating RSS and Vodcasting Learning Scenarios
For the learning scenario 1 with RSS, after reviewing all the available data; the anticipated benefits of this scenario were to stop students using dubious sources from the Internet, give the lecturer more control over web content and enhance m-learning. The scenario requires seven steps in the following order:

1. Lecturer compiles RSS feeds for module from Internet using RSS reader of choice;
2. Stores in a folder on RSS reader “Sustainable Design”;
3. Lecturer demos to the class at the start of the year how to use RSS;
4. Exports folder “Sustainable Design” as an OMLP file;
5. Lecturer makes RSS learning materials collected available as OMLP file, to students on student VLE;
6. Student imports the learning feeds to feed reader of their choice;
7. Student and lecturers have the same feeds and can access them from their mobile devices on the move.

Students will have access to mobile video for their modules; video demos to aid them to learn how to design circuits. The challenges faced in the previous scenario were taken into account. So instead of a mobile-internet device being required, Vodcasting could be useful to anyone with an mp3 player which supported video. The learner would download the learning objects from the learn server as a .zip file, assuming a decent broadband connection. The student could learn from a mobile device, for example, how to solder, to aid them with a project or assessment. The scenario requires these tasks in the following order:
1. Lecturer consulted on creating Vodcasts; a collaborative assessment of learning material useful as mobile video;

2. Researcher collects and manipulates video footage of lecturers using Camtasia software;

3. The mobile videos are uploaded to the learn server;

4. The learner retrieves the zip files containing the mobile video from the learn server;

Educators thus needed to know whether the students found using video demos on a small screen useful for learning and whether students can use the demos in the lab to help them with design education, (e.g. processes such as soldering). Thus the results of recording video data with four students was looked at and seemed to suggest that scenario is most suited to learning – by – doing, where students felt uncomfortable and did not want to ask a technician for help. To conclude; this section has evaluated the formative evaluations.

Stakeholders were consulted regarding the learning scenarios to aid evaluation. As an extension to the four learning objects created for electronics, the lecturer for mechanics was also consulted to arrange creation of four basic learning objects for mechanics. The lecturer highlighted four nuggets of information which students did not easily understand year after year in Mechanics, where a mobile video demo may prove useful. These were:

1. Drawing graphs correctly
2. Calculating efficiencies
3. Converting between units
4. Properly annotated sketches of equipment

In conclusion, there was much formative evaluation which allowed the research to progress.

**10.3 Action Taking: Revising the Evaluation into Guidelines**

This section proposes some guidelines to assist with the introduction of NM & NT into undergraduate design and technology education.
The previous section reviewed the evaluation of the previous three cycles; the purpose of this was to get an overview of the different issues which have arisen and see if there are any similarities. The undergraduate design and technology programmes are distinctive in their learning-by-doing approach. For, NM & NT to scaffold this type of learning, the mobile technology has to work effectively. This section will describe some basic guidelines for learning technology development that would help the potential to be realised for design and technology education.

To clarify the guidelines suggested they have been divided into guidelines for:

1. Creating Vodcasts for D and T education;

2. Creating RSS feeds for Modules in D and T Education and;

3. Guidelines for NM & NT, generally in D and T Education.

10.3.1 Guidelines for Creating Vodcasts for D and T Education

This section identifies guidelines to creating Vodcasts for D and T education derived from the findings from this research.
GUIDELINES FOR CREATING VODCASTS

1) Enhance small-screen learning: Students found occasional problems with following learning procedures due to the small screen of the mobile devices used. Future Vodcast production needs to take this into account in the set-up and design process. For example, is there a better way of creating the learning objects, so any text is readable and in the right colour size of font? The programme Camtasia was not helpful for this as the captioning text available was white and small.

2) Plan and Storyboard learning objects: Components were not put into the printed circuit board in the wrong order, in the video created: if you don’t get the learning script in the right order, this can be really confusing for the students, and the video learning object needs to be recreated.

3) Trial Learning Objects: Trialling the learning objects finds out what has been missed, for example, students needed to know the weight of the solder to complete the task, but this wasn’t given in the original version.

4) Keep Filesizes Down: Ensure that learning object file sizes are kept to a minimum. One problem is the assumptions that students have decent broadband connection to download the learning objects. Until this is a given the best policy to adopt is to keep learning objects file sizes small; 5mb where possible.

5) Ensure Vodcast Learning Objects Match Learning Outcomes: This means that the students will understand what they are learning and why. This applies to If course content changes then it necessary assess whether the Vodcast or RSS feed is relevant to the module. Learning objects need to be relevant, if not linked, to learning outcomes

6) Minimise the Length of Time Spent on the Process The learning uses of mobile video include that is automatically delivered via dedicated RSS feeds over the internet. So an ideal scenario is one where the students do not have to manually download the resources from the learn server. Using RSS with Vodcasting, the student with the correct feed set up could dock the iPod ®/mp3 playing device overnight. While it is charging the RSS feed would push the Vodcast to a folder on the students’ computer which is synced to the mobile device. The RSS feed pushes the D & T VideoBasics mobile video to the students device without them having to manually download it.
10.3.2 Guidelines for Creating RSS Feeds for D and T Education

Guidelines are based on qualitative video data analysis of students using computer and mobile devices to access RSS feeds as a learning task.

GUIDELINES FOR USING RSS IN MODULES

1. Students need to be aware how to use RSS.

2. Students and lecturers need to be in good habits of using RSS.

3. Students have to see some link between the pedagogic value of individual RSS feeds and module learning outcomes.

4. Regularly Update Feeds: Lecturers AND students have to review and update feeds.

5. Obtain Good Web Sources: Language of RSS confusing to learners and needs clear explanation, glossaries, and effort put into teaching/learning the web terminology. The success or failure of RSS for education to some extent lies with web designers who must embed RSS feeds within the website. If the language continues to be inconsistent it will be harder for the students to form good habits.

6. Encourage Using RSS as part of Academic Skills: Participants in this study went back to search engines they know rather than using the application search function. Thus the issue where lecturers want students to stop using the first ten sources from a search engine in their coursework will be a hard study skill pattern to break. If more students knew how useful RSS was when they learn academic skills, this may change the way students conduct research. On the whole, RSS is a beneficial tool to get them to think about how to search through news feeds and how to search on Sustainable Design projects. However, it needs to be clearly explained to them in a session.
10.3.3 Guidelines to Improve NM & NT for D and T Undergraduate Education

This section provides some overall guidelines to assist future directions in investigating the potential for NM & NT in D and T education.

GUIDELINES FOR EMBEDDING NM & NT ON D & T MODULES

1. Mobile devices need applications designed for educational tasks: Better mobile educational apps need to be designed. Problems with the Windows mobile operating system thwarted any plans to successfully use mobile technology for the educational context. Windows’ mobile operating system needs to be improved to support educational tasks. Now there are many other smartphone operating systems, such as android, symbian which are open source and can be developed for cheaply.

2. Mobile Internet needs to improve and be cheap! The mobile phone used (T-Mobile MDA Vario) was very basic and the developments over the last few years (for example, the iPhone) make using the Internet more feasible. The mobile phone needs applications: The fact that this high-end business phone could run the Bloglines mobile application for data collection did not necessarily mean that it was particularly usable.

3. The technology has to be up to the task. The mobile device used needs to have better video support, and YouTube included, it needs copy/paste, and it needs multitasking functions. Much depends on the technological capabilities. Until things like file size of images are not an issue for using NM & NT, or learn@boro there will be constraints on what can be achieved.

4. Design for Mobile Learning: When logging into applications, students need to be able to see password characters, they need feedback when they press a button that it is returning the correct character, due to unfamiliarity with using text entry for mobile devices.

5. Speed Up Learning Object Processes: This issue relates to Vodcasting more than RSS, but is also a cited reason why lecturers and module leaders cannot move to a paperless module; often it takes longer to access learning objects than looking at a piece of paper. The process of getting learning objects onto mobile devices needs to be simpler and less time consuming.
In conclusion, in investigating the potential for NM & NT in D and T education, this section identifies guidelines for D and T undergraduate education derived from the findings from this research.

10.4 Evaluation: Reflecting on Research Aims and Objectives

This section evaluates the research against the aims and objectives set at the beginning of this research, and discusses the developed learning scenarios in light of industry standards for learning design.

Section 10.1.2 above details the two dimensions of evaluation, crucial to investigating the potential for NM & NT in D and T education. The summative evaluation looks at whether participants DID learn new skills of using RSS and Vodcasting. It will also explore whether it solved the practice problems or contribute to knowledge about what will or will not solve these problems.

10.4.1 Using the IMS GLC Evaluation Criteria to Evaluate Learning Scenarios

The IMS GLC provides Learning Design Best Practice and Implementation Guide (2003), as a world-wide standard to devising learning content. Not only do they develop standards for learning design, they also issue awards for innovations in using technology for education. In order to assess the efficacy and efficiency of RSS and Vodcasting for D and T undergraduate education, this section matches the research findings on this technology in education to the evaluation criteria devised by the IMS. This helps to review the potential for NM & NT in D and T education. This evaluation is contained in Appendix FI: Evaluating the Research Project against the IMS GLC Criteria. For ease of reference, the evaluation criteria have been numbered.

10.4.2 Evaluation of Research Outcomes against Research Aims

Other learning technology evaluation literature was reviewed for an overview of this area (Appendix XXXIV: Literature Survey on Learning Technology Evaluation) but the IMS GLC Criteria resonated with the approach followed in this research. The aim of this research is to investigate the potential of NM & NT for D and T undergraduate education. This research aim included development of strategies for deploying NM & NT for D and T education, for example through looking at RSS and Vodcasting for D and T education. Further to this aim,
this researcher wanted experience of creating multimedia learning resources available on new technologies; thus video and RSS web searches to make learning objects with appropriate software. This thus furthered the field of e-learning and m-learning for D and T education;

The research aim was to find out how exciting forms of NM & NT could change education, and engage all the stakeholders in the learning process. A further aim of this research is whether NM & NT applications are usable for learning tasks on mobile devices. As noted, mobile devices may be suitable for students of D and T education as they may facilitate the project communication process required in design and make activities (Kimbell, 2005). This relates to the following research sub-questions highlighted in Chapter 1:

1. - Can mobile devices help students as a tool for D & T education and communication? .
2. - What findings on NM & NT might be useful for D and T education? Thus guidelines in section 10.3 above are created with a view to ensuring best practice.

10.4.3 Evaluation of Research Outcomes against Research Objectives

The eight research objectives of this project will be evaluated.

Objective 1: To engage with the theoretical and methodological issues in investigating the potential for using NM & NT in D and T undergraduate education.

This objective was achieved earlier in the project by researching what the appropriate theory and methodologies might be and considered which was more suited to answer the research question (Appendix I and II). This research has adopted an eclectic but broadly constructivist theoretical approach (Naismith et al., 2004). This sees learning in terms of an active constructive process, in which interaction with activities and feedback from teachers and task outcomes supports a process of development. Learners are constructing information and linking it to existing knowledge in an active, dialogical, experiential way. This means aspects of that Kolb’s (1984) experiential approach have been useful, but have been blended with elements of activity theory (Engestrom, 1996), and ripple theory (Race, 2005). These theories have proffered a richer understanding of D&T education from the students’ perspective. Thus engagement with the various theories and methodologies has been undertaken.
Objective 2: To devise an appropriate action research methodology for investigating potential for NM & NT in D and T undergraduate education.

This research objective was achieved as the MDHM methodology used in this research formed a new basis for an iterative process of planning, action and research. This focus on the student’s perspective has informed the choice of methodology, in the sense that action research is led by participant involvement in solving design and technology education problems. It also doesn’t prioritise the researcher’s ideas and agendas, rather subsumes these within the iterative process of planning, action, and research. The roles of teacher, student and researcher are not clearly distinguishable in action research, which also fits with constructivist theory. This allows the researcher to make explicit the biases and judgments upon with the research decisions are made.

Objective 3: To investigate the different types and features of NM & NT, and whether they are useful for learning activities within D and T undergraduate education.

This objective was achieved by looking at all the different features of different types of NM & NT and deciding which would solve problems identified by stakeholders. There were difficulties in getting lecturers to supply information over email. Thus a way of pushing information out to staff and students was investigated. RSS is the perfect technology for this. But it is doubtful whether students could use the technology and then they had to get into habits of use with that technology. A trial of using RSS was proposed for the “Sustainable Design” module, as there are many websites and blogs on sustainable design and sustainability issues. RSS was invented to assist with keeping track on the latest content on the Internet on a given topic. Therefore, RSS seemed logical learning support for an ever-expanding area of design. After reviewing many different types of technologies, Vodcasts were decided upon, as they linked to RSS technology and provided a useful way for students to go over core knowledge.

Objective 4: To consider which activities in D and T undergraduate education would benefit from the introduction of particular types of NM & NT.

This research objective was achieved by many activities in this research; for example, in Appendix XVI, we reviewed modules to investigate their level of NM & NT. Achieving this
Objective involved not just the looking at the analysed data but also looking at teaching styles and skills, the different modules and their content and analysing which activities would benefit from NM & NT.

Objective 5: To develop learning scenarios for New Media and New Technologies for educational purposes within Design and Technology undergraduate education.

Learning scenarios were developed but not pursued for further investigations, for although the students were in favour of them, they were not feasible, for example, due to high cost. Other issues emerged such as in the first learning scenario created on Multimedia Messaging Services (MMS) on phones; the aim of this scenario involving mobile devices for learning was to harness the creative uses of MMS for learning in design and technology education. The student should be able to document the experience of using the product or design flaws, and it is hoped that this will develop creative and spontaneous insights which will lead to students acquiring critical analysis for design and technology education.

Objective 6: To investigate the potential of New Media and New Technologies, assessing the simplest, low cost and most efficient way to deliver NM & NT to students of design and technology education.

This research objective was investigated and free online tools were used where possible. NM & NTs associated with the learning content were free. The applications for reading RSS and the download of Vodcasts would be free at the point they are obtained. However, how usable they are depends on stakeholders having access to mobile internet and broadband. One of the problems is that even though these tools are free, the industry is clearly changing so rapidly that they may easily become defunct, or they can radically change format so that they are not free at the point of download anymore.

Objective 7: To investigate new forms of learning Design and Technology subjects, through the delivery of New Media through mobile devices, mlearning and elearning.

With the move to more digital media technologies, it is argued that the art of design undergraduate education will become more computerised, as this may become more cost effective than the current model. Many computer programmes exist already to simulate Design
School education activities, which simplify the design procedure as all the elements for this process are in one computer package. With these computer packages a new style of learning can be developed in relation to m-learning and e-learning.

Objective 8: To produce guidelines and a framework for disseminating best practice for NM & NT in Design School’s undergraduate education.

The guidelines created were based on evaluating the implementation of RSS and Vodcasting in Design School’s undergraduate education. The framework identified a need for new education NM & NT tools called the D&TVideoBasics and the D&TModVods. Through a new category of learning applications or tools is where this research excels in innovation. A logical process was followed through from the stakeholder consultation to the design and selection of new NM & NT tools to explore the potential for NM & NT in the Design School’s undergraduate education. Although the evaluation is mostly positive in favour of NM & NT tools, organisational, technological and methodological barriers were identified in Appendix XXXV: Research Evaluating Barriers to NM & NT Tools in Education).

10.5 Specify Learning: An Evaluation Model for Research

This section specifies learning, evaluating the model for the research process which arose. It identifies what would have been done differently and why.

The researcher in the beginning research stages approached research question from the issue of learning design of curriculum content using new media and new technologies. There is a strict design approach to this which, according to the Instructional Management Systems (IMS) Global Learning Consortium (GLC) Learning Design Best Practice and Implementation Guide 2003, follows the stages of:

1. Analysis: of an educational problem, (called use cases), usually by elicitation of information from the various stakeholders. This analysis results in creating what is called in this research “learning scenarios”.

2. Design: Once learning scenarios were devised UML activity diagram. This is the first design step. The UML activity diagram then forms the basis for an XML document instance that conforms to the Learning Design specification. This is the second design step. This research followed UC/RDAD in mapping out the stakeholders’ relationships and designed
event sequence diagrams for those learning scenarios (Appendix XV).

3. Development: The Learning Design specification document forms the basis for the development of the actual content. So at this stage, development of Design View, RSS feeds, vodcast content were made.

4. Implementation: The learning design is tested; using RSS and Vodcasting is tried out on a Sustainable Design and a Foundation Technology module.

5. Evaluation: A model for how technology-based learning can be evaluated.

The difficulties with using a purely design-based approach is based on its’ rigidity and focus on the process of design, not on the students who are learning. The linear approach above was not really suitable for describing the organic and stakeholder-focussed approach which started to develop in the research. As the research progressed, more pressing issues of how best this technology could individually support the learning outcomes for particular modules became crucial to the success of this project. Thus a model of evaluation which combines the student-focussed view arose, using the MDHM methodology. If this project was done again, the focus would be on more how to support learning outcomes as opposed to testing out NM & NT which sometimes did not work.

**Summary of Evaluation Cycle (4C)**

1. Guidelines on RSS in D and T Undergraduate Education
2. Guidelines on Vodcasting in D and T Undergraduate Education
3. Generic guidelines for NM & NT in D and T Undergraduate Education
4. Evaluation of Research Approach
5. Towards Achieving Research Objective 8

10.6 Conclusion

Change can be a goal in action research, but one danger of this is that it assumes that action researchers have the right to make improvements, solve problems, and have sufficient tools to judge the efficacy of a particular change. As a way of avoiding (or at least minimising) these
pitfalls, a wide variety of methods were adopted; some traditional, such as interviews and questionnaires, some more innovative, such as working directly with students’ own displayed competences in performing IT learning tasks through observational study.

Action research acknowledges the complexity of research problems by allowing the research to progress within a series of cycles. This allows the research to mature while it is possible that the problem, variables, hypotheses, and methods may undergo modification as interim results are validated or invalidated, (Clark, 1976). Action research acknowledges the reality of a complex relationship between cause and effect through reflection as the evaluation/ specifying learning stages in each action research cycle. Using the MDHM in this research addresses this complexity.

Action Research in this research reflects on what emerged in a specific cycle, which then stimulates the “planning” element of the next cycle. To conclude, this chapter provided an evaluation of what action research is and a justification for action research as a research methodology. This chapter has evaluated the methodology adopted in this research, and described the development of a “the MDHM” to structure this research. The next chapter involves specifying learning.
Chapter 11: Specifying Learning: Future Directions for the Potential for New Media and New Technologies in Design and Technology Undergraduate Education

11.0 Introduction: What is Specifying Learning?

In this chapter a framework for the potential for NM & NT will be outlined. This chapter provides a conclusion to this research.

Specifying learning is “reflecting on the outcomes to understand how they have contributed to the change sought, and why the success or failure is observed in the organizational settings aims” (Rossi, 2009, p.6). As Susman and Evered note, it involves building a model or framework of the situation under study. In order to answer the research question “What is the potential for NM & NT in Design and Technology undergraduate education?” a digital media technology framework for education emerges. A framework is a hypothetical description of a complex entity or process. The framework is in two senses; firstly, how the digital media technologies (D&TVideoBasics and D&TModVods), developed as education processes and products, will work within Loughborough University. Secondly, how the MDHM methodology developed in this research can be reused to explore potential for NM & NT in future organizational contexts.

11.1 Diagnosing Future Directions for NM & NT Learning Scenarios

This section reviews the specifying learning metacycles to identify future directions emerging from the research overall for the potential for NM & NT in the Design School undergraduate education.

By way of conclusion to this research, this section reviews previous models built at the specifying learning cycles to diagnose a way forward for this research. Chapters 1 to 3 diagnosed the research problem (Cycle 1). Chapters 4 to 6 obtained data to action plan how to solve the research problem. Chapters 7 to 9 performed action to identify potential for NM & NT in D and T education. Chapter 10 performed an evaluation of potential for NM & NT
in D and T education. Following the 5 cycles within each of these cycles allows a progression of the research, where what occurs in a particular cycle is influenced by AND influences the previous and future cycles of action research. In order to follow this cycle it is necessary to first **diagnose** what has emerged from previous specifying learning cycles and prescribe how it affects how the research should be developed.

### 11.1.1 Reviewing Specifying Learning Cycles (C1.5, C2.5, C3.5, C4.5)

In the diagnosis cycle (C1), the literature review demonstrated a research gap for *NM & NT* in D and T undergraduate education. The research question arose from diagnosing that there are many *NM & NT* currently used in wider society and an investigation into their potential should be undertaken for D and T education. Section C1.5 specified learning potential of *NM & NT* generally; the two significant findings from this section are summarised:

**Summary of Specifying Learning Cycles (C1.5)**

1. Just- in- time delivery of learning resources (using mobile devices) seemed a major benefit to D and T education (see Chapter 3, section 3.19.1) and;

2. Using NM & NT in education could provide an extendible model for Design and Technology education, through elearning and mobile learning (see chapter 3, section 3.19.2).

In the action planning cycle, a wide range of solutions to the problems/ issues identified in Cycle 1 were considered. Some avenues explored were investigated but not pursued (see **Appendix XXXVI Cognima Project Report** which did not come to fruition).

**Summary of Specifying Learning Cycles (C2.5)**

1. There was potential in RSS learning scenarios to be able to assist with student referencing problems for their assessments.

2. There was potential for Vodcasting learning scenarios of learning sessions which could save lecturers from having to repeat themselves to students.
Specified learning scenarios (C2.5) highlighted ways in which NM & NT could be incorporated into D and T education, and focussed on two scenarios which could demonstrate potential for many different types of NM & NT for education: The results from the action taking cycle (C3), noted two significant findings which related to the action taking (C3.5) and research methods employed to investigate potential for NM & NT in D and T education.

**Summary of Specifying Learning Cycles (C3.5)**

1. Findings showed how and in what way RSS and Vodcasting might be useful, for example, students thought Vodcasting was useful for learning other subjects such as mechanics.
2. Students were not familiar with using RSS or Podcasting/ Vodcasting in their research habits. Potential for RSS and Vodcasting technology investigated was evident

From the action taking cycle, observational data revealed that there was potential, but it was not clear whether the outlay of time and resources justified a move away from traditional ways of disseminating learning. In order to find this out the evaluation cycle culminated in the development of guidelines of best practice, if NM & NT were to be employed.

**Summary of Specifying Learning Cycles (C4.5)**

The evaluation cycle (C4), produces an evaluation model of research which:

1. Evaluates the research findings in terms potential for RSS and Vodcasting in D and T education and creates guidelines for their use:
2. Evaluates the research methodology to establish whether and how research objectives were met.
The results of previous specifying learning can give an insight into how the research developed. This conclusive chapter reports Cycle 5, specifying learning; this involves building a model of the parts of the research process, taking into account all previous cycles.

11.1.2 Future Directions for RSS and Vodcasting
The learning uses of mobile video lie within the fact that it can be automatically delivered via dedicated feeds over the internet. So an ideal scenario is one where the students do not have to manually download the resources from the learn server. Using RSS with Vodcasting, the student with the correct feed set up could dock the iPod®/mp3 playing device overnight. While it is charging the RSS feed would push the Vodcast to a folder on the students’ computer which is synced to the mobile device. The RSS feed pushes the D&TVideoBasics mobile video to the students device without them having to manually download it. However, new research suggests that even if educators provide a subscription service for Podcasts and Vodcasts, students still will download the files manually (Lee, Millar and Newnham, 2009).

11.1.3 Future Directions Encompassing Newer and Latest Technologies
The use of NM & NT is subject to increasing change by consumers. It is therefore difficult to get a sense of whether investment in development of NM & NT for learning will prove futile as technology goes out of date. This researcher was therefore keen to ensure that this research was in some respects not technologically – led. The future directions of learning scenarios envisage undergraduate design projects done through the latest technologies.

- **New Mobile Tools:** Applications and creative technologies where learning can be accessed on mobile;

- **New Learning and Data Collection Tools;**

- **Using Latest Gaming Technologies:** Improvements to digital media design

- **Cloud computing and Social Networking Web Applications;**

In conclusion, this section has diagnosed future directions for NM & NT in D and T undergraduate education. The next section will explore these scenarios, in light of what has been learnt from this project.
11.2 Action Planning: Future NM & NT Scenarios in D and T Undergraduate Education

This section identifies alternative future learning scenarios for D and T undergraduate education.

NM & NT learning scenarios form a major finding from this research. This section provides an overview of the alternative future NM & NT learning scenarios and forms the future directions for this research. Current technologies which hold much potential but are out-with the scope of this work include:

**New Mobile Tools For Learning:** The Ipad has been released which may prove great technology for learning; however the cost is prohibitive for embedding within Universities at the moment. The android operating system on new mobile devices has the ability to run application designed specifically for learning uses; this is open source and a considerably cheaper option.

**New Tools for Learning and Data Collection:** There was a failed attempt in this research to collect mobile phone data using applications, using Vidya software. As data collection tools for this emerge and improve, it will be easier to collect data. An attempt was made to collect screen recordings of the mobile phone interaction with using RSS (using Vidya Software installed on the MDA Vario® smartphone, this made the phone unusable.

The researcher operating the video camera had to be in very close proximity to the person demonstrating the electronics to get a good view of the electronics demo. This is not ideal; one proposal is to use the police helmets which have a camera embedded on a person’s head to collect this learning data.

New video capturing tools which are currently being employed in universities to simplify the massive process of collecting and converting lecture content have been created. Echo 360 has been purchased by Loughborough University for this purpose, demonstrating that the potential for Vodcasting has been recognised.

**Using Gaming Technologies:** New types of controller for gaming technologies could be used to devise learning content and assessment. The new methods of interacting with computer games and virtual reality simulations hold potential for teaching and
learning design and technology education. This researcher investigated the use of 3D software and avatars for design and technology education (Page, Hepburn, Lehtonen, Thorsteinsson, and Arunachalam, 2007). However, limitations in interaction with the avatar meant that design tasks which were already difficult were made even less intuitive through controlling the avatars actions through a mouse and keyboard. These input methods require a complex set of keyboard and mouse/ controller commands.

The introduction of the Microsoft Kinect simplifies the interaction with digital artefacts through body and motion tracking, speech and gesture recognition technologies, intelligent agent/behaviour modelling and speech synthesis technologies. Thus it is now possible to naturally control the avatar through the movement of one's body and to interact through speech and gesture. These capabilities are now just beginning to emerge in the arena of computer gaming. Little or no research exists on how to use these technologies for learning outcomes.

Figure 41. 3D drawing using OpenKinect on OSX

Figure 41 above details a prototype created by a OpenKinect developer, which uses one hand to draw in 3D and another to rotate the view. The possibilities of using this technology in D and T education will be explored in future research. It poses an
exciting development for designers to design using more naturalistic interaction with the computer applications.

**Cloud computing and Social Networking Web Applications:** The rise of social networking sites like Facebook has changed the way people interact with one another (see Appendix XIX). Often these environments contain many of the features discussed already; text and chat facility, sharing of video and image files. The term "social software" is synonymous with the term new media. The term encompasses computer programs, which enable people to rendezvous (virtually), connect, communicate or collaborate through computers. Users have profiles which allow them to broadcast their preferences and habits to other users. These modes of communication allow for graphics, videos and music to be shared with others.

11.3 **Action taking: Specifying Learning Framework**

*This section identifies a framework for developing NM & NT tools for education.*

So if we wanted to explore in future the potential of using new Kinect technology to do 3D designing in D and T undergraduate education how would we go about it? What has emerged from this research is a reusable framework to answer this question (See section 11.3.3 below). The framework contained here details a way for NM & NTs to be developed for education. Current frameworks focus on either the pedagogical or the technological models for developing NM & NT in D and T undergraduate education. This research has identified new and emerging technologies which hold potential for D and T undergraduate education and merged these two together to form a clear way of embedding them within educational practice.

11.3.1 **ModVods and D&T Video Basics Programme**

Future advancements of learning scenarios include the *D&T Video Basics* programme. If the Design School can identify problematic learning information which creates large conceptual leaps for students, and streamline them into four *D & T Video Basic* learning objects for each module, then lecturer time will not be taken up with repetition. This blueprint for advancing m-learning in D & T education serves as a major finding from this research.

Collaboration with lecturers and technicians revealed on average four learning hurdles which students seem to face, year in year out with that particular module. There are currently 90
modules in the Design School. The aim is to identify four basic things each module leader would like as video podcasts, related to the learning outcomes of the module. Each module would offer those videos for download in two file formats, .m4v and .wmv. This is to offer support for students who own more generic mp3 players which play .wmv, and into MPEG-4, suitable for iPods®. Also the Design School would offer the chance for students to book out mobile devices preloaded with the videos on them. The ideal future scenario involves integrating RSS with Vodcasting, which is currently unavailable from the learn server in Loughborough University. But attractions for the stakeholders using Vodcasts are many. For lecturers and technicians, it can save time and prevent students from using dubious sources from the Internet. For students it allows them to go over content they have missed.

Devising New Media Learning Scenarios to support informal and formal learning will hopefully provide support for undergraduate students on particular modules. However, a clear demonstration of how to use, for example, Podcasts from the Internet via RSS need to be demonstrated step-by-step. The Design School was keen to develop low cost m-learning resources as module content called “ModVods”. If the majority of students already owned video-capable mobile devices, then costs could be kept down. It would be unfair to assume that everyone could afford a video-capable mobile device, so four School mobile devices were made available, which could be booked out by students to use in the lab. It was decided that a one-on-one approach to introducing students to “ModVods” would reveal potential problems that different students would experience. This would provide useful information in the future for teaching a class of students about this particular example of NM & NT, and how it could be useful for their modules.

Thus this research calls for the establishment of the D & T VideoBasics and ModVods programme. It is a “softly, softly” approach; as opposed to forging ahead with making all of the lectures available as mobile videos, before the challenges and issues have been engaged with and overcome. If the Design School can identify learning information which creates large conceptual leaps for students, and streamline them into four basic learning objects for each module, then lecturer time will not be taken up with repetition. Similarly availability of ModVods will enable students to engage with m-learning. This blueprint for advancing m-learning in D & T education shows much potential worthy of further investigation.

11.3.2 Matching NM & NT Types to Module Learning Outcomes
General problems with m-learning are perceived to be similar to that of e-learning; “manageability of an ever-growing portfolio of e-learning technologies, the desirability of providing too wide a choice of ICTs to staff and students, the balance between productivity gains and losses” (p.29: Armatas, Holt and Rice 2004).

This section indicates how to match appropriately the different types of \textit{NM & NT} to different types of learning outcomes. This serves as a major finding to this work, and will assist with this choice. When investigating the potential for \textit{NM & NT} in D and T education what became apparent was how many different types there were which have varying different functions; some kinds of \textit{NM & NT} may be better than others for facilitating types of learning within a module. Appendix XXXVII: Mapping New Media and New Technologies to D and T Learning Outcomes details the type of \textit{NM & NT}, the type of learning it would be suitable for and rationale for the type of \textit{NM & NT} delivering learning information to students to attain the learning outcome. For example, a wiki is better for groupwork than a blog which presents static user data collected; a wiki can be edited by a large group to provide for example, design documentation for a group project.

\textbf{11.3.3 Framework Architecture}

This section describes a reusable approach to the introduction of \textit{NM & NT} in an educational context.
Figure 42: A Framework for Embedding NM&NT in Undergraduate Design and Technology Education

Lecturer asks: What type of information do students need to know?

If modules are information intensive:
- Embed RSS Learning Scenario
  1. Lecturer compiles RSS feeds using RSS reader of choice
  2. Stores in a folder on RSS reader, e.g. “Sustainable Design”
  3. Lecturer demos to students how to use RSS
  4. Exports folder “Sustainable Design” as an OMLP file
  5. Lecturer makes RSS OMLP file available to students on VLE
  6. Student imports RSS feeds to feed reader of their choice

If modules contain more practical skills:
- Embed Vodcasting Learning Scenario
  1. Lecturer decides on appropriate content for video demos
  2. Lecturer collects & edits video footage of learning content
  3. Mobile videos are uploaded to the V.L.E.
  4. Student retrieves files containing Vodcasts from V.L.E.

If modules contain a combination of information intensive and practical skills:
- Embed RSS with Vodcasting Learning Scenario
  1. Set up the RSS Learning Architecture (Repeat Steps 1 - 6 for RSS Learning Scenario)
  2. Set up Vodcast Learning Architecture (Repeat Steps 1 - 4 for Vodcast Learning Scenario)
  3. Make link to Vodcasts and RSS Feeds available to students on Learn@iboro
11.4 Evaluation of the Proposed Framework

This section will provide an evaluation of the proposed framework and show how the research conducted can pre-empt some guidelines for the reusable framework architecture highlighted in the section above.

The opportunity and potential RSS and Vodcasting presented for the educational world as a solution to information overflow was very real. However, move forward to 2012. The Internet, New Media and New Technologies have undergone a major evolution. The previous section applied the process of this research to create a reusable framework for embedding NM & NT. This section reviews how this research conducted can pre-empt some guidelines for embedding future learning scenarios into D and T education.

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<thead>
<tr>
<th>EDUCATIONAL BENEFITS</th>
<th>EDUCATIONAL CHALLENGES</th>
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<tr>
<td>Design Ideas on a Computer At Point of Conception</td>
<td>Change of teaching and learning practices</td>
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<tr>
<td>Less Cumbersome for Lecturers to Mark</td>
<td>Redevelopment of module material</td>
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<tr>
<td>Student satisfaction</td>
<td>Cost of technology</td>
</tr>
<tr>
<td>Students save time</td>
<td>Worth time spent on development</td>
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<tr>
<td>Better Iteration Process</td>
<td>Technology- led learning</td>
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Table R: Perceived Educational Benefits and Challenges of NM&NT in D and T Undergraduate Education

In investigating the potential for this new technology some educational benefits and challenges can initially be identified. These educational benefits are mainly for students, but could also apply to the learning system as a whole. By evaluating research outcomes some guidelines for embedding this technology can be pre-empted.

11.4.1 RSS and Vodcasting within the NM & NT Learning Framework

On evaluation, issues hampering integration of RSS and Vodcasting include the student having to learn to use the mobile device, and the lecturer having to teach students about RSS/ Vodcasting technology and how to use it, as well as teaching their subject. Before the students learn to use technology, lecturers need to be in good habits of using it too! They are
the ones who need to decide on the learning content. Using RSS and Vodcasting also seems to be out-with students “comfort zone” at the moment.

11.4.2 E-Learning and M-Learning within the NM & NT Learning Framework

Exploring the potential for NM & NT in D & T education occurs within an e-learning and m-learning framework.

As predicted there was a convergence of NM & NT; software and devices, with more importance on the web. One problem with e-learning in design and technology undergraduate education lies in whether to use tried and tested external applications such as Coroflot (for e-portfolios) or whether to use the University in-house V.L.E (learn@lboro). Lack of good examples of how they are incorporated into design and technology education and a forced change of habits for educational stakeholders, (as outlined in the JISC report 2008) provide some heavy obstacles to the incorporation of e-learning and m-learning into a D and T curriculum, which might render the benefits obsolete. In conclusion, the following guidelines from the research conducted also apply to the reusable framework architecture for future investigations of the potential for NM & NT in D and T undergraduate education.
11.5 Specifying Learning Potential for NM & NT in D and T Education

This section summarises the learning potential of NM & NT for D and T undergraduate education.

The important factor is indeed how learning can be supported. This section will review the types of learning which can occur for each of the different stakeholders in this action research. Thus the stakeholders in this project are this researcher (the practitioner researching this field and writing this thesis), the client system (the Design School and Loughborough University) and the lecturers and students benefitting from investigating the potential for NM & NT in D and T undergraduate education.

This practitioner gained from this research organisational learning i.e. how the nature of education operates from the point of view of all the stakeholders. The student gained from computer aided learning (or elearning), mobile learning and informal learning. The model below describes how the research started with a wide review of different NM & NTs in relation to the virtual learning environment, Learn@lboro.

What is difficult about the use of NM & NT in D and T undergraduate education is the length of time it takes to rehash learning activities in an online environment. However from the findings of this research, the use of mobile technology can solve some practice problems or contribute to knowledge about what will or will not solve these problems. These practice problems can be solved in two ways:

1. Through asking lecturers what four things the students always get wrong then tailoring the NM & NT learning objects to what these are. This avoids repetition and helps student clarify difficult areas.

2. Through ensuring learning objects are designed with clear module or session learning outcomes in mind. Students tend to be assessment-driven and NM & NT designed with this in mind would be useful.
11.5.1 Summary of main findings

An article from Times Higher Education (20/08/09) suggests that hype of the pedagogic benefits of NM & NT for learning have not been followed by infrastructure development in Universities. This research aimed to investigate potential for NM & NT in design and technology undergraduate education. The main findings are:

1. Potential lies in delivery of in-time learning resources at the point of need.
2. A new research methodology emerges for managing large action research projects; the “Modular Double-Helix Metaphor” for researching potential of NM & NT in education.
3. Students identified potential through questionnaire; they would like lecture content available digitally. Lecturers identify through interview some problems using NM & NT for D and T education.
4. NM & NT solutions to those problems identified as “Learning Scenarios”
5. Types, functions and features of NM & NT identified and where best to apply them to achieve learning outcomes (Appendix XXXVI).
6. Observational data results: Findings from students using RSS on computer and mobile device for learning reveal potential for RSS so long as it is scaffolded properly by the module team. At this stage, neither students nor lecturers are in good habits of use to make this feasible. Findings from students using Vodcasts for learning reveal potential for the Vodcast learning scenario. Students found potential Vodcasts for the following reasons:
   a) “when you are in a group demonstration you can never see what is being done with lecturer’s hands, no matter how close you get” (Participant 1);
   b) “if you miss a bit in the group demonstration, you can’t go back, but with an iPod® you can rewind it and play it again” (Participant 2);
Figure 43 demonstrates one of the participants using the mp4 to learn to solder. What is interesting about this is that the student also has his phone on the table while he works. It is envisaged that as mobile devices improve and converge, there will only be one device needed which will be used.

c) “this is better than asking a technician, as it doesn’t matter how stupid the question is, you can just have a look” (have a look on the iPod®). (Participant 2).
Figure 45. Participant 2 Completing Mobile Learning Tasks
Figure 45 demonstrates the different mobile device, an iPod, used to access learning content. Video data was used to gather information about how the participants used mobile video learning objects on a mobile device.

7. Guidelines for NM & NT in D and T undergraduate education
8. A reusable framework for embedding NM & MT in undergraduate education
This research provides an insight into potential for NM & NT in D and T undergraduate education.

9. A user guide for staff on how to embed RSS within their modules.
The use of RSS needs clear explanations of how it can be valuable within an educational context and how to maintain RSS feeds, examples of good practice and guidelines for use. An outcome of this research is in Appendix XXXII.

**Summary of Specifying Learning Cycle (4C)**
1. A digital media technology framework for NM & NT in D and T education
2. Methodology for Investigating Potential: The Double Helix Metaphor
3. Apply methodology to NM & NT
4. Evaluation of Educational Benefits and Challenges
5. Towards Achieving Research Objective 8
11.6 Conclusion: The Potential for \textit{NM} & \textit{NT} in D and T Undergraduate Education

This section concludes the research, reports publications recent and future which emerge from this research and provides an overview of future research in this area.

Collaboration with all stakeholders has given clear directions for where to look for this potential. What emerges is a general framework for embedding \textit{NM} & \textit{NT} in undergraduate education, which pays attention to the different types of \textit{NM} & \textit{NT} and how their functions can best support different types of learning. A set of guidelines (see Chapter 10) and a new methodology for action research (Chapter 2) form major findings from this work. In terms of specifying learning, what would be required for better realisation of the potential is:

1. IMPROVED SERVICE FOR ALL: The upload of files to the learn server is slow; each one has to be uploaded by module leader and thus reliant on a quick connection. These files have to be downloaded individually by the student; a laborious task if there are 8 modules with 25 PowerPoint videos and a slow connection!

2. STANDARDISATION OF CONTENT: The type and frequency of Learn resources can be separated into course administration and course content. The timetables can change and are not really clear. If there was a standardisation of amount of content available to the student this would be good, instead of ad-hoc learning resources uploaded by the more technologically inclined lecturers or one’s who have more time to spend formatting resources in a way clear to students.

3. FACTORING FOR THE SPEED OF CHANGE OF \textit{NM} & \textit{NT}: One other emerging change with \textit{NM} & \textit{NT} is that the learner will have to learn more publicly, as many new media are open, and traceable. Also on this basis, the lecturer style and resources may be more easily scrutinised than before. This research notes that reviews in e-learning are often teacher-focussed, as opposed to student- focused. For example, Holtham & Courtney (2005) is a practitioner- focussed review of the benefits and disadvantages of virtual learning environment (VLEs).
The framework for future work combines RSS and Vodcasting, through the introduction of “D&TModVods” and the “D&TVideoBasics” Programme. Future work needs to take into account the particular module that the mobile videos are created for. Hopefully the framework above will be able to assist students at the point of design. This research details the results of adopting methods through mobile learning, matching them to course learning outcomes, in a way useful to undergraduate student education. RSS and Vodcasting can be useful for D & T education, so long as a reusable procedure can be devised which is simple to use and fits with the existing learning technology architecture.
Chapter 12: Review of Research Questions and Contribution to Knowledge

12.0 Research Review

This section introduces his chapter reviewing the research question and the perceived contribution to knowledge of this research.

The previous chapter of this research completed this research by expanding on the model for embedding NM & NTs into D and T undergraduate education. This concluding chapter will emphasise the main benefits for m-learning and the research approach adopted. There are various new media and new technologies available to aid the design and technology students to help them with formal or informal learning of their undergraduate modules. This research has investigated potential for NM & NTs, through e-learning and m-learning; this has involved:

1. Understanding the digital resource landscape within The Design School and Loughborough University.
2. Gaining an organisational perspective on use and non-use of NM & NT as digital resources

This concluding chapter also highlight the strengths of the methodology and methods used for getting in-depth data about m-learning with NM & NT. Also the strengths of the m-learning model of using D&TVideoBasics and D&TModVods for other modules and programmes will be discussed. The nature of D and T education is that it has its own set of educational practices, ‘learning by doing’ and workshop and lab activities. Therefore the benefits and features of NM & NT most suited to help students attain module learning outcomes are considered (Hepburn and Hodgson, 2009).

12.1 Reviewing the Research Questions

This section reviews both the main research question and the research subquestions which emerged.

The main research question concerns what the potential was for NM & NT in D and T education. This question gave rise to further subquestions which linked into the main research
question. This section looks at the following six research subquestions (as referenced from Chapter 1, section 1.2.3);

12.1.1 Reviewing Subquestions 1-3
Starting with the knowledge that there were many tools for teaching and learning which could be used, but not really seeing good examples of their use gave rise to this research subquestion.

1. What kinds of NM & NT are available, (for in Universities, Loughborough University and the Design School), and are particularly useful for teaching and learning?

This required constant review of the technologies and media used in Universities to assess what was available. The pace of change in technology and media applications is very fast. It was found that RSS and Vodcasting technologies seemed to stand the test of time and could be deployed at low cost in the Design School.

2. What kinds of learning and learning theories can be supported with NM & NT?

Appendix XXXVII contains an overview of the different types of learning that can be supported with NM & NTs in D and T undergraduate education. Learning theories were covered in-depth in Chapter 3, and in particular, Phil Races’ “Ripple Theory” appears to have the most relevance for D and T undergraduate students and provide a neat theoretical metaphor for how learning could occur with NM & NTs.

3. What are student/ lecturer’s level of knowledge of NM & NT?

The researcher in most cases had to teach or prompt the participants in the study on how to look for podcasts, Vodcasts or RSS in the case studies. The level of technological competency was less than the researcher expected, and, if they were “digital natives”, problems existed for how to translate the learning tasks to mobile devices. Kennedy, Krause, Judd, Churchward, & Gray (2006), assessed the potential for m-learning with first year undergraduate students – an age group regarded as digital natives. The results contradicted this researcher’s observational data – their results showed that these students have a range of competencies with these new technologies. They highlight the same issues though; the
challenge is how to cater for the broad range in students' levels of access to, and encourage familiarity with new technological tools.

12.1.1 Reviewing Subquestions 1-3
If an action research project using NM & NT was to be embarked upon, it seemed importat to gauge stakeholder involvement with these technologies.

4. What are the students/lecturer perceptions of using their mobile devices for learning
One of the reasons why the work of Kennedy et al., (2006) might have contradicted the results of this research is that they did not use observational data. Instead, they produced data from a questionnaire of 2000 students on the use and access to new types of technology such as mp3 players and mobile phones. This will have returned students perceptions on their use of NM & NTs for learning. Some of the questions they asked were similar to questions asked in this research. For example, although most students possessed podcast technology, 40% were unsure or thought it might be unsuitable for learning.

However, when further observational data was collected in this research on Vodcasts, students displayed competencies with the Vodcasts to help them design electronic circuits. Their perception of using this technology was very positive and they could describe other learning contexts where they would use the Vodcasts to help learn to design.

Lecturer perceptions on using mobile devices range from positive to negative; interview data seemed to suggest that mobile devices are personal communication devices. This data was collected before devices such as the iPhone were on the market. It would be interesting to repeat the interview study to see if a more positive reception for m-learning emerges, now that these new technologies access the internet more easily.

5. How to teach students to make use of online tools for their D and T education;
This researcher gained teaching experience, and so encourage the students to make use of NM & NTs in D and T education. Teaching students how to use RSS and Vodcasting helped to demonstrate in a clear way some of the benefits of NM & NT to this researcher first hand. Students of Vodcasting made some good points about those benefits too. For example, one
Vodcast participant saw that Vodcasting could be used when the technicians were unavailable to help them.

6. Can mobile devices help students as a tool for D and T education and communication?

All of the research seems to suggest that mobile devices can help for communication and engagement with learning. However, students need to have a standard level of mobile devices for this to work. Lecturers will have to demonstrate to the students how to access digital learning materials.

12.2 Summary of Original Contribution to Knowledge

This section summarises the main findings of this research and answers the research question and subquestions.

This research sought to answer the research question: what is the potential for NM & NT in Design and Technology undergraduate education? These findings were obtained from the methodology and methods used in this research, to answer the research question. The main research findings suggest:

1. Potential lies especially in delivery of just-in-time learning resources at the point of need.

This potential is investigated in a design and technology undergraduate context.

2. A new research methodology emerges for managing large action research projects; the “Modular Double-Helix Metaphor” for researching potential of NM & NT in education.

A new and innovative way for managing action research projects (the MDHM) which looks at NM & NT in educational settings is a major finding to this work and can be reused for different Higher Education contexts.

3. Students identified potential though questionnaire; they would like lecture content available digitally. Lecturers identify through interview some problems using NM & NT for D and T education.
New innovations such as Echo360 are being employed in Loughborough University to deliver lectures in an electronic video format. However, this is a time consuming, technical and expensive process.

4. **NM & NT solutions to those problems identified as “NM & NT Learning Scenarios”**

A new term, (NM & NT learning scenarios), arises for the design phase of embedding new media and new technologies with university learning.

5. **Types, functions and features of NM & NT identified and where best to apply them to achieve design and technology- specific learning outcomes (as contained in Appendix XXXVI).**

What was clear was the difference in how teaching was conducted within the Design School meant that being at a computer was not always practical. The different types of information for each module had to be assessed and then the NM & NT which would be help achieve those learning outcomes were assessed.

6. **Observational data results which suggest that mobile technology, NM & NTs are not quite up to the learning tasks.**

Students are working with: 1. Learning how to use the technology
   2. Mobile device hardware constraints
   3. The application software and;
   4. The learning content.

Although the technologies had much potential, these four difficulties hampered how students could be supported with mobile technology. These studies were performed in 2007, so a major issue emerged for this research of the “technological literacy” (Ingerman and Reed, 2007) of staff and students. This was combined with difficulties gaining information technology support in-house for the V.L.E., called Moodle.

7. **Guidelines for NM & NT in D and T undergraduate education**

Different guidelines were developed; specific ones for RSS and for Vodcasting and more generic ones for NM & NTs in D and T undergraduate education. This formed part of the evaluation of the research. As Motiwalla (2007), notes the granularity of m-learning content
delivered is critical; a two hour lecture is not practical for students on a mobile device. Small learning objects in line with session learning outcomes would allow for better m-learning. Guidelines such as this allow for a more tailored approach to D and T students and allow the emergence of an m-learning framework, “D&TVideoBasics” and “D&TModVods”.

8. A reusable framework for embedding NM & NT in undergraduate education.

The framework for future work combines RSS and Vodcasting, through the introduction of “ModVods” and the “D&TVideoBasics” Programme. JISC (2009), states that no blueprints exist for embedding Web 2.0 into higher education exist. This research aimed to create a “blueprint”, which we call “framework” for the purposes of this research. Future research would investigate whether this framework in this research can be transferred to other situations. The limitations for the framework are that it has only tested Vodcasts and RSS technologies. However, these technologies seem to meet stakeholder requirements and qualms about using ICT for learning D and T subjects. It is hoped that our results will provide a framework for integrating new media, RSS and Vodcasting with education in other fields. Thus, D and T students’ use of multimedia for learning will be enhanced, providing on-hand access to learning resources at the crucial point of design.

12.3 Discussion on the Potential for NM & NT

This section reviews research question and discusses the contribution to knowledge of this research.

The potential for elearning and m-learning very much depends on the support available from University institutions. The research question asked: “What potential exists for NM & NTs for students of Design and Technology undergraduate education?” Internet and mobile technology is now used extensively by students and lecturers for their research. This makes elearning and mlearning with NM & NT in D and T education possible, and is it of benefit to the stakeholders. By potential this research adopts the definition as ...“made up of knowledge of a particular situation, personal engagement with a situation, and social engagement in the world (Ingerman & Reed, 2001, p.137).

The potential for NM & NT depends on the technology; this research used technology which was very time consuming to design and build m-learning for: often the technology was not up
to the learning task. As early as 2004, the issue of potential for NM & NT came to the fore. McCormick (2004) notes that, prior to 2004, the International Journal of Technology and Design Education had only two relevant articles on potential. The author argues that although the technology is not there yet, organisations have to be ready to exploit educational potential, from where ICT goes beyond being effective at what can be done by traditional methods, to extending the capabilities of students.

12.3.1 Reviewing the Research Gap

However, this research has shown that the potential can only be exploited by technologically literate students. A BIG assumption was made by this researcher that students used podcasts, and that they were all up to the same standards. Not so! Ingerman and Reed (2011) describe a model for technological literacy within technology and design education. The model has two interrelated facets—the potential for and enactment of technological literacy. The model in this research investigates the potential for NM & NT specifically for D and T undergraduate education as opposed to the more generic capabilities of students as “digital natives (Prensky, 2001).

It seems that what has been missing from exploiting the potential for NM & NT in D and T undergraduate education is a model for enactment (Ingerman and Reed, ibid). JISC (2009) notes that there can be no blueprint for how to embed NM & NT.

“Advice and guidance is available to institutions, but there is no blueprint for implementation of Web 2.0 technologies, and each is currently deciding its own path” (JISC, 2009, p.6).

This is because the range of NM & NT is so wide (such as blogs, wikis, RSS) and each institution can support particular learner goals. However, there is less evidence of good practice of how to do this; there is no “one size fits all” approach. As JISC (2009), note:

“Deployment is in no way systematic and the drive is principally bottom up, coming from the professional interest and enthusiasm of individual members of staff” (JISC, 2009, p.6).

M-learning initiatives have to be taken module by module and programme by programme to check that the type of m-learning matches with the module learning outcomes. So the type of learning information in a Sustainable Design module will be different than in a Foundation
Technology module in the Design School. One of the major benefits of this research overall is that it attempts to provide a blueprint for the implementation of \( \text{NM} & \text{NT} \), depending on the technology and type of learning (see Appendix XXXVII). This blueprint also highlights the process of deciding which \( \text{NM} & \text{NT} \) might be suitable for particular types of modules.

12.4 Emphasising the Benefits of Mobile Learning for D and T Undergraduate Education

_This section highlights the benefits for mobile learning for design and technology undergraduate students._

Much has been written about the benefits for m-learning and Web.20 for higher education in general (Denk, Weber and Belfin, 2007; & McManus, 2002). It is argued that the major benefits of \( \text{NM} & \text{NT} \) for D and T undergraduate education lie with providing students with tools essential for just- in- time delivery of learning resources at the point of need. The potential for mobile technology to generate and stimulate learners’ ideas for D & T has been argued for. As Kimbell (2005) notes there has been too much emphasis on the role of Information and Communications Technology in education on “doing and recording activities; to control, to simulate, to manufacture”, (p.6). However, the nature of D and T education at both school curriculum level and at undergraduate level is practice- based and not so focussed on recording research.

A recent study supports this research published by this researcher, (Hepburn & Hodgson, 2009). The m-learning benefits of RSS have been highlighted in a study which found that RSS has better performance than SMS and email on content accuracy and adaptability (Lan & Sie, 2010). RSS is more appropriate for supporting various mobile devices to access content in a m-learning environment. This study argues that the developer and designer of an m-learning environment can take advantage of RSS techniques to support m-learning and achieve the goal of m-learning, anytime and anywhere. RSS require further research and development to work out a good way of maximising these benefits.

12.5 The Benefits of “\( \text{NM} & \text{NT} \) Learning Scenarios”

This research designs and implements \( \text{NM} & \text{NT} \) learning scenarios for undergraduate design and technology education, at Loughborough University. Action research is used to assess educational aspects, and develop strategies for developing future \( \text{NM} & \text{NT} \) learning
scenarios for technology and design education. The tool of scenarios is used in this research to design m-learning. Then this research specifies how future scenarios could be studied and implemented using this research as a model for doing so (see Chapter 11 above). Wishart & Green (2009), in their report to JISC, mention how to develop future scenarios for m-learning. The key difference between their approach and the one used in this research is that the future scenarios developed here are made relevant to the design and technology education approach. This is due to the types of learning which D and T undergraduate students do, which is different to more traditional methods, and areas of the University curricular.

Making reality out of scenarios, (see Milfsud, 2004), is one major contribution to this research, as well as finding a way to explore new future learning scenarios with NM & NT. The benefits of NM & NT learning scenarios are that they provide a way to present educators with ideas that can be reviewed for benefits such as cost effectiveness or educational effort estimation (Traxler, 2004).

12.6 Benefits of this Methodology for Action Research

This author has seen the utility of focussing on the 5 stages of action research by Susman and Evered (ibid). This meta-narrative is useful for describing how the methods utilised fit together to create an action research project within the 5 cycles of action research. Each data collection method was selected on the basis of what point in the cyclical process the research was at.

Thus this research came up with a new way of investigating potential within university settings. This really helped the researcher with research progression, and formed the “MDHM” methodological approach. This metaphor has the possibility to develop towards a new methodology for tackling research questions on “potential” of NM & NT in action research within an institutional setting. The MDHM was really beneficial for the research structure, allowing the research to progress organically. One of the problems with exploring potential is how to go about it, when to start or stop a particular research activity.

Use of the MDHM has now been used as a metaphor for how to understand project organisation and research progression in action research (Hannon, 1996). However, crucial differences in the research design in this author’s version of the methodology form a new way of doing an action research project. The double- helix metaphor contains five cycles in
one spiral and the other spiral uses the five cycles at each stage for further decomposition of each of the five cycles. Using the MDHM as a research methodology has revealed some interesting findings on the potential for NM & NT in D and T education.

Another reason for using the MDHM methodology is that there does not seem to be many research examples of NM & NT at university-level D and T education. NM & NT and the area of education was vast and quite wide, knowing the “who, where what and why” was difficult without some overarching structure. Existing literature in relation to NM & NT, D and T education, design education, and technology education, is reviewed to find points which might be relevant to this research, (see Chapter 3, Literature Review). This should offer an overview on the different New Media and how it is used in education design-based modules and programmes of study. This aspect of the research is relevant to assist with the development of scenarios, specifically for D and T education, within Loughborough University.

12.6.1 Discussion on Methods Used to Explore Potential

Thus the research aim is looked at through the development of strategies for deploying NM & NT for D and T undergraduate education. In particular, the potential is explored through introducing RSS and Vodcasting to a small number of D and T students and reviewing the outcomes through using Observational methods, and pre-task and post-task questionnaires. This fulfils the research aim of the creation of multimedia learning resources available on new technologies, using mobile devices in both studies.

It is argued that using these methods to gain data on m-learning constitutes a “user centred design” approach. Recent research has mirrored this approach, creating two m-learning scenarios from stakeholder feedback (Rebaque-Rivas & Gil-Rodriguez, 2010). The information collected from their interview research and user profile development allowed for the creation of two potential scenarios for m-learning which form the basis for the design and development of new applications linked to m-learning. The authors emphasised the enormous potential for m-learning by commuting students. This is similar from our research in 2009, (Hepburn and Hodgson, 2009), where interviews and questionnaire data identified student potential for podcasting lectures and D and T students are constantly on the move between labs.
Using the observational method for a small number of participants was emphasized in Susman and Evered (1978). The authors advocate change being made with small numbers of participants face-to-face, to maintain tight control of the ethics and to monitor those changes more effectively. Therefore, a one-on-one case study approach with 6 students was employed for the RSS study and 4 students were used for the Vodcasts. As we are making changes to educational practice, it may seem unfair to the students; as a difference in the content of the modules would be apparent. Keeping the number of participants small was of benefit to the researcher in gaining more in-depth data on actual performance of m-learning without compromising these ethical issues here.

Another benefit of the video observation method is noted in previous research. Pea (2005) notes the power of video as data for human interaction analysis and reflective uses specifically for purposes of learning, training and education. Part of the action research programme was that this researcher was attempting to teach students how to use the technology.

**12.7 The Benefits of D&TVideoBasics and D&TModVods**

Tailoring module content to m-learning situations is a very time consuming activity. Given the time, resources and availability to build m-learning into modules, a structure had to be put in place for design and development of m-learning in the Design School. Thus lecturers were asked to produce four blocks of learning information, which students always got wrong year after year. This allowed the development of four Vodcasts which students could use as an extra module learning resource, called D&TVideoBasics Programme. The D&TModVods on the other hand was a resource of recorded workshops which were broken down into session learning outcomes and created for a mobile device. The benefits of these were noted by the student, such as not having to find and ask the technician, they could solve problems themselves.

Introducing students to RSS would reveal potential problems which different students would experience. This would provide useful information in the future for teaching a class of students about using new media through RSS with new technology (mobile devices). A small pre-task questionnaire was handed out to students, to find out whether they had used the Internet on a mobile device and whether they had used RSS before. The findings from this RSS study gave some insight into students information searching and retrieval of information. This is still a major issue for the use of Web 2.0 technologies in higher
education (JISC 2009). One of the major findings from this report related to the issue of information retrieval which RSS was supposed to help with:

“Information literacies, including searching, retrieving, critically evaluating information from a range of appropriate sources and also attributing it – represent a significant and growing deficit area” (JISC, 2009, p.6).

In this way RSS could REALLY add benefits; As Lin & Sie, (2010) note, the developer and designer of an m-learning environment could adopt a suitable information delivery medium (such as an iPod® or RSS feed on a phone) to support the corresponding learning activities in a m-learning environment; moreover, RSS could be useful with current e-learning systems, such as Learn@lboro V.L.E.

If the Design School can identify learning information which creates large conceptual leaps for students, and streamline them into four basic learning objects for each module, then lecturer time will not be taken up with repetition. Also, benefits arise for the module videos “D&TModVods”, if they can be designed so that they are small chunks of information available on mobile devices accord with the session and module learning outcomes. This makes the content really relevant to the student’s assessments.

12.8 Research Dissemination Approach

Future dissemination of this work will use the structure of Susman and Evered’s 5 stage plan and this MDHM methodology to publish the following papers from this research, contained in Table P below.
Table S: Research Dissemination Plan

<table>
<thead>
<tr>
<th>RESEARCH DISSEMINATION APPROACH</th>
<th>Paper Title</th>
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| Theory                          | - Technology, New Media and the Public: Investigating the Impact of Technology for Communication (paper output from doctoral course, Bergen Appdx)  
- Using Activity Theory to Make Sense of Embedding New Media and New Technology Into Undergraduate Education |
| Methodology                     | - Towards an Innovative Methodology for Managing Large Action Research Projects: Using the “Double Helix Metaphor” to Guide Process |
| 1. Diagnosing                   | - What potential exists for New Media and New Technologies in Design and Technology Undergraduate Education |
| 2. Action Planning              | - Using Learning Scenarios to Design Learning Resources for Design and Technology Undergraduate Education  
- Developing Learning Scenarios For Mobile Devices for Design and Technology Curriculum |
| 3. Action Taking                | - Learning Across Sites with New Media. Integrating RSS Technology with Design Students' Research Practices |
| 4. Evaluating                   | - Evaluating the Potential for New Media and New Technologies in Design and Technology Undergraduate Education  
| 5. Specify Learning             | - Future Learning Scenarios with New Media and New Technologies for Design and Technology Undergraduate Education: Using the Kinect for D and T Education |

The above research dissemination plan shows a future research dissemination output from this research, which follows on from the work already published as part of this research (see
Appendix VI: Overview of Published Works). The MDHM has proved its use further in dissemination of the research findings. It allows the researcher to publish each stage of the five cycles; within each of those individual cycles the five cycles are followed. This furthers the action research approach, generally.

12.9 Conclusion

To conclude, this research details the results of trials of two m-learning scenarios using RSS and Vodcasting. The benefits of this research have been emphasised. Thus this research calls for the establishment of the *D & T VideoBasics and D&TM*od*Vods* programme. This forms a framework for how to design and develop m-learning at Loughborough University and hopefully beyond. It is a “softly, softly“ approach; as opposed to forging ahead with making all of the lectures available as mobile videos, before the challenges and issues have been engaged with and overcome. If the Design School can identify learning information which creates large conceptual leaps for students, and streamline them into four *basic* learning objects for each module, then lecturer time will not be taken up with repetition. This framework for advancing m-learning in D & T education shows much potential worthy of further investigation.

Future work needs to take into account the particular module that the mobile videos are created for. Hopefully the framework above will be able to assist students at the point of design. This research highlights the benefits of adopting methods through m-learning, and matching them to course learning outcomes, in a way useful to their education. To conclude, using RSS and Vodcasting can be useful for Design School Undergraduate education, so long as a reusable framework can be devised; one which is simple to use by all stakeholders and fits with the existent learning technology architecture. It is hoped that this authors’ results will provide that framework for integrating new media, RSS and Vodcasting with education in other fields. Thus, Design School students’ use of multimedia for learning will be enhanced, providing on-hand access to learning resources at the crucial point of design.
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APPENDICES FOR

INVESTIGATING THE POTENTIAL FOR NEW MEDIA AND NEW TECHNOLOGIES IN DESIGN AND TECHNOLOGY
UNDERGRADUATE EDUCATION

by

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A thesis submitted in fulfillment of the requirement for the degree of PhD

Appendix XXXVI Cognima Project Report
Appendix XXXVII: Mapping NM & NTs to Design & Technology Learning Outcomes

Loughborough University

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3.0 Terminology of this Research

The aim of this research is to investigate how \(NM\ &\ NT\) could transform aspects of D and T undergraduate education. Terminology in this area is often confusing, and full of jargon, thus the first subsection will explore terms within the research topic. The stakeholders in this research include this researcher. The emerging field of design and technology education is explored and the rationale for this research is made transparent.

Learning within the Design School is done through industrial or product design degrees. Archer, Baynes and Roberts, (1992), in the first of many booklets on the subject of D and T education explore fundamental terms related to D and T education. They explain design as the 'envisaging what' from technology; and distinguish technology as the 'knowing how' (p.8). According to the authors, the act of learning to design focuses on the uses learners can make of objects, (and technology!), and how to support the types of activities learners want to achieve.

\(NM\ &\ NT\) fall within the wider field of Information and Communication Technologies. The previous chapter introduces the term Information and Communication Technologies (ICTs). The term new media relates to the definition of Web 2.0 technologies. These are distinguished from the generic term ‘new media’, as Web 2.0 refers to the services that have arisen as second generation Internet applications have been developed, such as social networking sites. The term, Web 2.0, was coined by Internet entrepreneur, Tim O’Reilly, (2005), to describe the shift in the practices on the Internet, reflecting the growth of \(NM\ &\ NT\). The rise of Web 2.0 has changed how we manage knowledge and information on the Internet, and appears to have great potential for learning.

3.0.1 Exploring the Definition of New Media

The definition of "New Media" refers to any digital media objects with interactive features and which are digitally distributed. New media encompasses the cultural practices, which have arisen around the following types of technology:
• Internet technologies, such as online chat rooms,
• Wikis,
• Weblogs (or blogs),
• Instant message chat, email and
• Software and devices for communication.
• Websites
• Social Networking Sites

This section identified the terminology in the field of *NM & NT* for learning, the next section explores some of these new terms.

### i. New Media in Wider Society

The term *new media* refers to a new generation of **digital artifacts, software and hardware** that allow users to easier interact with one another and with digital artifacts. Manovich (2001), author of “*The Language of New Media*” provides a theory of ‘new’ media as within the historical and grammatological perspective of the media cultures of the last few centuries. He uses this theory to display how *New Media* is not that new because it relies upon similar features of old media, such as the rectangular/square frame and the mobile camera. The author shows how *New Media* works create and represent space in a similar way to ‘old’ media. He distinguishes categories unique to *New Media*, such as the interface and the database. A database is a collection of data components possessing a relationship to one another.

### 3.0.2 New Technology

Pockets of module information delivered through *NM & NT* are known as **learning resources** or **learning objects**. The University of Leicester have developed their own names for learning objects, “*m-tivities*” and “*e-tivities*” (Salmon, 2002). *M-tivities* are interactive learning objects accessed by mobile devices, and *e-tivities* are learning objects accessed online. **Networked Education** is a model for convergence of networked individuals with education network based IT services, transforming the way learners learn and teachers teach, (Falk, Ceccato, Hu, Wong, and Fischer, 2000). In relation to design and technology education, new ways of designing are prevalent with new technology such as CAD. Within the Design School, here at Loughborough University, the field of research known as **Computer Aided Design/ Computer Aided Manufacturing (CAD/CAM) for learning** has
arisen to teach design and technology students how to learn to design through computers (Hodgson, 2006).

3.0.3 New Terms Associated With This Research
Learning through computer-mediated communication becomes synonymous with computer mediated learning, where students receive and are encouraged to submit assignments using a computer. Learning through technology can also be referred to as technology-mediated learning. This section explores some useful terms.

i. Technology-Related Terms
This research makes use of NM & NT as a form of Learning Technology. Learning technology is a subset of devices and software for learning. Generally, learning technology consists of discipline-related learning objects. These are defined as educational content or communication of content done through the use of technology, such as computers, mobile devices (e.g. mobile phones, iPods®) and also games-based learning. The Institute for Electronic and Electrical Engineers (IEEE) Learning Object Metadata standard defines a learning object as “any entity, digital or non-digital, that may be used for learning, education or training” (IEEE, 2002).

ii. Learning-Related Terms
Networked Education is a model for convergence of networked individuals with education network based IT services, transforming the way learners learn and teachers teach, (Falk: 2000). Elearning is the use of technology, such as computers to mediate between the learner and learning content. Mlearning is the same, but done through mobile devices, which now have the capability to access a number of Web 2.0 applications, like Facebook. The rise of Web 2.0 has changed how we manage knowledge and information on the Internet, and has great potential for learning. This research will address how to apply this to design and technology education, within the Design School undergraduate modules.

Educational content specifically received through a computer has developed into the field known as Computer Supported Collaborative Learning (CSCL). CSCL is a method of developing the Internet and computers for learning. This area of research has paved the way for a mobile variation, mCSCL (Cortez, Nussbaum, Santelices, Rodriguez, Zurita, Correa and Cautico, 2004), where new implementations of this type have been trialled at school level.
science (although rarely at university level). Although not specifically defined as mobile CSCL, applications of this type are being developed at Nesta Futurelab, (Futurelab, 2009), to facilitate mobile collaborative learning at school level. To conclude, this section has set out some of the terms and topics which provide a useful foundation for the rest of this research.

3.1 Research Stakeholders and the Emerging Research Field

*This section introduces the reader to the research stakeholders within this research.*

This section reviews the literature on the research stakeholders and emerging research field highlighting early examples where media is used for this cohort of students.

3.1.1 Research Stakeholders: Design and Technology University Students

Kimbell and Perry, (2001), describe learning D and T as the “vanguard” for preparation of young people for the knowledge economy. Exploring the school subject of design and technology, they highlight the importance of design activity as creating change, and offer tangible ways forward for this discipline. To distinguish; this research is focussed on undergraduate education. This action research project concerns the development of D and T education through the use of NM & NT to scaffold learning at Loughborough University. Thus the relevant stakeholders are the students, the lecturers, support staff, this researcher and the institution. Within the Design School, there have been some inroads into exploring the potential for NM & NT in D & T education, particularly with CAD (Hodgson, 2006; Hodgson and Norman, 1993).

Hodgson (2006) in investigating the potential for CAD in D and T students notes the need to develop a student’s ability to design, and the requirement of CAD to scaffold this. Hodgson (ibid) notes CAD “is a great enabler for students, particularly those who do not have the skills or confidence to effectively communicate through sketches” (p.11). The potential for CAD in education is realised in 3 ways:

1. Realisation of high quality design output;
2. Simulation, testing and analysis of the operation of design concepts and;
3. Design iterations through redesigning components/ products within a CAD model.
There is great potential in cost reduction through a CAD iteration process too. Learning within the Design School, occurs through students working together on a project. To conclude, this section discusses the stakeholders’ context for using NM & NT in D and T undergraduate education. It discussed some of the successes of CAD and some of the potential of other types of elearning. The next section builds upon this with a more specific consideration of D and T education.

Where does the current potential for NM & NT in D and T education lie? McLaren (2007) highlights the dramatic turn in design and technology education from teaching and learning of wood and metalwork to students concerned with the knowledge, and processes related to industrial design. Exploring pedagogical and motivational approaches, McLaren seeks to move towards a more democratic way of learning which does not focus on the commercialisation of students learning to design. She concludes that this case study proves there is educational potential for language, digital and electronic tools borrowed from popular media and culture in design and technology education.

3.1.2 Early Design and Technology Education Research Using Media for Education

Early research work within the Design School uses new technology of video to teach students design and technology at undergraduate level. This research is however, quite old. Action research allowed for the use of interactive video in D & T education to facilitate learning. Hodgson & Norman (1993) identify the usefulness of video as a learning tool and develop a prototype interactive video application for school students. The learning content of the videos illustrates design contexts in such a way so as identify design specifications. Discussing the nature of the term "interactive", they identify "planned interactions" which arise from interactive video as pedagogical tools for structured learning. However, teacher feedback in this study identified control as an important aspect for the success of this type of technology.

3.1.3 Current Design and Technology Education Research Using New Media for Education

In terms of using new media and new technologies for students, other inroads are being made into elearning by the Design School at Loughborough University. Dr Trimingham (a lecturer in Sustainable Design) is interested in using audio attached to emails to provide feedback on large portfolio- assessed modules to students. There were two pilot studies, the first providing
feedback on essays, and the second on design folios. Pilot study 1 involved 11 first year undergraduate students on Design Contexts module. Each student for their individual essay was given additional feedback as an audio file via email. In pilot study 2, first year undergraduate students on Design Practice module received their feedback on audio via email to provide formative feedback (JISC, 2008). Findings showed that students liked this form of feedback. However, not much previous research exists in design and technology education to indicate which types of NM & NT would be most suitable for all stakeholders.

3.2 Benefits of New Media & New Technologies in Design and Technology Education?

This section will briefly explore why NM & NT in D and T education would be a good pursuit.

Using NM & NT in D and T education particularly, could stimulate the students creativity, increase "technological multiliteracy" (surely one of the aims of D and T education) and allow stakeholders greater flexibility on when and where to conduct D and T education activities.

3.2.1 New Media & New Technology for Learning “Democratizes” Design and Technology Education

One rationale for studying the potential for new media and new technologies in D & T education is highlighted by Williams (2007), who proposes that NM & NT have a democratising effect on technology education. Williams suggests that the explosion of a new type of information technology has become an integral aspect of young people’s lives; therefore, in education there is a need to develop a “technological multiliteracies” (Williams, 2007) approach to pedagogy in D and T education. This is based on the theory that diverse learners may get their education from multiple formats of education, adopting those which suit their learning style and preference.

Teaching and learning are not distinct from political and theoretical categories; and these are not universally defined (Suchman, 1994). The position outlined affects the methods chosen to collect data. It involves the researcher in an eclectic blend of pragmatically informed research designs, along with developing productive ways of characterising the research as it proceeds.
Petrina (2000), in discovering the politics of technological literacy, describes it as within an ideological context of competitive supremacy and conservative politics. He calls for a turn to critical technological literacy, transforming forms of power that sustain inequalities. To engage in these politics, the author concludes that technology educators will necessarily have to resituate their teaching practice within cultural studies.

3.2.2 New Media & New Technologies promotes “Technological Multiliteracy” in Design and Technology Education

Other justifications for NM & NT in D and T education are apparent. Williams (2007) also concludes that technological multiliteracy should become the focus of technology education, through repackaging it as a moral rather than vocational or instrumental practice. As the mechanism is available for students to share and comment on their designs; - then the move toward a more democratic educational system becomes attainable. The actuality of how this becomes embedded in everyday D and T education practices is missing from this evaluation.

The democratising effect mentioned was one of the reasons for pursuing NM & NT in D and T education particularly (Williams, 2007). To conclude, this review looks to previous research to create settings for new forms of learning within organisations. This provides a framework for radical changes in D and T education. New ways of learning D and T are envisaged, and the importance of setting these in some kind of theoretical context is highlighted. The next section will therefore look for theoretical approaches to guide this research.

3.3 Selecting an Appropriate Research Strategy

This section ties the research methodology and research methods to the aims and objectives of this research.

The research questions contain some specific objectives in exploring the potential for NM & NT in D and T education. Investigating this potential should engage therefore with the stakeholders to find out.

a) Whether stakeholders use NM & NT for learning already;

b) What they think about using NM NT and explain it to them if they are unfamiliar;

c) An introduction of stakeholders to NM & NT for learning to investigate the potential.
The research question involves investigating the potential for \(NM \& NT\) in D and T education. Thus adopted research strategy and methods employed were flexible according to the needs and requirements of the D and T stakeholders. Practice-based methodology does not have a clear structure for action in a research project. The social sciences method is a more observational and does not apply the findings of the data as neatly as action research in an organisational context. There was no requirement for this researcher to have control over events, therefore, experiments and the scientific approach were ruled out.

Exploring the potential for \(NM \& NT\) to D and T education will not be possible via the scientific method, because there is no strong hypothesis on which will be most appropriate. The most relevant methodology to the research question was thus action research. Chapter 2 elaborates on how the action research methodology aids this research. Action research tends to favour the phenomenological. Emerging wireless and mobile technologies bring new opportunities for learners to be strongly linked in terms of communication through text or images, either face-to-face or at a distance. Modern learning theories tend to focus more on social aspects of learning such as discourse, communities of practice, collaborative learning, internalization of social process, and situated learning (Kinshuk, 2003). (And less on being experimental subjects)! The act of researching and knowledge formulation does not occur in a vacuum and the weight of scientific validity will depend on the research questions.
3.3.1 The Relationship between Research Theory, Methodology and Action Research

Action research seems useful for exploring the potential, as it relates most heavily to socio-constructivism; the potential can be reviewed with an account from the stakeholders perspective. Habermassian theory can provide an ethical justification of the “action” in action research as action is seen an emancipatory force in organisations. This allows the researcher to take into consideration new technology in D & T education, how it integrates with the context; with management processes of the institute and academic schools, the design and development of the teaching materials, and the students’ management of their own learning.

Salmon (2002) bases her methodology for the creation of e- learning resources on Action Research. She states that for effective learning to be devised learners should be chaperoned through the online learning development process. She devises a five - stage model for teaching and learning online which have two subcomponents namely:

<table>
<thead>
<tr>
<th>Stages 1 – 5</th>
<th>Subcomponent: E – moderating</th>
<th>Subcomponent: Technical Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access &amp; Motivation</td>
<td>Welcome/ Encourage</td>
<td>Establishing/Accessing system</td>
</tr>
<tr>
<td>Online Socialisation</td>
<td>Bridges between cultural/social environment</td>
<td>Sending/ Receiving Messages</td>
</tr>
<tr>
<td>Information Exchange</td>
<td>Facilitates tasks &amp; support</td>
<td>Search/personalise Software</td>
</tr>
<tr>
<td>Knowledge Construction</td>
<td>Facilitating process</td>
<td>Conferencing</td>
</tr>
<tr>
<td>Development</td>
<td>Supporting</td>
<td>Provide links outside conference</td>
</tr>
</tbody>
</table>

Table F: A Five Stage Model for Teaching and Learning Online, Salmon (2002)

Susman and Evered (1978) are a key reference in action research. Their theoretical review will be looked at. The authors wrote ‘An Assessment of the Scientific Merits of Action Research’ in 1978, facing dissatisfaction with claims from positivist science. In particular, the authors identify the following shortcomings of positivist research:
1. treating persons as objects of inquiry, which is too individualistic;
2. - ignoring the role of history in the generalisation of knowledge, thus forgetting the importance of history to help solve problems;
3. - A system is defined only to the extent that a denotative language, e.g. science or maths, exists to describe it.

3.3.2 Action Research, Positivist and Phenomenological Approaches

In highlighting the positivist deficiencies of action research, Susman and Evered (ibid) state that the criteria for judging the scientific legitimacy for action research should be based on its philosophical foundations. With more traditional positivist approaches the researcher’s task it to be objectively detached from the object of their enquiry, so as not to bias results. While this may be appropriate for laboratory studies, in social systems that the researcher is involved with and wants to change, it is naive to think that one could be free of bias. Also social situations are complex and typically involve an array of different and sometimes competing influences, so if we want to effect change, a more flexible and responsive approach is needed.

This thesis argues that one of the most useful philosophical underpinnings for action research is the work of Jurgen Habermas. Habermas (1992) stresses the importance of dialogue in determining how social change ought to proceed. The act of engaging in discussion presupposes, and so provides the grounding for, what he sees as a universal principle – that everyone should be accorded equal respect. Opening channels of communication, in a way that respects all participants’ perspectives, is, therefore, a founding principle for action research. As Susman and Evered (1978) argue, it is important to develop the theory-led capacity of Action Research to generate knowledge for solving problems, and this constructs it as scientific in a way more suited to social situations than simple positivism allows.

3.3.3 An Overview of Methods Selected for this Action Research Project

Schostak (2006), in Interviewing and Representation in Qualitative Research asks if action is desirable or unavoidable, and poses the following action research questions when one employs methods (p. 46):

- What are the points of difference which manifest themselves to create one decision over another or alternative forms of action?
- How are decisions supposed to be made?
• How are actions supposed to be implemented?
• What are consequences of actions of action researcher?

In employing various methods, one should have these questions in mind.

Hence this action research is informed by Habermas’s insights into communicative ethics, and the importance of ongoing collaboration and discussion. What are the outcomes from pursuing an action research framework? Research findings are not so much the produce of observational coding of all the findings, focussing more specifically on particular issues.

To conclude this section; lots of methods or instruments were tried out in an action research methodology. Lecturers will be interviewed to get a sense of potential for NM & NT. A questionnaire will be used to plan whether students want to use NM & NT for learning D and T education. To assess whether stakeholders use NM & NT, an Internet- based study using the ICT/ Media content analysis method will be used. Reasons for why particular methods were chosen are in Chapter 2, Research Methodology. An action research methodology was adapted to help to explore the potential for NM & NT in D and T education. A new approach for how to use action research was developed in Chapter 2 Research Methodology, which describes the structure of this research.

3.4 Research Methods and Methodology

This section provides an overview of research methodology and research methods. Research methodology should provide theory and methods for how to answer the research question. Methodology is distinguished from method in that it is the study of method, and the reasons underlying the approach used in the research. To distinguish, methods are, on the other hand, the techniques and tools by which research information is gathered.

3.4.1 Investigating Different Research Methodologies

Methodology is the principles upon which you select our research methods. Ensuring that the research question can be answered through the most appropriate methodology is crucial. This relates to the theory one starts off with on a research topic, (or in the case of grounded theory ends up with!). More phenomenological research methodology can focus at micro levels on what people are doing and saying to build up a corpus of data to answer a research question.
Research can follow a fixed or flexible research design, depending on the methodology adopted. A fixed form of research design has a heavy pre-specification on what you are going to try to find out. Flexible research designs are where the issues are not so clear cut; generally employing qualitative research methods. Different methodologies include:

Scientific Research: The scientific method seeks to attain facts through a causal relationship of variables. It can be useful where we have a working hypothesis and the ability to control variables. It can be applied in the disciplines of science, the arts and social science.

Social Sciences Research: Scientific and academic research on humans, human society and social groups. Example fields of knowledge in this discipline are psychology, and sociology.

Practice Based Research: Often undertaken by clinicians in hospitals, researching health care processes in action, but also occurs in D and T undergraduate education (REF Norman).

Design Research: Archer (1981) states that Design Research is “systematic enquiry whose goal is knowledge of, or in the embodiment of configuration, composition, structure purpose, value, and meaning in man – made things and systems”.

Action Research: Rapoport's definition of action research is “...to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework” (Rapoport: 1970, p. 499). Action research is a systematic mode of enquiry which facilitates finding solutions to problems (Stringer, 2007). Action research uses research through data collecting techniques to justify action or change within a particular context or organisation.

3.4.2 Overview of Different Research Methods

Robson (1993) classifies three main methods used in research; case studies, experiments and surveys. In educational research, such as this project, the following methods have been identified:

- Experiments
- Ethnography
- History and Documentary Research
- Surveys and Questionnaires
- Internet Based Studies:
- Case Studies:
- Observational research
- Interview and Focus Groups
- Personal Constructs
Experiments: This method is part of the scientific methodology. Particularly using the Random Control Trial method is considered the gold standard for social scientists (Oakley, 1996). An experiment has a developed hypothesis, and measures the casual relationship between variables. The results negate or prove a theory. Surveys are widely used in the scientific method also: They are statistical tools collecting quantitative data about a population. These two methods are a fixed form of research design as they have a heavy pre-specification on what you are going to try to find out. They have a conceptual framework of theory which guides what it is the researcher is trying to find out. They are generally quantitative data and statistics.

Ethnographic Research, Personal Accounts and other Naturalistic Data: In this methodology, researchers provide descriptive accounts of everyday interactions. Generally, these are first hand observations where the researcher records/notes what is going on.

Personal Constructs: Relies on a theory of the personality developed in 1955 by George Kelly, where the way individuals construct meanings can be studied. Educational research should be experimental. Attributing types of person is a very individualistic method, and can be dangerous in education, where it a person’s conceptions are fixed; it does not allow for development or difference.

Historical and Documentary Research: As a research method collects and collates this type of research document, performing data gathering, analysis, interpretation.

Surveys and Questionnaires: Surveys are methods which gather data at a particular point in time. Usually data gathered is from a representative sample of the population being researched.

Internet Based Studies: These can take the form of Internet surveys and Internet interviews. A method called ICT/ Media analysis (Taachi, Hearn and Slater, 2004), is an example of and internet based method where the authors reviewed the internet with women from India to increase their digital literacy.
Case Studies: These are qualitative reports, generally performing in-depth, (often longitudinal) examinations of a single instance, event, individual, group, or community.

Observational Research: This method can be structured, where researcher knows what they are looking for (this can be represented numerically) or semi-structured, where the researcher has a set of issues they are looking to elaborate on (tends to do qualitative analysis) or unstructured where the researcher does not know what they are looking for. Problems with observational data can include difficulties in measurement and sample sizes.

Interviews and Focus Groups: Interviews are generally between two people, the interviewer and the interviewee (or more people if a focus group) where questions are asked by the interviewer to obtain information from the interviewee. An interview schedule of questions is usually drafted relating to a research question and

Tests: A method for gathering quantitative data (usually). Tests can be parametric, applying to a wide population or non parametric, not applicable to the wider populace.

(Cohen, Manion and Morrison, 2000)

This research employs interviews, ICT/ Media Analysis, observational methods and questionnaires, and is thus a triangulation of methods. This can provide multiple perspectives, more holistic accounts of complex situations like exploring the potential for NM & NT in D and T education for all stakeholders.

Action research is investigated more fully to highlight its operation in research projects. Objective X specifically highlights that methodology will be more fully investigated. Thus this Appendix seeks to review some literature in relation to action research methodology, which will provide some insight into how this research project will develop.

3.5 Action Research Methodology as a Change Methodology

Action research as a dynamic research paradigm was adopted. To assess whether NM & NT does or does not improve knowledge and skills, requires study of specific teaching in the particular field, with the particular students (Hannafin and Minchi, 2003). Due to the cyclical
process of research, action research can provide research outcomes that have a high degree of relevance, and can address complexity of social and information systems well; this is especially true in educational research where reproducible, controlled experiments are often impossible, as we are dealing with real people living their lives in real-world settings. Action Research is thus good for holistic accounts of organisational issues. The cyclical nature of this type of research allows researchers to build on the knowledge from each of the different stakeholders whilst utilising the researchers own skills within this area.

3.5.1 Action Research in Use: Previous Examples

When Baskerville (ibid) applied the five cycle model in an organisation requiring changes to their IT infrastructure, this is how he went about it: Diagnosing the immediate problem; it initially was one of systems analysis in implementing a large database. So specifically, the issues for previous failure were in too large a set of data classes, the large volume of data, and the high degree of volatility in the organisational environment. Action planning involved prototyping a new database schema with participants through interview. Action Taking initiating rapid prototyping of the database, with participant involvement. Evaluation indicated mixed results; on the one hand the motivation by the parties to adopt the prototyping was achieved, but the scale of the technical side of the project was unachievable. Specifying learning, the successful and unsuccessful aspects resulted in reworking the model behind the design of the database.

What is the action research process which follows on from this? Dickens and Watkins (1999) describe a different four stage action research process;

1. Identifying the problem within a community;
2. Action researchers within community collect relevant data. Data sources might include interviewing, measurements, conducting surveys, or gathering any other information that the researchers consider informative.
3. Feeding data back to the organization, researchers identify the need for change, and the direction that that change might take. The feedback to the community may act as an intervention, or the action researchers may arrange for more structured actions that create changes within the system.
4. Generate possible solutions to the identified problem.

3.5.2 Different Types of Action Research
This section explores the different types of action research. This researcher wanted to know category of action research this project would. Table X identifies the different types of action research and the goals of the different types.

### Table X – Types of Action Research

<table>
<thead>
<tr>
<th>Action Research Type</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canonical</td>
<td>Follows and provides guidelines for conducting action as a method of inquiry</td>
</tr>
<tr>
<td>Diagnostic</td>
<td>Diagnose a problem in need of change, and to seek and find cures which are feasible</td>
</tr>
<tr>
<td>Participant</td>
<td>Participants are actively involved in the research</td>
</tr>
<tr>
<td>Empirical</td>
<td>goal is to use recurring experiences to gradually develop generally valid principles</td>
</tr>
<tr>
<td>Experimental</td>
<td>variety of techniques in identical situations are studied in a controlled way to determine their relative effectiveness</td>
</tr>
<tr>
<td>Technical</td>
<td>Effective practice developed ‘through the practical skill of the participants’ (Grundy, 1982, p. 357).</td>
</tr>
</tbody>
</table>

### 3.5.2.1 Canonical Action Research

Susman and Evereds’ (1978) approach can be known as “canonical” action research because it follows five cycles as guidelines. The authors highlight many different types of action research, which utilise different methods or approaches. The methods the authors focus on use face-to-face small groups or individuals, as the primary medium through which the problem situation may be changed (1978, p. 588).

Another example of canonical action research will provide different results/ findings, although still within the major goal of change. An example; Davison, Martinsons and Kock (2004) describe principles of Canonical Action Research which they adopted:

1. **Principle of Researcher- Client Agreement (RCA):** The RCA provides the basis for mutual commitment and role expectations.
2. **Principle of Cyclical Process Model (CPM):** The CPM consists of stages; diagnosing, action- planning, action- taking, evaluating, and specifying learning.
3. The Principle of Theory: Theory must play a central role in action research.

4. The Principle of Change through Action: Action and change are research tropes focused on producing change.

5. The Principle of Learning through Reflection: Considered reflection and learning allow a researcher to make both a practical and theoretical contribution.

3.5.2.2 Diagnostic Action Research

There are other different types of action research. Chein, Cook, and Harding (1948) use the term "diagnostic action research" when the researcher is involved only in collecting data for diagnosis and feeding the data back to the client-system. The authors use the term "empirical action research" when the researcher only evaluates the actions undertaken by the client system and feeds data back to it. They use the term "participant action research" when diagnosing and action planning are carried out in collaboration between researcher and client system. Finally, the authors refer to the term "experimental action research" when researcher and client system collaborate in all

3.5.2.3 Emancipatory Action Research

Another type of action research which influenced this project is "emancipatory" action research. Habermas (1974) provides a methodological basis for this research framework. Emancipatory action research is not so much a researching-of a community in the traditional "researcher as expert" model, but a researching-with paradigm in which mutual expertises are acknowledged by all research participants. It has been noted that this abandonment of the researcher as expert and participation of the researcher, leads the researcher to collect data in a manner that is akin to the ethnographic method (Baskerville and Pries-Heje: 1999) and tends to be in the first person.

3.5.2.4 Emancipatory, Technical and Practical Action Research

Recently, important authors such as Carr & Kemmis (1978) have used the ideas of Jurgen Habermas when describing three kinds of action research - technical, practical and emancipatory.

1. Technical Action Research (TAR): encourages more efficient and effective practice. Grundy (1982), the guiding principle behind this type of action research may not be
created by or engage the group, instead it only requires consent. The practitioner/researcher SKILL informs the action.

2. **Practical Action Research (PAR):** an outside researcher establishes cooperative relationships with teachers and helps them to articulate their concerns, to plan some action, and to evaluate its effects. For some, this is not appropriate action research as the professional researcher owns the theory or at least critical aspects of it.

3. **Emancipatory Action Research (EAR):** requires a self leading group of teachers accepting responsibility for its own emancipation of problems. It involves not only the transformation of individuals and the profession but ultimately a more far reaching transformation of the language, organisation and the practice of education. (McTaggart 19:27-30)

The key difference between TAR and PAR, EAR is the moments in the creation of measurement data to assess efficiency and effectiveness. The moments are not recorded thus in PAR and EAR.

**3.5.3 Differences between Action Research from Case Study Research**

Blitchfeldt and Andersen (2006), discuss the similarities and differences between case-study research (CSR) and action research (AR). They argue that action research can draw upon the case-study in order to improve its’ scientific acceptability. Differences of AR and CSR are:

- AR takes its problems from the practitioners and participants more
- AR answers a research question and fulfils a practical need
- Collaboration in AR means less control over processes and outcomes than with CSR
- Findings with CSR are directed at academic community whereas the AR findings are more directed towards the beneficiaries
- The most significant difference is that action researchers do not declare and discuss an intellectual framework of ideas from the outset. Apparently, it is this which makes it difficult to position itself as a viable form of scientific research (Kock, MacQueen and Scott, 1997).

Thus to ensure similar transparency which exists in CSR, AR should discuss a framework of ideas and analytical generalisation of findings. Also AR has to solve actual problems and
generating research outcomes. Thus they conclude four ways action research could learn from CSR; though transparency, a prior theoretical framework, transferability of research and defining appropriate forms of accumulation of results.

3.5.3.1 Similarities between Action Research and Design Research
Scenarios inform appropriate design of NM & NT for learning objectives. This research methodology included an element of design in creating the learning resources. This design component is not incompatible with action research (Buchanan, 2001). Also, Cole, Purao, Rossi and Sein (2005), argue that combining two research methods - “action research” and “design research” - can cure Information Science research of being irrelevant. The authors highlight the similarities between them, arguing for ways to assist cross-fertilisation between the two approaches. They apply action research criteria developed by Davison, Martinsons and Kock (2004) to an exemplar design research paper, and applied the criterion developed by Hevner et al., (2004) to an exemplar AR paper. They conclude that they have revealed how similar design research and action research both are in their process models. This research supports this; it has an element of action research in trying out case studies with students. Yet it has elements of design research, designing ways to use NM & NT for D and T education; - as no prior examples on how to create Vodcasts for D and T education exist to guide the research.

3.6 Extending Susman and Evereds 5 Cycles of Action Research Methodology
So to illustrate this innovative methodology, for example, DIAGNOSING was the first step; within this step the following stages were carried out:

1. Diagnosing the research problem, the stakeholders and the area for the research.
2. Action Planning; how the research question was to be tackled; deciding on action research.
3. Action Taking; identifying the research gap, reviewing literature, attending seminars.
4. Evaluating existing NM & NT: which might be useful and why
5. Specifying learning: Summarising issues which inform the next stage

Similarly with the action planning stage and subsequent stages, the five cycles occurred within this cycle.
The double helix model in action research is not a new model. However, this research extends the model by Pete and Fregona (2004), providing a diagram with a set of tasks accomplished in the research. So at each individual Cycle phase, the five stage process was adopted to help make decisions about what would be appropriate.

Dick (2000) uses the double helix metaphor to describe the intertwining of research and action in an action research project. Pete & Fregona (2004) also use the metaphor of a double helix in their research, so it is not a completely new idea. They describe their double helix model as two recurring, cyclical strands, namely reflective and participatory action research. These are intertwined. Participants use action research methods to reflect on the process of problem-solving and re-curriculation.

In creating and facilitating online courses, lecturers plan, act, observe, reflect and report on/share the process. This is done in online journals. Participants give each other constructive feedback on these reflections. The journal entries eventually result in action research papers which are published online for the community launch, which heralds the end of one cycle, and the beginning of another. Graduating” participants present their papers and demonstrate their online courses to new members. On a macro-level, participatory action research is employed when participants give regular feedback about the development of the community and the design of the project.

Hannon (2004) in Quality Management in Education shows how the metaphor of the double helix was a useful research methodology for teaching science and the promotion of disability awareness within her curriculum. Figure X shows how the author used the double helix metaphor to inform a visual representation of her action research project.
Hughes (2000) also uses the notion of a double helix metaphor to describe working as part of a team and having individual reflection to guide the research. Author mentions the double helix metaphor in relation to observation by researchers using standardised methods of data collection as part of a team and reflection which is done as an individual;

Through his research into Aboriginal culture and Indigenous Community Action, he makes reference to the double helix as a model for understanding a less individualistic approach to research. He asserts that the individualistic goals are not really present in the aboriginal concept of the “dreaming”, and Indigenous Community Action more generally.

“So the process of action research is a mirror image of Indigenous Community Action. This could be represented as an opposite dynamic, representing movement in the opposite direction. A diagram would contain two intertwining spirals, like a double helix”.

He makes a comparison where the spirals in the double helix are actually moving in opposing directions; this symbolises the individualistic mode of reflection against the channel current of the Indigenous Community Action.
1. Beneficially Accommodated the Subject Area: This model was more better than the other approaches, it provided a clear way forward where the research question was broad and vague; i.e., to investigate the potential for new media and new technologies in design and technology education. The research question was vague as the area of new media and new technologies is forever changing. This model allowed a certain degree of flexibility AND guidance at the same time, where other models proved too vague or inflexible.

2. Provided a Clear Academic Framework: The model tied the research question to the aim of this research; to investigate the potential of new media and new technologies for D and T education and investigate whether these New Media applications are usable on a mobile device for learning tasks. So the aim was investigated through adopting the 5 cycle approach at every individual cycle. In this way the objectives were factored into the model at different parts of the cycle.

3. Extendable and Open-Ended: This double helix model could be used on a variety of different levels. “Planning and Reflecting” spirals or “Theory and Practice” Spirals. This model is open ended and thus can be useful to identify future learning scenarios for D and T education. It is asserted that using the 5 stage model also link theories of learning to practice allowed for futures forecasting: Through the identification of learning scenarios at the planning stage it was possible to map the latest technologies for ideas on how these new technologies could be used in a D and T context.

4. Recursive and thus Reflexive: You can go over your previous steps to inform at different stages. For example. if researcher wanted to know what were the worst things students thought about using new media and new technologies to make an evaluation, I would go back to 2C5 in the model and use the comments made by students in the questionnaire to evaluate the potential for new media and new technologies. This guided reflexivity by the researcher who did not have a great deal of previous experience with either teaching or new media and new technologies.

This section explores the relationship between action research and methods, where participants are often deciding methods. Baskerville (1999), uses the notion of Weltanschauung, (the structure of humankind perception as tailored by evaluation and ideals), to describe shared meanings between the researcher and the participant; this implies
that biases are not easily removed from the action research process. The ideographic approach of action research, (i.e. involving the study of individual cases or events) manifests in the use of participants as collaborators in the research. Due to the ideographic nature of the research, often qualitative data is the most suitable to obtain the “medium to empirics” (Baskerville, 1999, p.5) in this type of action research.

3.7 Validity in Research

This section identifies the nature of validity in research; what it is and how it is achieved.

What this research aims to achieve is to investigate the potential with for NM & NT in D and T education. How is potential validly explored? Validity applies to all different research methodologies and methods. There are many different types of validity in research. Validity in quantitative research checks that the instrument or tool used to gather the information does in fact measure accurately what it is researching. Validity in qualitative research can include the scope, depth, honesty and richness of the research (Cohen, Manion, & Morrison, 2000, p. 133).

Validity in qualitative research is related to triangulation, being a form of concurrent validity (the notion that data gathered using one instrument must correlate highly with data gathered from another instrument). To achieve validity Breen et al., (1998) also propose a triangulation of methods in order to collect data on learning technology. Using interview, questionnaire survey and observational data to facilitate change in design and technology education s a triangulation of methods which will achieve scope and depth highlighted as a requirement for validity. Also ICT/ Media Content Analysis method was adopted to analyse the scope for NM & NT in D and T undergraduate education.

3.7.1 Validity (or Understanding) in Action Research

It has been argued that validity in qualitative research should be repackaged as “understanding” (Cohen, Manion, & Morrison, 2000, p. 133). As action research is indeed more qualitative, then validity (or understanding) in research is achievable by ensuring data in produced in terms of the respondent and not the researcher. However one of the dangers of action research is that the researcher end up performing a job, as opposed to research. One of
the core issues with action research is its similarity to consultancy; however Baskerville (1999, p.12), highlights five key differences:

1. **Motivation**: Technically consulting is performed for profit, whilst action research for publications contributing to knowledge;

2. **Commitment**: Action research commits to a research community, whereas consulting is responsive to the client alone;

3. **Approach**: Action research requires collaboration with stakeholders, whereas consulting relies on outsiders to provide objective information;

4. **Foundation for Recommendations**: Action research’s’ foundation is a theoretical framework, but consulting involves the provision of solutions which worked previously in similar situations;

5. **Essence or organisational understanding**: In action research, this understanding is derived from practical review of changes implemented within the organisation, whereas in consulting the approach to the problem is from an independent critical viewpoint.

The danger in any action research project is that the researcher is in effect performing work responsibilities which conflict with the nature of research, and do not further an academic community.

Thus, to keep action research from descending into work practice, McKay & Marshall (2000), suggest a four point framework to improve the rigour and quality of action research, specifically in information science involving:

1. **Credibility**: match between the representations constructed by participants and those attributed to the participants by the researcher;

2. **Transferability**: Occurs first through an explicit theoretical framework to explain and interpret the outcomes of actions in a problem situation. Secondly, transferability is likely to increase the more iterations of the action research cycle performed. Thirdly, ensuring a triangulation of methods (similar to what Breen et al., call for); using multiple cases, multiple participants and/or multiple data collection techniques are all likely to increase the transferability of the action research findings

3. **Dependability**: of research is confirmed in the ability to track a transparent process or a decision trail and;

4. “**Confirmability”** (p.6): requires that research data can be traced back to its’ source.
Attainment of these four desirables is within a framework conduct of research, practical and conceptual significance and in the presentation of the research.

Thus validity or understanding in an action research project will be achieved by trying out a number of different methods. It is important ethically that the action researcher is not fulfilling work practices, instead of contributing to research. Validity can ensure the research rigour in an action research project through applied concepts of “credibility, transferability, dependability and confirmability”, (McKay and Marshall, ibid).

### 3.8 Conclusion

This section concludes Part 1 of the Literature Review, which has explored the theory and methodology in research.

Part 1 began by exploring essential terms within the D and T education research field. Theories relevant to this research provide the research with a basis for exploring the potential for NM & NT in D and T undergraduate education. A suitable methodology was adopted to answer the research question; Action Research. Action research acknowledges the complexity of research problems by allowing the research to progress within a series of cycles. This allows the research to mature while it is possible that the problem, variables, hypotheses, and methods may undergo modification as interim results are validated or invalidated. Action research acknowledges the reality of a complex relationship between cause and effect by having the element of “reflection” in each action research cycle to reflect on what emerged in a specific cycle, which then stimulates the “planning” element of the next cycle.
APPENDIX II THEORETICAL INVESTIGATIONS

1.0 Introduction

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1.1.2 EDUCATION THEORY AND TYPES OF LEARNING
1.1.3 EDUCATION THEORY AND MOBILE LEARNING

1.2 THEORETICAL TURNS GUIDING THIS RESEARCH
1.2.1 THEORETICAL TURNS IN DESIGN AND TECHNOLOGY EDUCATION
1.2.2 EDUCATION THEORY AND DESIGN AND TECHNOLOGY EDUCATION
1.2.3 CONCLUSION

1.3 DIFFERENT TYPES OF THEORIES
1.3.1 BEHAVIOURAL THEORY
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   1.3.2.1 SOCIO COGNITIVISM
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1.7 CONCLUSION TO THEORETICAL RESEARCH IN THIS PROJECT
1.0 Introduction

The story of learning theory moves from educational psychological views of mind to ones based more on learners and learning processes. Objective X of this research commits to investigating theoretical issues around this area of research. This theoretical review contains theories from a technological and pedagogical perspective. This appendix introduces theory to this research, and the following become important to how learning is done and how it is researched:

- Distinction of quantitative and qualitative data
- Structuralism and post structuralism
- Macro/micro perspectives
- Interpretivism vs. Positivism
- Learning Theories

To distinguish theory can be applied to the way the research is constructed or the approach taken to how stakeholders learn in a pedagogical sense. The next section will identify the different type of theories.

3.5 Theory Concepts and the Nature of Research Knowledge

There is contrast between positivist and phenomenological accounts of how we obtain research evidence. Do we rely on the researchers “objective” data creating scientific “facts” or do we rely on the perceptions of students and lecturers in informing us on best practice for using NM & NT for their education? This research argues that phenomenological approaches can be of practical use for exploring the potential for NM NT for learning by providing concrete descriptions of in situ practices of learners. To enter into an ethnomethodological study involves backing off from predefined notions of what constitute ‘design’ and ‘education’ so that we can instead examine stakeholders’ practices from students’ displayed understandings. Hence the organisation of stakeholders’ practical actions and practical reasoning will be the focus for part of this study (see Chapter 8 and 9).

Theory can be either inductive or deductive; so for example, in experimental methodology a deductive approach would be applied, a theory about $x$ would lead a hypothesis to be tested, generating data on the truth or falsity of the hypothesis. This may then support, modify or
completely falsify the existing theory. This is an example of the scientific method. An example of an inductive theoretical approach is in grounded theory (Glaser and Straus, 1967). The data is gathered then coded, thematically analysed and then a theory emerges from the data – analysis is therefore ‘grounded’ in the issues arising for participants in the research. Other theory foundation topics covered in Appendix II:

- Distinction of quantitative and qualitative data
- Structuralism and post structuralism
- Macro/ micro perspectives
- Interpretivism vs positivism

Other important but opposite terms in for investigating theory in this research are positivism and phenomenology. Positivism claims that the only valid knowledge is scientific knowledge, whereas phenomenological accounts deal with first person accounts as data. Action research tends to favour the phenomenological (Susman and Evered, 1978). For example, in Chapter 8 and 9, this research will focus on phenomenological accounts of stakeholders using new media and new technology. These definitions formulate the types of research questions asked and the approach followed in answering them, for example, exploring the potential for new media and new technologies is from a first person account of the data collected and is therefore phenomenological.

3.5.1 Identifying Different Theories

Many theories were looked at throughout the course of this research. This section outlines them. Appendix II discusses how and why they were conceived to be relevant to D and T education and NM & NT. The previous section has sought to identify how research knowledge is formed: This list details the theories and the main protagonists of these theories;

- **Cognitivism and Socio- Cognitivism**: Hutchins (1995); Hjorland (2002).
- **New media theory**: - Lister, (2003); Hassan and Julian, (2006);
- **Education and Learning theories**: - Vygotsky (1978) and Piaget.(1967);
- **Constructivist theory & Social Constructivism**: Sharples, Corlett. & Westmancott, (2002); von Glaserfeld (1995);
- **Activity theory**: - Engestrom (1996);

Appendix II provides an overview of the different theories summarising what they are and how they would be relevant to this research in design and technology undergraduate education.

### 3.5.2 Educational Theory and Types of Learning

Theories on how people learn are derived from the models listed in the previous section. For example, the behaviourist would favour rote learning of materials. The socio-constructivist would attempt to foster collaborative learning through a group work approach. The table below defines the different types of learning:

<table>
<thead>
<tr>
<th>Learning Type</th>
<th>Definition of Learning Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal Learning</td>
<td>Learning which occurs incidentally, or not in an institution for that purpose.</td>
</tr>
<tr>
<td>Formal Learning</td>
<td>Planned learning derived from activities within a structured learning setting</td>
</tr>
<tr>
<td>Active Learning</td>
<td>Responsibility of learning rests with the learner – opposite of passive learning</td>
</tr>
<tr>
<td>Passive Learning</td>
<td>Learning is not central goal but occurs incidentally</td>
</tr>
<tr>
<td>E – learning</td>
<td>Or Electronic learning; Learning where technology, such as a computer mediates between the learning materials and the learner</td>
</tr>
<tr>
<td>M-Learning</td>
<td>Mobile learning uses mobile technology to mediate between learners and learner activities</td>
</tr>
<tr>
<td>Constructivist Learning</td>
<td>Learners learn differently and have different requirements, which should be attended to. Emphasises instructors role as facilitators</td>
</tr>
<tr>
<td>Cooperative learning</td>
<td>Processes which help people interact together in order to accomplish a specific goal or develop an end product which is usually content specific</td>
</tr>
<tr>
<td>Collaborative Learning</td>
<td>Consensus building through cooperation by group members, (in contrast to competition in which individuals beat other group members. In Computer Supported Collaborative learning (CSCL), computer mediates between humans, but this is still collaborative.</td>
</tr>
<tr>
<td>Lifelong Learning</td>
<td>Generally refers to adult education where informal and formal learning is supported</td>
</tr>
<tr>
<td>Socio-cognitivist learning</td>
<td>A learning theory, where people learn by watching what others do; human thought processes are central to understanding personality</td>
</tr>
<tr>
<td>Blended Learning</td>
<td>Combines different techniques and methods of learning together</td>
</tr>
</tbody>
</table>

**Table D: Theory and Types of Learning**

The difference between collaborative learning and cooperative learning is that the former is more student led, cooperative learning tends to be more teacher directed. Collaborative is more a philosophy whereas cooperative focuses on an end goal! There is the assumption of
the learner within scientific theory, through an information transmission model in which the learner as sender and receiver is individually controlled and thus observable. Hung (2001), proposes that instead of regarding the learning theories as conflicting, as human cognition is complex, there is a role for behaviourist, cognitivist, constructivist and social - constructivist models of learning based on the learning outcomes and context of learning.

3.5.3 Education Theory and Mobile Learning
Swan, Kratcoski, & van ‘t Hooft, (2007), argue teaching needs to be reconceptualised; boundaries of formal and informal learning need to be broken; and that the possibilities of mobile technology afford individual and collaborative learning. In a behaviourist learning theory only individual learning is the focus, learning is facilitated through the reinforcement of an association between a particular stimulus and a response (drill and feedback).

Thus, Naismith, Lonsdale, Vavoula & Sharples, (2004), call for a **blended approach** to enabling learning with **mobile** technologies because **successful learning objects use a number of different theories and practices**! The authors, on behalf of Futurelab research, conduct a literature review of mobile technologies and learning. The authors highlight different learning theories and describe examples in m-learning in the table below:

<table>
<thead>
<tr>
<th>THEORY</th>
<th>OPERATION OF THEORY IN LEARNER CONTEXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviourist</td>
<td>learning as a change in learners’ observable actions; such as with stimulus/ response modes</td>
</tr>
<tr>
<td>Constructivist</td>
<td>learners construct learning based on prior and current knowledge</td>
</tr>
<tr>
<td>Situated</td>
<td>learning occurs within an authentic context and culture; (examples include context-aware mobile applications in museums)</td>
</tr>
<tr>
<td>Collaborative</td>
<td>activities promoting learning through social interaction between students</td>
</tr>
<tr>
<td>Informal and lifelong</td>
<td>activities supporting learning outside a dedicated learning environment and formal curriculum</td>
</tr>
</tbody>
</table>

**Table E: Theory and Operation in a Learner Context**

As Clark (2002) notes, traditional education has paid little attention to the psychology of learning and most current methods of delivery still rely on "a supply-led, lecture and classroom-based model that flies in the face of the theory" (Clark, 2002, p.45). That is often due to the fact that, as Hung, (2001), notes, theories seem to be conflicting. Hung (2001) advocates’ application of four learning theories in different computer-mediated instructional
contexts. The learning theories are behaviourist, constructivist, social constructivist, and cognitivist. The author asserts that different kinds of computer-based tools draw on different types of theories.

3.5 Theoretical Turns Guiding This Research

This section investigates various theories, and analyses which is most suitable to this research.

New Media, new technologies, elearning and m-learning can cover a wide theoretical base, from traditional forms of scientific positivism and hypothetic-deductivism, to more the more textual approaches of social constructivism. Theory generally guides the adoption of appropriate methodology and methods. In an educational context, theory has an effect on which style of teaching and learning to adopt, and how to design effective teaching and learning resources. This research project adopts an eclectic approach employing different approaches for different research objectives throughout this research.

Within the social sciences, theory has taken many “turns”. It began with cognitivism and behaviourism, studies of the individual which can yield measurable data on mind and behaviour. The structuralist approach favoured social science research which revealed that social structures determine the position of various elements of society. Studies turned to structures as the tangible things that lie beneath the surface or the appearance of meaning. The notion of meaning as a socially constructed one grew in popularity with sociocognitivism. Studies of meaning turned to linguistic accounts of meaning. In an “action turn”, Reason and Torbet, (2002) describe a transformational science, based on action research.

3.5.1 Theoretical Turns in Design and Technology Education

Work by Dakers (2006) and Williams (2007) seeks to posit the area of D and T education within a theoretical framework. There are calls to repackage D and T education within a social-constructivist theoretical framework, but this requires a change of teacher behaviours and theories (Dow, 2006). So, the idea of rote-learning basic engineering theories still accords to behaviourist principles, in the sense that there is a right and wrong answer which can be “pushed” into an individual’s head.
Thus theory in education focuses on the best way practitioners can teach students a volume of information. Archer, Baynes and Roberts, (1992), call for a practitioner’s theory, although there appears no unified approach on what this is this within the action research literature. Questions on when theory is relevant in an action research project (i.e. after, during or before), is as unclear as the form that theory should take and how it should be applied.

Generally, there is consensus within the action research field that positivistic science-based theories cannot help with the notion of learning to design (Susman and Evered, 1978); this is perhaps due to design and technology work where a number of stakeholders are collaborating; there are too many intersecting variables to conduct hypothetico-deductive experiments on learning to design. Hence the main theoretical thrust comes from post-positivist, largely social-constructionist approaches, detailed in the following sections.

3.5.2 Education Theory and Design and Technology Education

Thus benefits of interactive media to support a social constructivist theory of learning design and technology education have been proposed. Ehiyazaryan, (2008), reports a study on interactive media in design and technology education. Surveying students, the major finding from evaluation pointed to the value of absence of authoritarian control in exploring the design context. Unencumbered by this role, the tutor could act as a scaffold in peer-group interactions to solve a design problem. The act of the interactive media mediating was useful to students’ levels of engagement. Results from D and T students within this research suggest this is a major benefit to NM & NT in D and T education. This research adopts a critical theory approach to pedagogy.

The other learning theories which resonate with D and T education include work by Kolb (1984) which draws on the work of Lewin (who coined the term action research), specifically in relation to point 4 below. Kolb posits a theory of experiential learning; it is within the realm of behaviourist approaches to the way people learn. There are four elements to Kolb's model of experiential learning
1. Concrete Observation
2. Observation and Experience
3. Forming Abstract Concepts
4. Testing in New Situations
To clarify on the operation of this main theory; *concrete observation* means looking at things as they are, without any change, in raw detail. To distinguish; *abstract conceptualization* means looking at things as concepts and ideas, after a degree of processing that turns the raw detail into an internal model. This model of learning is take place within a spiral learning cycle, where the learner can enter into the spiral at any point (see Figure 7 below):

![Figure 6: Kolb’s Model of Experiential Learning](image)

The implementation of experiential learning theory requires the following steps within the learning process identified above.

**STEP 1:** Action + Effect

**STEP 2:** Understand Effect

**STEP 3:** Understand Basic Principle

**STEP 4:** Application through Action in a New Situation

The notion of experiential learning, ties into the popular model of learning- by- doing as it emphasises the role of action in relation to the way in which learning occurs. Phil Race's model is based on the premise that the most effective form of learning is experiential learning - *learning by doing* (2005). Race, an educationalist, felt that most theories of learning were phrased from the viewpoint of educational psychologists, rather than the way in which the great majority of people learn. He therefore proposed a much simpler model of learning which practicing educators and trainers could better understand and apply, called “Ripple Theory” (2005). Basic features of this theory include need/ wanting, doing, digesting and feedback. Race’s theory is similar to Kolb’s theory of experiential learning; but instead of a
sequential process of the basic features, needs/wanting happening in a timeline, they intersect like ripples on a pond.

A key factor of experiential learning is the importance of receiving **feedback** on the success or otherwise of the learning process. The importance of reflecting on one's learning experience and developing a sense of 'ownership' - a process that he describes as **digesting**. He departs from Kolb in identifying a new, highly important element in the learning process, namely, the **internal motivation** that makes a person want to learn something in the first place. In keeping with his use of everyday terms rather than the language of professional psychologists, he describes this as **needing/wanting**. These, then, are the four basic elements that, in Race's opinion, constitute successful learning:

**Needing/Wanting** - motivation  
**Doing** - practice; trial and error  
**Feedback** - seeing the results; other people's reactions  
**Digesting** - making sense of it; gaining ownership.

Learning-by-doing is the method by which students learn design and technology education (Kimbell, 2005).

### 3.5.3 Conclusion

To conclude on research theory: Different new media types will draw on different theories; so for example, wikis rely on the wisdom all, rather than tutors as experts and thus can be regarded as socio-constructivist. This research will focus on humanistic, communication and socio-constructionist theories in implementing *NM & NT* as learning tools. This section has described the theoretical approaches relevant to this project; this includes learning theories on experiential learning.

Pragmatism and postmodernism can take into account the different stakeholder identities, and the role of power in an educational institution. Grounded theory can describe a method of deriving useful theories from the data. Activity theory relies on the art of creating the learning tools relevant to the context required. Education Theory is present in the design of the New Media or New Technology learning tools: It is also the method by which students learn about the process of design.

### 2.0 Types of Theories
The next section looks in depth at the following theories:

- Behaviourism (Skinner and Pavlov)
- Cognitivism and Socio-Cognitivism: Hutchins (Hjorland)

### 2.1 Behavioural Theory

This original theory promotes the view that learning is based on subconscious responses to stimuli. The work of Skinner and Pavlov were influential to this theory. Many educators have serious concerns about behaviourism.

### 2.2. Cognitivism and Socio-Cognitivism

Cognitive science is devoted to the study of information processing in human cognition, and includes varied approaches to the study of the human mind including the study of artificial intelligence and linguistics. It views the human mind as an information processor. Thus cognitive psychology focuses on "modes of knowing" - e.g. perceiving, imagining, conceiving, judging and reasoning. This type of study focuses on abstract reasoning and problem solving that are based on manipulation of:

1. Linguistic symbols (propositions) and;
2. Iconic symbols (Images)

![Figure X The Mind as an Information Processor (based on Shannon and Weavers Information Transmission Model 1949)](image)

This doctrine cognitive model assumes that what is in a person’s head can be objectively studied, and so would seek to elucidate the symbols above by systematic empirical manipulations and observations. Methods and theories of cognitivism are influenced by two different traditions, behaviourist methodology and experiment. Human machine interaction
uses cognitivism in the sense of a computer as a metaphor for human cognition (Kuper and Kuper, 1996).

2.2.1 Socio Cognitivism

Cognitivism assumes that if we can find out what is in someone’s head by psychological experiments, what is in an individual’s head can be measured. The socio-cognitive method derives from cognitive theory (Hjorland: 2002). Hjorland cites Noam Chomsky as one of the most influential contributors in the initial period of cognitive science, as Chomsky explicitly draws upon the cognitivist tradition of Rene Descartes. The most famous Cartesian phrase “I think therefore I am” is an epistemological slogan evidencing the Cartesian (and cognitivist!) view that we must look to what is going on in the individual’s head to “know” about people. The cognitivist view makes two assumptions which Hjorland highlights, namely:

- Methodological individualism,
- Connections between mental models and neural, innate structures in human beings (also known as rationalism).

Hjorland (ibid) states that in cognitive theory there is the assumption that mental structures or models can be made visible through psychological experiments. Hence the main problem in cognitive research is that other perspectives are not focused upon, because of these implied rationalistic assumptions. His central assertion is that “tools, concepts, meaning, information structures, information needs, and relevance criteria are shaped in discourse communities, for example, in scientific disciplines, which are parts of society’s division of labour”. (page ref)

Thus researchers instead must look to “discourse communities” in order to obtain data which will be of a more social nature; thus he uses the term socio-cognitive. He explains that “In this way socio-cognitive views in many respects turn the cognitive view upside down. They are interested in individual cognition, but approach this from the social context, not from the isolated mind or brain”. (p259).

Hjorland identifies the different layers that people may be working with information retrieval and states that users must have knowledge of all layers. Hjorland (ibid) concludes that the problems of information science and information retrieval are intrinsically based in positivist epistemology: the basis, origin and nature of knowledge. So the cognitivist view of knowledge: the idea of the mind as a computer which processes information is flawed because it ignores the social construction element of knowledge: that meaning and thus
knowledge is constructed socially within these discourse communities. We can’t simply have access to the internal workings of the human mind, and expect this to provide explanations for a person’s complex behaviour in a social world made up of many other competing variables.

2.2.2 Socio Cognitivism and Distributed Cognition

Other attempts to contemporise and take cognitivism out of the laboratory have been made by Hutchins, (1995) who develops a theory of distributed cognition. This framework asserts that cognitive process can occur with members and are not confined to individuals’ head. Distributed cognition has been utilised heavily to make sense of interactions in learning environments. Jonassen and Land, (1999), exploring theoretical concepts in learning environments, through introducing children and researchers to the Fifth Dimensions learning environment. The researchers are undergraduate students who are junior researchers conducting participant observation on the children and the game. The emphasis is on socially shared cognition or distributed cognition as a way of understanding and making sense of interactions within the learning environment.

Summary Points:
- Cognitivism looks inside minds, brains, as the object of discovery and the explanation for behaviour, and thus it is individualistic
- Cognitivism uses the hypothetico-deductive scientific method to extract mental models
- Cognitivism assumes that knowledge exists in a vacuum and provides objective understanding, therefore experiments can be used to assess knowledge
- Socio-cognitivism is a learning theory, where people learn by watching what others do; human thought processes are central to understanding personality

2.2.3 Relevance to this Action Research Project:

D & T education takes many students and attempts to teach them all how to use the tools they will need to design. Thus the process of imparting the information they need to become designers involves much technical knowledge which is best didactically served. Much of the educational approach is therefore based upon a cognitive model of the student, in that it favours teaching students via a lecturer – student model, and assumes the rational autonomy of the learner, and a lecturer who possesses cognitive knowledge imparting it to those who
don’t. It follows that the design of learning resources may inadvertently cater to the idea of a mind as an information processor, you get the knowledge into your head to be regurgitated at assessment stage, at the expense of more collaborative approaches. This in itself may entail a somewhat strategic approach among students, not conducive to creative engagement with course materials. An example of the socio-cognitive aspect comes into play when, for example, lecturers engage students in the learning process, or when the technicians in the D & T Department show the students how to operate the tools. These differences become yet more stark when we consider the constructivist approaches.

2.5 Activity Theory
Activity theory is closely associated with information technology and has roots in the work of Vygotsky (1978). It arose in the 20s and 30s to transcend the typical behaviourist and psychoanalytic accounts of the mind within that period. The fundamental premise involved unifying the notion of the human mind by analysing "activity". Thus with activity theory the activity is the unit of analysis. Scanlon, Jones & Waycott, (2005 discuss the future of research on mobile learning in informal science settings. The researchers found activity theory very useful for understanding informal learning and mobile learning for science education.

2.5.1 Activity Theory: A Theory for Technology
Traditional scientific methods have typically analysed context in interaction in a cognitive sense. Thus researchers take contextual factors, in a closed loop of information flow between the system and user and vice versa, then mapping, for example, task decomposition or information flow models, which thus slot into a theoretical framework (Kaptelinin et al., 1997). This approach is not without problems. However, it has been argued that this approach can be complemented by turning this process on its head and starting with theoretical framework - in this case through activity theory - then mapping this to the representations of design and evaluation (Kaptelinin et al., 1997). It is argued that activity theory offers us a powerful tool to model and understand the design of a mobile learning environment that is usable and contextual.

A brief digression into the nature of activity theory will reveal why this theory is now being used for CSCL (Kuuti, 1996), mobile learning (Uden, 2007), and the design of learning technology (Kaptelin et al., 1997). The unit of analysis with this theory is the activity. Rather than providing merely a research framework to analyse the structure of an activity, this theory
upsets the traditional research paradigm, which focuses on either the individual or the social, and the macro or the micro level. Instead, it links them, and provides some conceptual tools for application and analyses of them together, such as the notion of context. Engeström (1987) formulated the context of activity as a hierarchy or network of different parameters or elements that influence each other. Thus the activity context is a triangulation of mediation, the subject and the object (see Figure 1 below).

Table 1:

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<table>
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<tr>
<td>1</td>
<td><strong>Means and ends</strong>: assessing the amount the technology facilitates and constrains the realisation of users’ goals and measuring the role of technology in creating or resolving conflicts between different goals</td>
</tr>
<tr>
<td>2</td>
<td><strong>Social and physical aspects of the environment</strong>: Integration of designed/evaluated technology with requirements, tools, resources, and social rules of the context and environment.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Learning, cognition, and articulation</strong>: internal versus external components of activity and support of their mutual transformations with target technology.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Development</strong>: developmental transformation of the foregoing components as a whole.</td>
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![Diagram of Mediating Artefact](Image)
Table source from Kapetilin et al., 1997 (but definitions reworded slightly)

The checklist of Kapetilin and others (1999) relies especially on the activity theoretical principles of mediating tools. In activity theory, a tool mediates an activity, thereby connecting a human being not only to the world of objects – his or her physical surroundings – but also to other human beings. We will use these principles of activity theory to evaluate different ways to enrich computer-mediated learning.

Computer applications and websites mediate human activity in three different ways: as being a system, a tool or a medium (Bodker, 1991). A tool is transparent (i.e. not in focus) mediating the users shaping of some material. A medium is transparent in mediating the communicative relation between human beings. A system is not transparent to the user because the purpose of the system is placed outside of the use context.

2.5.2 Applying Activity Theory to this Research
Activity theory can provide a useful tool for looking at how technology mediates learning tools. Activity theory is especially useful to guide informal learning; for example, the RSS in Sustainable Design scenario uses more informal learning methods to ensure students are kept up-to-date with developments in this area and stops the students using dubious web sources from the web in their assessments.

3.0 New Approaches to Theory of Learning

- **Grounded Theory:** - Dick (2003), Glaser and Strauss (1967); Strauss and Corbin (1990)
- **Constructivist theory & Social Constructivism:** Piaget () and Vygotsky (), Sharples, Corlett. & Westmancott, (2002) and von Glaserfeld (1995)

3.1 Grounded Theory
Grounded theory (GT) is a research method where data is collected and coded. It is then thematically organised into concepts, and categories to derive a theory around a field of
study. There are many different types of grounded theory. The summary points for grounded theory:

- Researchers do not have theory worked out before they begin studying an unfamiliar area; theory is developed later on in the work. In the scientific method, theory usually informs the data collection process and not the other way round.
- There are four points of analysis, in order: CODES, CONCEPTS, CATEGORIES & THEORIES
- There was a split in grounded theory, Glaserian being more fluid and incorporating different types of data sets other than qualitative; and Strauss who applies a rigid coding approach and look for causal relationships in every finding.

Glaser and Strauss. (1967) discuss the elements of their own version of Grounded Theory:

- Not purely qualitative, researcher can use surveys too;
- Results of GT are not a reporting of facts but a set of probability statements about the relationship between concepts, or an integrated set of conceptual hypotheses developed from empirical data (Glaser, 1998).

Strauss and Corbin, (1990) develop their own version of Grounded Theory. They assert that too much searching for causes and mapping of categories creates a rigid research approach, which does not take into account different meanings and interpretations, within a potentially wide sphere of study. The method can focus so heavily on mapping categories and relationships it misses the point of the data collection. If the action researcher is faced with a dilemma of whether to act on data or people, to use the data over decisions of external stakeholders to the action research project, would be insensitive to the environment.

**3.1.1 Grounded Theory and Action Research**

Dick (2003) explores what useful aspects action research can extract from grounded theory. He notes some differences; First, Grounded Theory is more observational, and not so participative. Second, action research makes assumptions that it is OK to intervene in an environment. Crucial similarities between AR and GT are; first, they are both emergent qualities, in that understanding are shaped slowly. Secondly, they both involve an iterative process. Dick (ibid) makes reference to the double helix of action and research.
The timing of when theory emerges is the fundamental difference between grounded theory and the hypothetico-deductive model. The differences are epistemological (i.e. related to theories of knowledge - how we know what we know) and ontological (i.e. related to theories about the fundamental material nature of things). This in turn has implications for the kinds of questions asked, e.g. is knowledge something in the head which can be put into the brain and objectively measured? Or is knowledge a socially produced thing? Knowledge in design and technology education can be based on scientific theories, (e.g. about the best materials for the job), but it can also be social (e.g fostering a shared consensus on which design is aesthetically pleasing). Winograd and Flores (1986) illustrate the hermeneutical aspects in the social nature of knowledge. Hermeneutics refers to the theory of interpreting human actions and artifacts in a relativist manner. This emphasises shared meanings and understandings of the creator and interpreter as opposed to an objective realm of understanding.

3.1.2 Application of Grounded Theory to this Research
Grounded theory can offer a holistic way of analysing a qualitative corpus of data, in a way useful to the action researcher, allowing theory to emerge from data to help with the action research approach. In helping categorise data, it can help the action researcher develop theory from a position grounded in data as opposed to bias or intuition. It will therefore be a useful tool in the analysis of interview transcripts (chapter ?) and the video data (chapter ?) I’m wondering if you should put this in the methodology chapter too, with details about how you coded transcripts etc.

3.2 Constructivist and Social Constructivism
Piaget (1896 - 1980) established a cognitivist, yet constructivist account for learning. Social constructivism takes the view that categories of knowledge and reality are actively created by social relationships and interactions, there is no independent existence of forms. Social activity presupposes human beings inhabiting shared forms of life, and in the case of social construction, utilizing semiotic resources (meaning making and meaning signifying) with reference to social structures and institutions. These interactions also alter the way in which scientific results are interpreted. Vygotsky, (1896 - 1934) founder of a Russian school of psychology was one of the first writers to develop a theory that gave the role of language centre stage in the development of thought. These ideas are slowly making their way into methodological developments, and in particular into theories around NM & NT. In a development of these ideas, Muilenburg & Berge, (2000), describe a theoretical framework
for designing questions to provoke online discussion through a constructivist pedagogic theory. Data is gathered from an online discussion forum to enhance the theoretical approach, concluding that questioning is an efficient method of instructional delivery, in an online environment.

Relevance to this project: Also social -constructivist methods of engineering mobile devices for learning have proved groundbreaking areas of research (Sharples, Westamancott, 2002). This approach draws on the knowledge of users to create the artefact. It has been argued that the design of new media, such as blogs, wikis and discussion forums lends itself more to a social constructivist view of learning. Instead of the lecturer imparting knowledge via a curriculum, knowledge is socially constructed by the members within that new media environment. This might prove useful for learning in a D and T education context.

Action research seems socio-constructivist in its’ overall methodology, as it is a collaborative account of organisation practices. So, it aims to foster an environment in which all the stakeholders, technicians, lecturers and learners actively construct learning based on prior and current knowledge. The challenge will be to apply this approach to NM & NT.

3.3 Critical Theory and New Media

Ethnomethodology is the study of people’s common sense methods for understanding and living their lives. It was developed by Harold Garfinkel (1967) and studies how people produce meaning and social order in their interactions, and how they communicate this to others around them. It emphasises the central role of language and interaction in how people construct and orient to social orders such as rules and roles. Traditional scientific research methods make assumptions on the nature or fact of social order, whereas ethnomethodologists are interested in how it is produced.

Manovich (2001) provides a theory of ‘new’ media as within the historical and grammatological perspective of the media cultures of the last few centuries. He uses this theory to display how new media is not that new because it relies upon similar features of old media, such as the rectangular/ square frame and the mobile camera. The author shows how new media works create and represent space in a similar way to ‘old’ media. He distinguishes categories unique to new media, such as the interface and the database. Another word for interface is boundary, and a database is a collection of components possessing a relationship
to one another. However there are new characteristics of new media that were not so prevalent in ‘old’ media. These have arisen through the attitudes and cultural practices of new Internet technologies for communication.

In *The New Media Theory Reader*, Hassan & Thomas attempts to create a theoretical start point that establishes new media as a discipline in its own right while also referring its connections to more established academic areas like cultural studies, economics, politics, history and law. Hassan and Julian, (2006), cover many articles on new media in society. Looking at the nature of technological change, they attempt to chart the new media landscape, covering issues such as monitoring and surveillance. Why is explicating the theoretical tropes of these authors an important endeavour for this research? Other authors use the theoretical work of Habermas and Foucault side by side, to argue for more explicit meta-theoretical debates for new media, specifically discussing power, reason and closure

### 3.3.1 Habermassian Critical Theory and Action research

The work of Jurgen Habermas (1929-) has been synonymous with the term the public sphere, as a communicative network of individuals in society. His *political theory* derives from his reconstructive discourse theory - this is the project of his book, *Between Facts and Norms*. He is attempting to rework our understanding of democracy by inscribing it within the theory of intersubjective communication. Habermas thinks that the relation between public and private is thus a complementary one. As he ironically says: "There can be no public sphere without a public" (p364). So we are thus, publicly and privately, always between the influence of norms and the reconstruction of facts.

Habermassian theories have been used in action research particularly "emancipatory" action research. Habermas (1974) provides a theoretical basis for this research framework (see Section 1.5.6 for theoretical discussions of Habermassian technology above). Emancipatory action research is not so much a researching-of a community in the traditional "researcher as expert" model, but a researching-with paradigm in which mutual expertises are acknowledged by all research participants.

### 3.3.2 Postmodern Critical Theory and Technology

Similarities in the work of Foucault relate to the use of analysis of discourse as action in contemporary society. Michel Foucault (1926 - 1984) is perhaps most recognised for the way
power operates in institutions, however his work is considered as poststructuralist; that is to look beyond structures to find out how power gets played out in society. So, Habermas focuses on the emancipator, "normative principles", which can be drawn from the modernist project and Foucault focuses on "mapping" the disciplinary mechanisms at work in modern society. Rhole (2005) marries the work of Habermas and Foucault in such a way as to highlight their fundamental differences in their conception of the Enlightenment as inscribed through concepts such as power, closure and reason. Rhole (ibid) thus argues that it is necessary to look at the underpinnings of the theories in the field as opposed to mere application of them. Thus, it is argued that, as technology rapidly progresses, new applications of the theoretical work of those introducing new and relevant interpretations can

Work by Habermas, Derrida and Foucault can help to map out interaction between new media, democracy and the public - and thus give insights for future directions of technology and the public. Arnold (2005), argues that certain principle of these authors theories can aid system design. Habermassian notions of "Ideal speech"; and Foucault's development of "power/ knowledge" and "discipline" confirms that social theory is able to offer systems designers concrete recommendations to guide their work.

Jacques Derrida (1920 - 2004) is a philosopher best known for his conception of the deconstruction, which opens a text up for many interpretations. Thus, these theorists will provide analyses on new media technologies from the perspective of Foucault, Derrida and Habermas. Advances in how the public and technology interact have changed drastically with the impact of New Media. The concept of New Media encompasses the cultural practices which have arisen around Internet technologies, such as online chat rooms, Wikis, weblogs (or blogs), instant message chat, email and software for communication. The change in the "entire public and private space of humanity” (ibid) is evidenced at the level of Internet architecture.

Theories of teaching and learning are about communication and therefore communication theory should form part of this research. With the advent of the Internet as a learning technology, notions of what communication is have evolved significantly from language and speech as the mere transmission of messages. Following the structuralist tradition he inherits, Saussure (1983) argues that the ‘sign’ is the element or unit of language to be studied. Saussure anticipated a science that could study the role of signs as they occurred in social life.
that he called *semiology*. Under Barthes (1967), *semiology* is the study of non-linguistic phenomena *as* a type of language. Thus, Derrida has extended the notion of communication as a system of signs further, particularly with reference to email. Thus, telecommunication disturbs our sense of ‘public’ and ‘private’ space: And so “electronic mail today, even more than the fax, is on the way to transforming the entire public and private space of humanity; and first of the entire limit between the private, the secret (private or public), and the public or the phenomenal” (Derrida, 1994; p.56).

The Internet is made up of thousands of interconnected computers. One of the ways the Internet has changed the entire public and private space of humanity is in the possibility for tracking and recording of all communication on the Internet. Not only that, but with the introduction of mobile devices comes the ability to pinpoint exactly where a person is in the world. These features have the metaphoric effect akin to Foucault’s notion of the “Panopticon”, where the architecture of this 19th Century prison (a central watchtower where the inhabitants of cells at any point cannot know whether they are being watched or not) is used as a metaphor for disciplinary power and “the gaze” in society. Foucault highlights the use of "technologies" as the machineries of power over the body starting with the schools, the barracks, the hospital and the asylum.

### 3.3.3 Critical Theory, New Media and Elearning

Feje & Nicoll (2008) performs an examination of e-learning as it applies to universities as sites of disciplinary practices. In particular she highlights the modernist narrative accompanying the discourse of e-learning, In particular the benefits of “e –learning” is *autonomy*. The notion of autonomy as self-conditioning the self, ties into disciplinary power. It is helpful in examining critically what is going on in education at the present time.

“Bildung, the notion policies and practices of education to develop self reflexivity, learning as self autonomy and critique as an emancipation. Foucauldian notions applied to this research would not blindly follow this interpretation, trying instead to upset the notion autonomy as a naturally positive power producing outcome. Autonomy regarded unquestionably as a good thing”

Bildung ties into Habbermassian notions of learning as emancipatory, in chapter 13 examines e-learning from 3 standpoints.
1. University as the means for the constitution of knowledge and different allocation of that knowledge to groups in society;
2. Education as the instrument of access to a particular discourse;
3. Teacher as a repertoire of predispositions and ways of doing things;

Discourse of e-learning confines subjects by the architecture of it. An e-learning space is a place where meaning is constructed, first meaning is characterised by the designer who designed the environment and then learner; so maps of meaning are drawn up as course materials and their virtual connections in a web of locations (p. 170).

And so for Baudrillard, the abundance of information and the causal effect of the dissolution of meaning express itself in the term “hyperreality”. Dakers (2006) posing the question is D & T education really real? uses the notion of hyperreality to challenge the widely held view that D & T education is a vocational as opposed to an academic pursuit. In his article he points out an example of substituting the "signs of the real" for the "real" in the Design and Technology Associations’ collaboration with Sainsbury, providing the public with virtual tours on websites of the in-store bakery.

Stringer (2007) in Action Research states that postmodernism focuses on deconstructing mechanisms of knowledge production. His view is that focussing on postmodernism allows understanding of the frustrations of the practitioner as they work in organisational contexts. He cites Foucault and the systems of knowledge – discourses – situated in organisation settings, such as the school, and academic fields. Foucault believes that to “develop action, thought, desires by proliferation, juxtaposition and disjunction and “to prefer what is positive and multiple, difference over uniformity...” (p.197).

For example, the participant observation case study (section x) taught this researcher how to teach new media better, and how this particular form of new media could be taught within the context of D and T education. This insight has been communicated to colleagues in the Dept of D & T via talks, informal feedback, and email. The following priorities are identified from the literary investigation into theory in this field:

- Flexible, adaptive approach to research
- Orientated to what stakeholders say, not what can be assumed
- Justification for action and change
Different ways individuals are affected by media and new technologies

- Reflexive

To incorporate both theory and practice and the changing set of priorities which arose in this research required a flexible, recursive methodology – i.e. Action Research.

This latter approach was adopted as a way of moving away from this researcher’s own post hoc judgements about their competence and those assumed in the literature review. Researcher reflexivity cues the researcher in to their own assumptions and biases. It is hoped that by increasing the breadth of approaches to data collection in this thesis, will put this researcher in a position to gain a deeper understanding of the issues that D&T students and lecturers face when confronting the challenges of new media. This researcher responded to the values of the stakeholders even where they seemed contradictory. In particular, the postmodern perspective responds to needs as they change through the department. It is argued that the flexible, reflexive nature of action research is suited to postmodern theories. “[T]he postmodern perspective asks us to ‘deconstruct’ and ‘transgress’ beyond our taken for granted assumptions, strategies, and habits” (Reason & Bradbury: 2007, p.4.). It is through the theoretical perspectives reviewed in this research, that the design of the research methodology follows suit.

Summary Points and Relevance for research project: Theoretical research here can provide some issues associated with the implementation of new media which give rise to some interesting further questions:

- Will students feel that with using new media, there is too much monitoring of the communication?
- Will using new media for learning D & T create much more information?
- How will new media and mobile technology change communication practices within the department, and what is the effect of this?
- Does using NM & NT fit with student identities?
4.0 Relevant Learning Theorists

This section provides an overview of relevant learning theorists and their theories.

4.1 Maslow’s Hierarchy of Needs

In Maslow’s hierarchy of need theory, the act of learning has to do with individual needs. Too often, formal education is conceived in terms of what groups of students’ need, as opposed to what may be helpful to each individual. Generally, before any of the other domains can be addressed by teachers, individuals' needs must be met. Usually, students' motivation to learn depends on attention to these needs. Like Blooms hierarchy of domains of learning, Maslow distinguishes different levels.

Figure X from http://www.learning-theories.com/maslows-hierarchy-of-needs.html
4.2 Bloom’s Domains of Learning

Blooms research on domains of learning (called usually Blooms taxonomy) focuses on the objectives that educators set for students. It is a behavioural approach which has various forms and levels of knowledge. There are three domains of learning, affective, psychomotor and cognitive, each organised into different levels. It is not possible to move to higher levels until the lower levels have been achieved. The affective domain is associated with values and looks like this:

![Affective domain diagram]

Figure X: From http://www.learningandteaching.info/learning/bloomtax.htm

The psychomotor approach focuses on the role of imitation in appropriating skills. Bloom never quite got round to finishing this domain of learning. Dave (1975) recorded a way forward with this domain, which has the levels identified in Figure X below:
Finally the cognitive domain of learning tends to be the most used in higher education to inform the levels of learning outcomes for modules in higher education programmes. The use of Blooms taxonomy enables the creator of learning objects to develop learning outcomes different layers of knowledge, evaluation versus rote learning. So this enables the educator to distinguish between types of knowledge in different years of study, the assumption is that it would not be good learning to have the same TYPE of learning done at earlier stages, and that learning should progress to higher levels.

4.3 Knowles Andragogy
Andragogy makes the assumption that the way that adult learners and minors learn is different. Knowles' learning theory of androgogy was developed specifically for adult learning. To distinguish adults and minors, this theory assumes that adults are more self-directed and expected to take responsibility for their own learning outcomes. Adult learning programs, especially in Universities must accommodate this fundamental aspect.
Andragogy makes the following claims to approaching the design of learning:
(1) Adults need a rationale for why they need to learn something;
(2) Experiential learning is how adults learn best;
(3) To adults, learning is problem-solving, and;
(4) Adults learn best when the topic is of immediate value.
Andragogy equates to instruction for adults needs, which focus more on the process and less on the content being taught. A critique; it very much depends on the type of subject being taught. Teaching computing subjects often require rote processes, there is no margin for error and there tends to be a right or wrong answer. Inexperience at scaffolding the type of learning required, and a desire for all the

In applying the theory, Knowles (1984) provides an example of applying andragogy principles to the design of personal computer training:
1. There is a need to explain why specific things are being taught (e.g., certain commands, functions, operations, etc.)
2. Instruction should be task-oriented instead of memorisation -- learning activities should be in the context of common tasks to be performed.
3. Instruction should take into account the wide range of different backgrounds of learners; learning materials and activities should allow for different levels/types of previous experience with computers.
4. Since adults are self-directed, instruction should allow learners to discover things for themselves, providing guidance and help when mistakes are made.

4.4 Phil Race Ripple Theory
Phil Race, an educationalist, felt that most theories of learning were phrased from the viewpoint of educational psychologists, rather than the way in which the great majority of people learn. He therefore proposed a much simpler model of learning which practicing educators and trainers could better understand and apply, called Ripple Theory. Basic features of this theory include need/wanting, doing, digesting and feedback. Phil Race's theory is similar to Kolb’s theory of experiential learning; BUT instead of a sequential process of the basic features, needs/wanting happening in a timeline, they intersect like ripples on a pond, hence the name “ripple theory”.

Race's model is based on the premise that the most effective form of learning is experiential learning - learning by doing. A key factor of experiential learning is the importance of receiving feedback on the success or otherwise of the learning process. The importance of reflecting on one's learning experience and developing a sense of 'ownership' - a process that he describes as digesting. He departs from Kolb in identifying a new, highly important element in the learning process, namely, the internal motivation that makes a person want to learn something in the first place. In keeping with his use of everyday terms rather than the language of professional psychologists, he describes this as needing/wanting.
These, then, are the four basic elements that, in Race's opinion, constitute successful learning:

**Needing/Wanting** - motivation

**Doing** - practice; trial and error

**Feedback** - seeing the results; other people's reactions

**Digesting** - making sense of it; gaining ownership.

Race's model of learning is similar to that of Kolb in that it is based on experiential learning and that it is dynamic in nature, but differs from that of Kolb in that its various elements are not regarded as constituting a sequential cycle. Rather, they are regarded as constituting an integrated, interacting 'whole' - to use Race's words, "rather like intersecting systems of ripples on a pond". His model is shown in schematic form in Figure 4.

### 4.5 Kolb’s Theory of Experiential Learning

Kolb posits a theory of experiential learning; it is within the realm of behaviourist approaches to the way people learn. There are four elements to Kolb's model of experiential learning

1. Concrete Observation
2. Observation and Experience
3. Forming Abstract Concepts
4. Testing in New Situations

To clarify on the operation of this main theory; *concrete observation* means looking at things as they are, without any change, in raw detail. To distinguish; *abstract conceptualization* means looking at things as concepts and ideas, after a degree of processing that turns the raw detail into an internal model. This model of learning is take place within a spiral learning cycle, where the learner can enter into the spiral at any point (see Figure X below):
The implementation of experiential learning theory requires the following steps within the learning process identified above.

**STEP 1:** Action + Effect

**STEP 2:** Understand Effect

**STEP 3:** Understand Basic Principle

**STEP 4:** Application through ACTION in a New Situation

Kolb’s theory has been critiqued on two grounds

1. Too Individualistic: – focuses on the individual as the source of learning, ignoring socially constructed aspects.

2. Too Simplistic: - Some question how well the model matches the reality of how people actually learn through experience.

If a learning model is possible, what follows from this is some way of codifying learner styles. Learning styles are unpopular as they can be a little rigid in application, and different learning outcomes may require different learning styles based on the


### 5.0 Action Research Examples Containing Theory

The next section investigates some current research examples where theory informs the action research. This section will highlight some action research which uses theory to inform the research, to assist this researcher in doing the same. Action research often employs *interpretivism*. Interpretivism is For example, Olesen & Myers, (1999), describe an interpretivist action research project in Information Science. The underlying theory for this research is *interpretivist*, so predefined dependent and independent variables are not created, but research knowledge arises on the complexity of human sense-making as the situation emerges. Their research describes an action research project which failed, and their research highlights some of the difficulties with action researchers who face resistance to change and restrictions out with their control.

Reason and Torbert (2001) call for an action turn similar to the linguistic turn in social sciences. The linguistic turn relies on postmodern, interpretivist perspectives over positivistic appeal to truth and knowledge formation of science. They argue that this turn should create a transformational science which needs to “integrate first- second- and third-person voices in
ways that increase the validity of the knowledge we use in our moment-to-moment living, that increase the effectiveness of our actions in real-time” (p.45). Thus, Action Research orients towards “change” in a particular context (Baskerville & Pries-Heje; 1999). The historical development of action research has had 'change' as it’s’ goal since it was first used by Lewin (1947). Action research tends to use participatory methods in its approach to research.

The authors above (ibid) offer criteria for measuring the legitimacy of methods of science appropriate to action research. Susman and Evered (ibid) highlight the five schools of philosophy which offer empirical accounts for scientific knowledge.

1. Formalist: form over content or meaning
2. Reconstructivist: break things down and redo them till they are perfect (both these affirm logic or maths to attain scientific knowledge
3. Pragmatic/ Pragmatacist: this could mean adopting different theories at different points in the research.
4. Anglo-linguistic: knowledge is formulated through English-speaking linguistic turns.

The small face-to-face group is the primary medium through which the problem situation may be changed, as well as in which the interests and ethics of the various parties to this process may be developed "within a mutually acceptable ethical framework."

They suggest that positivist approaches to science are deficient in the capacity to generate knowledge for use by members of organizations for solving the problems they face. Positivist Science shortcomings, as identified in this article are that:

- It treats people as objects of inquiry, instead of whole system
- It ignores the role of history in the generalisation of knowledge
- It system is defined only to the extent that a denotative language (e.g. science, maths etc) exists to describe it. However they argue that the capacity of Action Research to generate knowledge for solving problems equates to scientific knowledge of sorts.

Philosophical concepts of action research justifying its scientific legitimacy are thus:

- **Praxis:** art of acting upon the conditions one faces in order to change them based on good judgements.
- **Action Research as Hermeneutic circle**: in Hermeneutics no knowledge is possible without presuppositions, therefore Action Researcher understands their own preconceptions

- **Existentialism**: values human choice, human experience, where other types of philosophy are too abstract and logical.

- **Pragmatism**: the major proponent of thin educational

- **Phenomenology**: first person accounts as data

(Susman and Evered, 1978).

Dick (2000) proposed an action research methodology for extracting theory from data; this is based on a grounded theory approach. A way of proceeding is offered, explaining the link between finding the theory and the process of research:

- Any corpus of two datasets are compared and identified
- If datasets concur, evidence refuting them is looked for by conducting further data collection.
- If datasets disagree, explanations are sought for the disagreement.

To conclude this section has discovered different ways theory is used within an action research project.

### 3.6 Action Research’s Theoretical Starting Point

#### 3.3.1 Action Research’s Theoretical Starting Point

Due to its meta-theoretical application, Hearn and Foth (2004) argue action research is better because it does not take the “objective” observer position, coming from a different “epistemological stance” (ibid, p.5) than functionalist, interpretive and critical methodologies. There are other practical problems with this the scientific/empirical method; it has been argued that the scientific method:

"help[s] distance theory from action: the stripping of context from actions, dissociation of meaning from purpose, inapplicability of general data to individual cases, and exclusion of the discovery dimension in inquiry" (Hearn & Foth, 2004: p.3)
3.3.3 Action Research and Positivist Theory

Kock et al., cite a positivist critique of Action Research as possessing an ad-hoc approach, with a typically unplanned and informal structure (p.9). This is why some action research is viewed as “postmodern” (Stringer, 2007). However, they argue that the five cycles of diagnosing, action-planning, action-taking, evaluating and specifying learning is a process of building up model generality in Action Research. This can make action research more theoretically rigorous. They test out their multiple iterations model in a company in Brazil facing problems with the installation of IT services, such as the database and email.

What they found was, as the number of Action Research studies conducted on a similar topic grows, their resulting descriptive models can then be integrated into more general and predictive models, and eventually lead to "grand theories" (supra Strauss and Corbin, 1990). Kock et al., conclude that the multiple iterations of the five cycles could help with hypothesis creation and testing, and alleviate some of the criticisms which positivist levy at Action Researchers; those being contingency of research findings, low control of the environment and personal over-involvement.

6.0 Conclusion on Theoretical Investigation in the Research

The story of learning theory moves from educational psychological views of mind (Piaget, ) to ones based more on learners and learning processes (Kolb, 1984; and Race). Objective X of this research commits to investigating theoretical issues around this area of research. This theoretical review contains theories from a technological (see Lister, New Media Theory) and pedagogical perspective (Kolb: experiential learning). An attempt to analyse how these theories could be made relevant to design and technology education where made.
APPENDIX III Report on Attendance at "Beyond Distance Conference", University of Leicester, January 10th 2006

By Marian Hepburn

Full Conference title: Pushing the Boundaries: Setting the e-learning research agenda

Date Attended: January 10th 2006

Background

My research aims to incorporate aspects of Gillian Salmon's work into the methodology of my research on mobile learning. She is also at this stage extending her work on e-learning to m-learning and I was interested in how that was done. Having emailed her a couple of times she informed me of this conference. Attendance at this conference seemed vital to meet her and discuss the work she has been doing.

Aims of Conference Attendance

- Meeting leading researchers in the field of e-learning.
- Getting an overview of research work in this area.

Outcomes

- Insight into up-to-date research work being done by Gillian Salmon (academic, University of Leicester). Meeting her to discuss her work and my proposed work
- Insight into work on m-learning being done by Joint Information Systems Committee (JISC),
- Demonstrations of the work of Curtis Bonk (Keynote) a leading researcher in the area of e-learning, who demonstrated the application of e-learning in a variety of short case studies.
- The meeting of Rick Bennet founder of the Omnium Project "Online Creative and Education Communities". This is a collaborative investigation involving many universities from across the world to assess how the Internet can assist with design and technology education.
Appendix IV: Report on Doctoral Course Attended, “New Media and the Public Sphere”, University of Bergen, Norway

This researcher was accepted on a competitive doctoral course at the University of Bergen. Doctoral students from all European countries were invited. The course was free of charge. Non-Norwegian students were given a travel refund of 300 euro upon completion of the course. There was much reading to be completed for this course. The relationship between media technologies and the public sphere is becoming increasingly important. We explore it theoretically and empirically during four days of intense academic activity.

Before the Bergen event we had to close-read three seminal theorists. John Dewey was an American pragmatist who wrote about technology and the public sphere in the 1880s to 1930s. Marshall McLuhan was the hyper-sensitive medium theorist with oracle-status, writing in the 1950s to 1980s. Jürgen Habermas is the acclaimed wise man of the European public sphere, and has theorized its role in civil society since the 1960s. A range of articles from contemporary writers was also discussed, among them James Carey, Chantal Mouffe and Graham Murdock. Habermas was quite difficult to digest which was a shame as there is a type of research known as “Habermassian Action Research” which would have been useful to get to grips with.

In Bergen we discussed the main topics during plenary sessions and debates, in parallel panel sessions and study groups, and in the evenings. Professor Andrew Feenberg (Canada) and professor Brian Winston (UK) and Professor Peter Dahlgren (UK) joined us. They gave plenary lectures and took part in discussions.

Each of us had to produce a paper which was commented on by one of the Academic Professors (see below). All students must write papers related to our topics. A first draft must be written before November 1st, and after reviews and critique during the seminar, the final version should be handed in by January 1st 2007. The course gives 10 ECTS points for the participants, and a diploma will be issued for those who complete.

The doctoral course was organized by Cultural Techniques (a research project in the Norwegian Council of Research), with financial support from the Department of Information Science and Media Studies and the Social Science Faculty at the University of Bergen, Norway. The course was promoted under the umbrella of the European Communication Research and Education Association.

Supplied with the CD with other research Appendices is the paper created by this researcher for this doctoral course entitles New Media and the Public Sphere.
Appendix V: Report on Tutor Role for module “Internet and Interfaces for Designers” 2007

About the Role

The researcher performed tutor role support for Internet and Interfaces for Designers module in Year 1. This module taught Macromedia Flash to students for their assessment. Part of the assessment was to create an interface for a car stereo with working controls. The working controls, stop, play etc could be modelled with the use of ActionScript which is a programming language solely for use with Macromedia Flash.

Teaching methods

There were lectures and tutorials and this researcher was given an opportunity by the lecturer to take a few lectures. The lectures talked the students through learning basic internet terms and was an introduction to working with Flash. The file format .swf was explained; other teaching items covered included animating an object, creating objects and working with them. This was through the use of videos on the learn@lboro server which took the student step-by-step through Flash.

Reflections on Teaching and Relevance to My Research

Using video in lectures to show how to work with an application was quite difficult to manage at first. You had to explain the point you are covering and show how it is done with the video. It was difficult to manage interaction with the students while stopping and starting the videos. Using the videos on the learn server gave me an insight into what kind of techniques you need to use web-based videos in undergraduate teaching.
### Appendix VI: Overview of Published Works

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APPENDIX VII: Schedule of Questions for Lecturer Interview

Lecturer Interview Schedule

PhD Study

Investigator: Marian Hepburn

I am interviewing a number of staff within design and technology education. Thank you very much for taking part in an investigation of technology mediated learning. This interview has questions designed to stimulate your thoughts on the use of technology within the department of design and technology. This information will be confidential. It is hoped that your feedback will inform the future of the departments' use of technology.

1. Which Course Modules do you administrate / teach within the department of design and technology?

2. How are those modules assessed?

3. Do You Use the Learn Server for those modules? If so, to what extent?

4. What would encourage you use the learn server more.

5. Have you ever used
   (a) Wikis
   (b) blogs
   (c) RSS feeds

6. What has been your most successful experience of using technology such as computers for your course modules.
7. What have been your least successful experience of using technology for your work?

8. Are there any scenarios you can think of where technology, such as computers or mobile phones, would not be suitable for learning.

9. Do you have any ideas on how the departmental efficiency could be increased with technology such as computers or mobile phones?
## Appendix IX: List of Thematic Analysis Codes

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APPENDIX XI - INTERVIEW THEMATIC ANALYSIS REPORT ON LECTURER INTERVIEW

4.1 EXPLORING EMERGENT AND SECONDARY THEMES
4.2 SUMMARISING PARTICIPANT TRANSCRIPTS

This thematic analysis report finds evidence for major and secondary themes identified. It also summarises the participant transcripts identifying some patterns.

4.1 Exploring Emergent and Secondary Themes
This section provides examples of each of the major and secondary themes which emerged from the interview data.

**Major Themes**
1. *NM & NT* Does Not Fit With Current Student Learning/ Lecturer Teaching Habits
2. Lecturers Do Not Know How to Use *NM & NT*
3. Lecturers Envisage Educational Potential for *NM & NT*
4. *NM & NT* not Suitable for Some Modules of D and T Undergraduate Education
5. Lecturers Face Technical Issues
6. Lecturers Thought RSS Could Be Potentially Useful for Design and Technology Undergraduate Education

**Secondary Themes**
A. Reasons for Little Uptake of *NM & NT*
B. Negative Comments on the Learn Server
C. Lack of Time and Resources
D. Course Administration Issues

4.1.1 Major Theme 1: – *NM & NT* Does Not Fit With Current Student Learning/ Lecturer Teaching Habits
Generally within the Department of Design and Technology, there is currently little or no use of the technologies for learning identified. This is surprising in two senses; first the learn@lboro has functionality for *NM & NT* such as podcasts and second, the literature review suggests that students learning habits are based in *NM & NT* (Williams, 2007). One lecturer gave an insight into why this might be.

Extract 1: P4.
If I could see an example of how it could be used to enhance teaching and learning, but also good use of my time and the students time. And also I would need to know how to do it
This is a theme in that it displays a lack of awareness of two things: - the usefulness of NM & NT, and also the basic issue of how to use it. Other teaching habits where lecturers cannot see the benefits of NM & NT over typical ways of imparting knowledge to students:

Extract 1: P4.
P4. Sometimes they are not as good as talking to somebody. Or working with somebody on a drawing not that it can't be used but the use of them gives a false situation unless there is a problem with distance or time.

In the extract X above we can start to see the diversity of types of teaching present in the Dept of D &T. This creates some interesting challenges for the design of NM & NT for learning if it is to remain sensitive to the needs of stakeholders, lecturers and students.

Student Learning Habits
Interview Participant 3
• they put sustainability into Google and they use anything from there without looking at the quality of the source,
• one thing students are bad at is referencing sources
• I mean someone emails me and asks what time is the tutorial and I was able to say if you check the learn server

Interview Participant 2
• students like to be involved with live projects or feel that other people could contribute or benefit from their hard work
• I think sometimes students don’t use email,
• I think it would be good to be able to text the students when there is a change of plan or timetable

Interview Participant 1
• students still want to be told with a lecturer standing at the front of them and repeating exactly what’s on the learn server; - infuriating
• even though they all work at different speeds so one person is going to be struggling and another finds it boring
• they have been brought up to be spoon fed.
• hide behind a computer if they can’t draw or can’t model and they can CAD,

4.1.2 Major Theme 2 - Lecturers Do Not Know How to Use NM & NT
Theme 2 was mainly elicited through Question six, which was designed to probe lecturers’ views on what was successful using technology for learning. Some reported successful experiences with the learn server. But one lecturer was unsure that NM & NT could provide an interactive experience between student and lecturer;

Extract 1: P4.
I. What would you say has been your most successful experience with using technology for learning?

P4. Simply electronic documents Word [For windows]

I. What about in terms of designing your course modules

P4. The use of learn for the module interface for designers simply as an information resource

I. As a communication tool would you say

P4. Well it is a communication tool, but it’s one way. I have done little experiments with collaborative work tools in the modules but that is to teach them of those things and not to teach them method.

As we can see, this indicates fairly basic usage of technology for learning.

4.1.3 Major Theme 3 - Lectures Envisage Educational Potential for NM & NT

So what was useful about the Learn Server? Other lecturers highlighted aspects of the learn server which as a successful use of technology, again mentioning information dissemination as the primary useful function.

Extract 1: P3

P3. I feel quite happy that using learn [server] they have no excuses that they didn't have the notes or they missed the lecture. I mean someone emails me and asks what time is the tutorial and I was able to say if you check the learn server there is a timetable on that. Well I am a bit like a stuck record. I put everything on learn and I tell them.

And;

Extract 1: P1.

P1. Em obviously dissemination of information its very good and frequently asked questions so you can put stuff up there. I also put a countdown on my module pages which freaks the kids out but at least it can’t be an excuse so they know exactly down to the second when hand in.

Many of the lecturers were not confident that they knew what a wiki was but, once the concept of a Wiki was explained to them (many knew of or had used Wikipedia) most of them thought that they would be useful.

P2. To an extent it might be good for sustainable design group seminar might be able to use it as an addition it could be in there. Even design studies for group design project. I mean can you have images in their as well?

P4. Yes because I ask for all the submissions to be in digital format, both presentations and reports so ultimately I have collected a lot of reports, maybe this format would be more appropriate to access information more clearly.
However the educational potential of Wikis was called into question by another lecturer who thought this type of technology was “dangerous”.

4.1.4 Major Theme 4 - NM & NT not suitable for type of D and T Undergraduate Education
One lecturer explained why NM & NT might not be suitable for design and technology students.

Extract 1: P1.

P1. Yes well obviously some of the things we teach in design are very hands on and you can’t teach hands on stuff via a computer. And I also think students hide behind a computer if they can’t draw or cant model and they can CAD, either way it’s a vicious circle. You need individual feedback from the lectures unfortunately. It is very much intensive hands on.

Some lecturers were not sure how the implementation of other types of a blog for learning would assist with the design process of the student.

Extract 1: P5.

I. Have you thought about their use for learning in terms of providing an easy way to manage a timeline of how they are going to design something. Have you thought about the use of that type of technology?

P5. I haven't thought about it in my teaching and initial thoughts are that there is so much in designing that's not verbal it would be difficult to imagine how that would happen.

4.1.5 Major Theme 5 - Lecturers face Technical Issues
Lecturers mentioned technical issues as a major drawback to using NM & NT for learning. Most of the interviewees mentioned that the learn server was not suitable for large file size images, which are used in D and T education.

Extract 1: P5.

P5. Em the ability to very, very quickly have access a resource of images and text that is on a webpage, pdfs or any electronic documents have those in an accessible form on learn.

I. So like an image viewer that could speed up the process of marking portfolio and allow faster scrolling of images.

P5. Its not just images but the folio themselves; it’s a technical issue as well file naming and mac vs pc interfaces, file transfer across networks

Some lecturers cited other human computer interaction problems as reasons where technology would not be suitable for learning. It also shows that there are typically a cluster of problems around specific tasks needed by individual lecturers and their differing levels of
ability with \textit{NM} \& \textit{NT}. One example of incidences where using the learn server made more work was in the way the Learn server was designed for PC users and not Mac friendly.

\textbf{4.1.5 Major Theme 6 - Lecturers Thought RSS Could Be Potentially Useful for D and T Undergraduate Education}

All of the lecturers had to have RSS feeds, wikis and blogs explained to them but they all thought that RSS would be a good use of technology for reasons such as quality of information. This interviewee, once RSS was demonstrated to him found it might be useful:

\textit{Extract 1: P3.}

\textbf{P3.} Yes I think the learn servers covers more or less with the exception of sending out the information to the student, its’ just sitting there waiting for the student to go to it. So I think if it was more proactive then that’s a good thing, especially for some students who say it their email doesn’t work, it’s actually being texted to their mobile or whatever.

Some lecturers thought they would be useful as a communication device to students.

\textit{Extract 1: P6.}

Yes suppose they would be useful in all of them, but especially in dissertation as students have very intermittent contact and if as a tutor I could communicate with the whole of the dissertation group then that would be good if I or they come across an interesting piece of literature. I can imagine it would be particularly useful for those who I have very little staff contact with.

There seemed to be more favour for RSS than blogs and wikis. Also as Transcript X shows lecturers beginning to have ideas on where particular types of \textit{NM} \& \textit{NT} fit into their modules.

The major themes identified give some indication on where to look for the potential for \textit{NM} \& \textit{NT} in D and T education. In particular, they point in the direction of investigating RSS as a useful way of managing course administration issues and curing learning habits of students. The next section identifies some secondary themes which arose from interview data.

\textbf{4.2 Secondary Themes}

However there were not so many instances of them appearing in transcripts, thus they are secondary themes.

\textbf{4.2.1 Secondary Theme 1- Reasons for Little Uptake of \textit{NM} \& \textit{NT}}

Diagram X above illustrates the reasons for little uptake of \textit{NM} \& \textit{NT} by D and T lecturers and staff. An example transcript shows that reasons for little uptake relate to the nature of design and technology education.

\textit{Extract 1: P3:}
It’s hard to imagine how you would do woodwork or metalwork with computers, you need a sense of the materials and how they work under certain conditions, when you are designing a product.

Lecturers have voiced appeals to the verbal and nonverbal “sense” of designing. These are convincing reasons why mediating technology such as mobile phones and computers might not be suitable for the act of designing and learning to design. Nevertheless, these technologies show promise.

4.2.2 Secondary Theme 2 - Negative Comments on the Learn Server
Thus there was the general feeling amongst lecturers that combining lectures with technology would make more work for them. The learn@lboro server provides a way of administrating modules, however lecturers clearly find it cumbersome to administrate.

Extract 1: P4.
P1. The getting the stuff onto learn server is a pain – it is ok for me as I know how to do web pages but not for some of the other staff. So for example turning word into html is rubbish and they spend hours faffing about trying to get it to work properly.

This highlights some important and fairly basic problems of usability with the VLE at Loughborough for some members of staff. This relates to a further lack of awareness of the systems already in place within the University that offer training and support for using Learn. Other lecturers pointed out that for their module type computer or mobile technology would not be useful.

Extract 1: P1.
In terms of mobile phones or whatever it’s still a technological and educational barrier as they haven’t been brought up that way – they have been brought up to be spoon fed.

The extract above taps into a problem of technological and educational barriers; lecturers have with education expectations; they want to be spoon fed.

4.2.3 Lack of Time and Resources

4.2.4 Secondary Theme 4: Course Administration Issues
Course Administration Issues arose in relation to assessments, the learn@lboro server and in relation to using New Media for administration of Design and Technology modules.

1. Course Administration: Assessment and the Learn server:
Interview Participant 6: “Unless they are in some way linked to assessment then it’s hard to get anyone including me to get interested in contributing to it”.

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Interview Participant 5: “But my feeling is that it’s not good to have assessments uploaded anyway in case there is a fault with the system.”

Interview Participant 3: “Well I know we can use it [Learn server] for small tests but unless it’s marked then the students won't go for it”.

2. Re: General comments on Course Admin issues and the Learn@lboro server

Interview Participant 6: “To put puts word docs up. That’s by far the easiest thing to do, otherwise you are spending ages converting different types of documents and reformatting things”.

Interview Participant 5: “I tend to photocopy what they need anyway, rather than for undergrads and I just put it on the Learn Server, and if they want it’s there.”

Interview Participant 3: “lecture notes information on assignments those types of things, although not in an interactive way for students - it more of a resource”.

3. Course Administration - Comments on New Media

Problems with Email

Interview Participant 5: “Very often we won’t find out if they have a problem until there is an assessment, then it can be too late. We end up with a load of confused students sending a load of confusing emails, that gets hard to manage”.

Usefulness of RSS
the sustainable design module because it is something that is changing all the time, so if there had been a government conference you could get the latest information

Potential of Discussion Forums
so alot of people don’t always turn up or can’t make times, so the logistics are that the students have to be very flexible

Use of websites in D and T Education
I have collected a lot of reports on a website called usabilitynet and I put them on the website for everyone to see

4.4.1.2 Summarising Participant Transcripts
This section draws out some of the points made by each lecturer which is useful to making decisions on learning scenarios and highlights issues generally with technology for learning, such as the learn server.

P1

- Thought RSS might be a more proactive way of delivering information to students;
- Thought using computers all the time for design and drawing was cheating abit - “people hide behind the technology”
• Used the Learn Server in an advanced way to put video tutorials on it
• Found that getting the information on Learn “a pain”
• Also even if there was content on the learn server, students ignore this anyway, and still want to be “spoon fed” the information

Comment: This lecturer was making good use of the learn server, had a countdown to hand in function so the students knew there “was no excuse”. This lecturer was using the learn server already in an advanced way, embedding new media and new technologies, although he seemed keen to use RSS.

P2:
• Course on assistive technology focussed on “practical skills” out in the field so not sure how Learn could assist.
• Not comfortable with putting stuff on the Internet due to issues of copyright
• Therefore a lot of printing was done by this particular lecturer
• Never used wikis before
• Thought that discussion boards would be useful as might make things more flexible for students who are out in the field

Comment: This lecturer was making no use of the learn server, due to perceived copyright issues. The lecturer conceded that discussion boards might be a possibility.

P3
• Identified the use of RSS to help with sustainable design module.
• Wanted to stop students putting sustainable design into Google and not referencing properly. The lecturer wanted to control the content
• Had not seen good examples

Comment: This researcher used the data from this lecturer to make a clear link between wanting to control the content of what students do on Google, in relation to their D and T education.

P4
• If there was a quick and easy way to access images then that would be really useful
• Was not sure about the use of new media such as blogs, had not seen good examples of their use.
• Had tried to use discussion boards but this was not successful
• Problems with wikis for groupwork as so much of designing is not verbal
• Quick access to documents, PDFs, and a repository of images desirable
• Have to see good examples of its use. Not as good as talking and there are still haven’t ironed out Mac vs PC issues on Learn.
Comment: This lecturer making good use of learn server, but was not sure how to incorporate new media into existing practices and would have to see good examples of them.

P5
- Problems with Macs and PCs an issue for uploading lecture content on learn
- Learn Server: Good for putting Papers on learn, especially for PGs
- However, Learn@lboro not suitable where the module was small one? X didn’t use it.
- Lecturer thought wikis might be dangerous as you have no idea whether the information you have collected is correct or not.
- Thought RSS a good idea, especially for certain modules where there is little staff contact time.

Comment: This lecturer made use of the learn server. This lecturer felt happy that using photos for group-work or RSS could be implemented on this lecturer’s modules.

P6
- Was not sure how the act of designing could be enhanced by new media
- Might be useful for distance and time
- Computers can stop you wasting materials through the iteration process
- No clues about how RSS could help

Comment:
Although thinks students should work with “raw” materials, computers have benefits sometimes which outweigh the fact you are not designing with tangible materials.
APPENDIX XII: Mobile Research Questionnaire

Mobile Research Questionnaire
PhD Study

Investigators: M. Hepburn

Thank you very much for taking part in the questionnaire looking at mobile devices for learning. This questionnaire is designed to gauge your response using mobile devices for learning. This information will be kept confidential in line with laws on data protection.

1. Age: ____

2. Sex: Please Circle: Male/ Female

3. Do you own a mobile device? If so, please circle the type/s below:
   (a) Mp3 player  (b) 3G mobile  (c) PDA
   (d) Smartphone  (e) PocketPC
   (f) Other (Please Specify)____________________

4. If you own a mobile phone please specify whether you are on:
   (a) contract      (b) pay-as-you-go
   If on contract when does it expire? ______________________

5. What features of your device do you use? (Please circle options below).
   (a) Telephone calls: Daily/ Weekly/ Monthly/ Rarely/ Never
   (b) Text: Daily/ Weekly/ Monthly/ Rarely/ Never
   (c) Photo: Daily/ Weekly/ Monthly/ Rarely/ Never
   (d) Audio (e.g. Mp3) Daily/ Weekly/ Monthly/ Rarely/ Never
   (e) Video: Daily/ Weekly/ Monthly/ Rarely/ Never

6. What type of learning tasks and scenarios below would you engage in with your mobile device? (Please tick against)
   (a) Streamed lectures on learn server for your mp3 player;
   (b) Sending photos for groupwork;
   (c) Quizzes on coursework;
   (d) Mobile text blog;

Student ID: (On Uni Card)
(e) Can you envisage any other ways of using your mobile device that you might find useful as a student in design and technology, e.g. other learning scenarios, timetable changes & updates?

7. Can you identify any drawbacks to using your mobile device to enhance your design education?

8. Are there any opinions and/or comments you would like to express regarding the use of your own mobile device(s) to support learning tasks?

10. What would be the attraction(s) of mobile learning tasks/scenarios that would make you want to use your mobile device(s)?

11. AND FINALLY…. What is the make and model of your mobile device(s)
Appendix XIII: SPSS Output for Student Questionnaire Data (ON CD)

APPENDIX XIV: Review of New Media and New Technology Literature and Projects in Universities

3.14 NEW MEDIA, NEW TECHNOLOGIES AND VIRTUAL LEARNING ENVIRONMENTS
3.14.1 HISTORY OF NEW MEDIA IN HIGHER EDUCATION
3.14.2 ENHANCED TUTORED VIDEO INSTRUCTION
3.14.3 SOCIAL NETWORKING AND VIRTUAL LEARNING SYSTEMS

3.15 E-LEARNING AND M-LEARNING IN EDUCATION
3.15.1 DIFFERENCES BETWEEN ELEARNING AND MOBILE LEARNING
3.15.1.1 BENEFITS OF ELEARNING
3.15.1.2 THE BENEFITS OF MOBILE LEARNING
3.15.1.3 LEARNER EXPECTATIONS WITH ELEARNING & MOBILE LEARNING
   i. JISC Report into Student Expectations with ICTs for Learning
   ii. Students perspectives on ICTs for Learning
3.15.2 ELECTRONIC LEARNING (ELEARNING)
3.15.2.1 ELEARNING IN DESIGN AND TECHNOLOGY EDUCATION
3.15.2.2 ACTION RESEARCH AND ELEARNING
3.15.2.3 ELEARNING DRAWBACKS AND ASSUMPTIONS
   i. Four Unintended Consequences of Elearning
   ii. Elearning Requires Investment
3.15.3 MOBILE LEARNING (MLEARNING)
3.15.3.1 BEST PRACTICE FOR MLEARNING IN DESIGN AND TECHNOLOGY EDUCATION
3.15.3.2 NEW DIRECTIONS FOR MOBILE LEARNING
3.15.3.3 REQUIREMENTS FOR SUCCESSFUL MOBILE LEARNING

3.14 New Media, New Technologies and Virtual Learning Environments in Higher Education

This section reviews current examples of NM & NT within their institutions.

This research seeks to integrate with the students' own mobile device use. In this respect it seeks to develop "ubiquitous learning" (Laroussi, 2001), which means flexible anytime -anywhere learning that integrates with the students own methods, technological prowess and pedagogical context. In terms of more computer- based elearning scenarios, most universities provide terminal access either on or off campus to allow users to access e.g. Internet based journals to complete their studies. This section will look at different Universities to find out how NM & NT integrate with institutions current elearning platforms.

World media providers like the BBC have also been using New Media to provide learning content to students at school, studying a variety of subjects. The BBC “bytesize” example is where the UK
national media have created small graphical interactive learning objects, generally for learners at school level.

3.14.1 History of Media in Higher Education

This use of video as a new media learning tools, in particular the use of web or audio visual techniques for delivery of lectures has originated from Tutored Video Instruction (TVI). TVI was invented at Stanford University in 1977. In TVI, a small group of students play a pre-recorded videotape of a classroom lecture. Learning differences were not significant between those who watched the video together and those students who were not in the same physical location, also known as Distributed Tutored Video Instruction. During the playing of the tape, a facilitator encourages the students to pause the tape to ask questions or discuss topics. In this form of collaborative learning, TVI & DVTI students have shown to outperform students who physically attended the lecture (Gibbons, Kincheloe & Down, 1978). The use of video as an instructional medium could be beneficial to design and technology education, (Hodgson and Norman, 1993).

An extension of this research in today's web-enhanced education has given rise to "enhanced DTVI". This incorporates the feature of shared notes taking, whereby students collaboratively take notes as the lecture plays and the notes automatically appear as web pages so that the group members can view the notes later. Because the notes are collated and students have a shared task, the outcome is of value to all of the students, thus collaborative learning can be evaluated as more effective (Seng & Hok, 2003).

3.14.2 Social Networking Websites and Virtual Learning Systems

Current examples in other universities include Community@Brighton. This is a social networking learning system for students and staff at the University of Brighton using the open-source software Elgg, for sharing files, and posting blogs. It complements the existing VLE at Brighton University. VLEs used in conjunction with Birmingham University’s Content Management System promote the use of Web 2.0 technologies allowing the download of podcasts for learning course materials, such as dentistry.

Media Zoo form Leicester University aims to provide support to academics struggling to cope with how NM & NT could change teaching. It provides an on-campus laboratory and an interactive website which takes the mystery out of mobile learning, e-learning and e-moderating. Aiming to improve the student experience through for example Second Life 3D game engine, there are demos for future uses of new media and new technologies.

3.14.3 Types of New Media and Virtual Learning Systems

OpenLearn website from the Open University provides new media tools for its courses, such as instant messaging, video conferencing and online forums. The LearningSpace is the student space for new media for learning. The LabSpace is the area for lecturers and tutors where they can experiment
with providing their module materials in new ways using new media and new technologies. Adopting a “Web 2.0” approach, they use RSS to allow engagement with the learning materials, not at a computer. So they push RSS information via text to mobile phones, using Feedcycle and Wattpad to deliver to phones. Unfortunately the use of Feedcycle is no longer supported.

Due to the lack of available literature of NM & NT in D and T undergraduate education, a literature review highlighting current examples of NM & NT for learning in other universities was conducted. This would help with diagnosing the problems which other universities had, so as to avoid them, and provide some scope for relating this project to the wider fields of mobile and e-learning. The next section reviews literature relating to elearning and mlearning and design and technology education.

3.15 ELearning and Mlearning in Education

*This section reviews relevant literature in relation to elearning and mlearning.*

Looking at NM & NT falls within the category of elearning or mlearning. Exploring the potential for new media and new technologies within D & T education comes under the bracket of e-learning. The term e-learning was first used on the web by Jay Cross leading proponent of web 2.0 technology and refers to the use of computer technology to deliver learning. It can be within learning institutions or work settings.

Laurillard (1990) is a proponent of a conversational model of elearning where the features of it should be:

**Discursive:** Lecturer and students conceptions should be accessible, with agreements on learning goals. The lecturer must provide environment within which students can receive feedback on descriptions appropriate to topic goal.

**Adaptive:** Lecturer must use feedback on student’s conceptions to revise focus of ’dialogue’.

**Interactive:** Teacher must provide feedback to students based on their tasks and conceptions.

**Reflective:** Teacher should support process where students relate tasks and experiences to the topic and topic goals.

3.15.1 Differences between elearning and Mobile Learning

Differences in elearning system and m-learning system have been described in terms of the pull of elearning architectures, where students are pulled into a V.L.E and the push of services out to a mobile learning architecture. Armatas, Holt, and Rice, (2005), discuss the balance required between the elearning environment in a university and a mobile environment describing it in terms of the pull of the learning environment and the push of the information to mobile technology.
Also a key argument of this research; the authors argue for balance in the interrelationship between virtual learning environments which pull students into the learning environment, and mobile technology solutions which can push information out to students, so that each adds value to and complements the other. The authors call for learning resources to be developed in ways which ensure just-in-time delivery, with a range of media through various platforms and devices. One of the key difficulties to this research is how to achieve this balance and interrelationship between the learning environment and mobile technology. So scenario 1 tested out with RSS model for downloading the lecturer OMPL file from the learn server depended on students using an RSS reader, and the sharing and monitoring of feeds. Also for scenario 2 there was a question of how to make the video podcasts available on the learn server.


Keegan (2004) also attempts to model the differences between the two, describing elearning environments as they are today with wireless technology (Figure 8): Then he describes the learning architecture of tomorrow (Figure 9):

![Figure 8: A Wireless ELearning Environment, (Keegan 2002)](image-url)
3.15.1.1 The Benefits of Elearning

The benefits of e-learning; Zemsky and Massy (2004), describe e-learning as a “radical technological innovation”, (whether an innovation is radical, they define in terms of providing better performance and lower costs than its predecessor). The research question they pose related to e-learning could apply to any department or institution facing a large financial outlay for IT; “What strategy would help sustain and grow online learning during challenging and changing circumstances, in an under-resourced institution?"

The major claims made to support “radical” benefits of e-learning include:

- the combination of new electronic technologies and newly accepted theories of learning (such as social constructivism) promised to create a revolution in pedagogy;
- the surge in demand for adult education meant anytime- anywhere learning was desirable and;
- that the market would provide the funding available to make the potential for e-learning a reality.

3.15.1.2 Benefits of Mobile Learning

Prensky (2005) questions what students, as digital natives, can learn with a mobile phone. As mobile phones are far more advanced than most of the computers of ten years ago, the authors answer to this question is “anything”, (provided the education tools are designed correctly). He cites abilities; “listening, observing, imitating, questioning, reflecting, trying, estimating, predicting, speculating,
and practicing” (p.7). Despite limitations, such as screen size, it is claimed that students are already using mobile phones for learning. The learning technologist can deliver education in a way that fits into students' digital lives through the functionality of the mobile phone. The author concludes that instead of wasting energy ignoring their preferred delivery system it is time to support mobile phones in education.

### 3.15.1.3 Learners Expectations with Elearning and Mobile Learning

Futurelab develop elearning with NM & NT in line with their Learners Charter which specifies learner expectations, in terms of the following objectives:

**Choices:** emphasises roles of learner as individuality, joint responsibility and active agent of learners own choices.

**Skills and knowledge:** learners are expected to design their own learning paths, and directed in unfamiliar knowledge areas.

**Appropriate Learning environments:** different teaching, people, learning environments

**Feedback:** assessment tools, achieve recognition, assessment activities as feedback to the education system.

The key issue with Futurelabs’ work is **personalisation;** that the system conforms to the learners, not that the learners conform to the system. Thus, Futurelab make innovative and technologically advanced projects for students to assist with learning.

#### i. JISC Report into Student Expectations With eLearning

The JISC Great Expectations of ICT report (2008) describes how universities are actually shaping up in terms of student expectations and experiences with e-learning new media and new technologies. The study was in two phases which compared expectations and experiences of cohort group of 17 -19 year olds. Due to poor response rate in the second wave a boost group was introduced. This gave two results for comparison, the cohort group and the boost group.

#### ii. Students perspectives on ICTs for Learning

The next section delivered results on whether they FEEL stretched with ICTs for learning. Firstly 50% of students feel stretched but this result is course dependent and secondly, science students’ expectations are exceeded. Only 57% or (73% of cohort) agree they like to look for new technologies to help them learn. Reasons for this: students get into a habit of trying to regurgitate what is expected of them in modules. This allows for one learning style set by the lecturer, and puts people at a disadvantage who haven’t adopted a way of using that style which works for them.

#### iii. JISC Report Results

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The report was divided into three policy implications:

**Heading 1. Students and ICTs**

E-learning policy depends on whether we want to take students out of their comfort zones and stretch them further; or do we focus on a basic level of IT competency across the board but students think that the basic level is catered for! Think through the use of NM & NT as students do not like using it when forced – VALIDITY of SOURCES – get them to think about the potential uses.

**Heading 2. ICTS and Learning**

There is a need for successful learning techniques with technology. This involves thinking about learning styles; apparently the way they are using the technology and the information does not come naturally to students. The technology environment students’ will suit will depend on type of the technology. The way that they use them will be important. Try to make the technology students useful in social situations. This is depending on whether we use technology for formal or informal learning.

**Heading 3. Teaching**

**Teachers need support!** For example, support in the form of newsletters and introductions to basic technology to get them to collaborate as a department. But what also should be done is get the early adopters of technology to help. IT support overheads are inevitable. Apparently 54% of lecturers/teachers do not use wikis, blogs or online networks. In conclusion, Universities are not thinking about new ways PEOPLE CAN LEARN and thinking about information presentation is crucial to Web 2.0.

To summarise, there are not many examples of a coherent strategy for elearning, new media or new technologies in education (Cunningham, 2003). The reason is often that the introduction of them is dependent on an assessment of needs in the institution where the new media is proposed. The many different types new media, there has been circumstances where it has to be redesigned for a particular educational context (Xin and Feenberg, 2002).

**3.15.2 Electronic Learning (Elearning)**

This section reviews literature for elearning in D and T education, how action research works with elearning and some drawbacks and assumptions of elearning which should be considered.

**3.15.2.1 Elearning in Design and Technology Education**

Whitehouse and Brotherhood (2002) describe a five stage SiFT model of implementing elearning into D and T education:

1. **Paper mock ups:** involving the designers of the learning environment;
2. **Electronic form:** within the virtual space with designers and computing personnel;

3. At the **prototype phase,** with participating teachers;

4. After the **live system** was launched, with teachers and;

5. Involving the **TTA** quality assurance process.

This cyclical model of implementing elearning, appears useful for this research. They applied elearning in the following subject areas; resistant materials, textiles, food and control systems. They conclude that a blended model of elearning is more suitable to teachers (a blended model draws on the real and virtual worlds to achieve learning objectives). Work conducted by this researcher follows 4 out of the five steps highlighted. But because this work is relevant to undergraduate education it does not need to involve the TTA quality assurance process.

### 3.15.2.2 Action Research and Elearning

Salmon (2002) bases her methodology for the creation of e-learning resources on Action Research. She states that for effective learning to be devised learners should be chaperoned through the online learning development process. She devises a five - stage model for teaching and learning online which have two subcomponents namely:

<table>
<thead>
<tr>
<th>Stages 1 – 5</th>
<th>Subcomponent:</th>
<th>Subcomponent:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E – moderating</td>
<td>Technical Support</td>
</tr>
<tr>
<td>Access &amp; Motivation</td>
<td>Welcome/ Encourage</td>
<td>Establishing/Accessing system</td>
</tr>
<tr>
<td>Online Socialisation</td>
<td>Bridges between cultural/social environment</td>
<td>Sending/ Receiving Messages</td>
</tr>
<tr>
<td>Information Exchange</td>
<td>Facilitates tasks &amp; support</td>
<td>Search/personalise Software</td>
</tr>
<tr>
<td>Knowledge Construction</td>
<td>Facilitating process</td>
<td>Conferencing</td>
</tr>
<tr>
<td>Development</td>
<td>Supporting</td>
<td>Provide links outside conference</td>
</tr>
</tbody>
</table>

**Table F: A Five Stage Model for Teaching and Learning Online, Salmon (2002)**

### 3.15.2.3 Elearning Drawbacks and Assumptions

Elearning is often delivered through V.L.E.s. Browne and Jenkins (2003), devise a report comparing the use of V.L.E.s in higher education institutions between 2001 and 2003. The reason for the report
was to explore any trends and developments that have occurred over this two year period. What they found was V.L.Es are being used amongst all different subjects. However, V.L.Es require IT support and have drawbacks such as high support and lack of customisability for the lecturer.

Also it is a big assumption that student learning is improved with elearning, (Smeaton & Keogh, 1999). The authors found no improvement in grade from students using elearning. This section will identify further drawbacks in the literature.

1. Four Unintended Consequences of Elearning

Slevin (2008) argues that e-learning today contains assumptions about learning, media and technology which are hard to throw away. Focusing on aspects of social, education and communications theory, the author looks to the potential of elearning. However, Slevin offers an insight into the unintended consequences of Salmons’ five stage emoderating model. The first unintended consequence: Emoderation models are risky, because they do not involve subject experts and involves navigation of a number of disciplines other than the one by the lecturer.

A second unintended consequence is the focus our attention on empowering teachers to advance their individual professionalism. The author claims Salmons’ work is weak on guidance for whole institutions looking to make these changes. Slevin (ibid) states, by limiting the technology to forums, bulletin boards, emoderation principles do not have clear application to other forms of NM & NT. Emoderating (2002), does not give any guidance on moderation of other forms of NM & NT, such as blogs, and wikis. A fourth unintended consequence; by dealing with lurking, and nonparticipation within a module, she sets an agenda that limits consideration of the implications of marginalisation and exclusion in e-learning. Slevin concludes that elearning research needs to be tied to social theory. It is hard to know which individual aspects of e-learning are of most effective in education.

II. Elearning Requires Investment

Holtham and Courtney’s report (2005), posits Virtual Learning Environments (VLE) in e-learning and e-business context. Although VLEs have good value and potential, they are a business risk for universities. It is argued that there is waning support for spending on elearning, and that there may be a growing trend among institutions to invest in other aspects of learning infrastructures (e.g. physical buildings and information resources) rather than IT-based technologies alone. Hannafin and Minch (2003) offer criticism on web-based teaching and learning. They argue that web-based teaching and learning has not broken the new pedagogical ground supposed and offer some new directions for research; it merely replicates a limited module outline on a website.

3.15.3 Mobile Learning (Mlearning)

This section of the literature review highlights factors for consideration when introducing mobile learning. Mobile Learning uses the following technologies in education; P.D.As, mobile phones, mp3
players. Mobile learning or m-learning can refer to learning objects or resources. Very often mobile learning resources will be part of a wider remit of elearning and technology-enhanced learning; i.e. a blended model of education.

i. Mobile Technology Offers a Blended Learning Model

The blended learning model highlighted by Whitehouse and Brotherhood should incorporate mobile technology (Horton, 2007); however, there are no good examples of how mobile devices could be used for D and T undergraduate students. There is a need to balance how mobile technologies could be used to support ongoing implementation of e-learning in context; i.e Loughborough University (Armata, Holt and Rice, 2005). Design research is very helpful in this regard, and not incompatible with action research, (Järvinen, 2007). It can help to design the blended – learning approach.

ii. Developing Mobile Learning Scenarios

Universities in the UK have been employing advancements in terms of mobile learning or m-learning (Sharples, Corlett and Westmancott, 2002), and computer-mediated learning. Universities in the UK have been leading the way in developing m-learning scenarios as part of the blended model approach (Sharples et al., 2002). Universities such as Leicester have been investigating the development of “m-tivities” (Salmon: 2004); using mobile devices and content for learning activities.

The authors research a prototype model of a mobile learning device for 9 – 11 year olds, which children capture everyday events such as images, notes and sounds, and upload them to web-based learning resources, to share with other learners and teachers.

Cochrane (2006) outlines four scenarios which synthesise socio-constructivist pedagogy with wireless mobile devices (WMD) technology. Describing four trials with different classes of design and technology students at New Zealand University, the author describes WMDs as “disruptive technologies” requiring a technology steward to help with implementation.

3.12 New Media & New Technologies in Education : Wikis & Blogs

This section demonstrates where different types of NM & NT have been used in education. iT focuses particularly on types of NM & NTs; blogs, wikis and RSS. It also explains the new phenomenon of podcasting/ vodcasting for learning.

As this research field is new there are not many research examples to guide this research. Thus this research looks at other examples where NM & NT are used in education to get a sense of best practice. With knowledge of how other Universities are using these technologies an insight into the potential
3.12.1 Blogs and Wikis

Recent work by DeRienzo (2000) notes that in on-line learning, interaction is the key factor and passive “lecturing” seems not to work. The use of blogs, wikis and RSS is one way to ensure interactivity. Klamma, Cao, and Spaniol, (2007), discuss knowledge - sharing using blogs. They suggest their own design of blog watching software. Blogging in education has been investigated as part of a JISC funded project (Trafford, 2005). RSS is a type of technology which supports web feeds and includes podcasting. Blogs or weblog is like a digital web diary which people can view with an Internet connection.

3.12.1.1 Examples from Literature on How to Use Wikis in Education

A wiki-web is a type of website that anyone can edit or add to using a normal web-browser. The video clips were attainable to the students from their network drive on their computers with a link from the wiki to the video files. The students really liked this tool but there were three ways to make it more functional:

1. First, creating new pages was too difficult.
2. The second problem in with the wiki technology was that two or more students could not concurrently edit wiki-pages.
3. The final problem identified was that it was not possible to rename pages.

The use of wiki technology for educating has proved a useful technology for education.

Brereton, Donovan and Miller (2003), combine the use of wiki technology with a video game to assist IT students to develop sharper observation skills that will assist them with the design process, and their design assessment. The Video Card Game is similar a virtual card game, where the students have to develop themes of user interaction from video analysis. Students then post their interaction themes onto a wiki website. The authors found that the cards, game, role playing and collaboration involved in this method gave rise to more interaction and discussion between student groups and between students and the teaching team, than in previous traditional teaching methods. It took no more time on the part of the lecturers and the quality of the resulting interaction themes suggests that this method gives rise to students' development of observational skills.

3.12.1.2 Difficulties with Using Blogs in Education

There are currently no clear guidelines in how to embed blogs into assessment practices and module learning outcomes within universities. Then other difficulties arise where blogs are timestamped, as students will often leave assessments until the last minute. Particular difficulties exist at this stage with tying in blogs into the learn@lboro server. This problem is noted by other JISC funded groups attempting to use blogs, specifically moblogs for education "At some stage the reflective blogs will need to be related to their learning environments" Trafford, P. (2005). The author looked at some of the education problems encountered by teaching staff regarding using blogs in university maths.
course, so for example, the students used tended to use bad grammar and “text-speak”. Diversity of thoughts and going off topic were also a big problem.

3.12.1.3 Educational Potential of Wikis and Blogs in Education

Duffy and Bruns, (2006), provide an overview of educational benefits and opportunities wikis, blogs and RSS, and how they can be incorporated into student learning. For example, lecturers and students provide RSS feeds on assignment topics and area of research interest. The paper argues that incorporation of these technologies is part of student digital literacy. This paper concludes that these socially-based technologies are useful to encourage socially constructed learning. Duffy and Bruns (ibid) also identify the educational possibilities of blogs, wikis and RSS in terms of:

- collaborative digital content creation,
- peer assessment
- evaluation of student work
- individual as well as group reflection on learning experiences
- Up-to-date information regarding changes in collaborative spaces and learning tasks.

They ask what conceptual understanding is necessary for the implementation of RSS, wiki and blog tools. The authors argue for an understanding on impacts of digital technologies on pedagogy and practices. Really Simple Syndication, or RSS - a type of "new media" - is a way of pushing information from the Internet to an application; so, by supplementing or syndicating websites with an RSS feed, information can arrive on a particular topic of interest of the user. Therefore, an RSS application has the ability to manage blogs, podcasts and websites that you are interested in. The next section describes the operation of RSS and Podcasts in education in more detail.
### Review of Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Description</th>
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<tbody>
<tr>
<td>UniWap</td>
<td>An m-learning project concentrated on the testing of the use of WAP technology in higher education is the UniWap project. The team tries to explore the process of creating an operating environment for studying and teaching through smartphones and WAP phones. One phase of the project was to create some working prototypes (courses modules) and to investigate the problems and the value of such courses. The positive results they encountered (easy to develop, willingly accepted and widely used modules)</td>
</tr>
<tr>
<td>Ultralab M-Learning</td>
<td>Ultralab M-Learning project the team is producing m-learning materials for people with literacy and numeracy problems. The great potential is encountered from the cognitive and pedagogical point of view, but the development is quite trivial (MacromediaFlash), Ultralab M-Learning project is one of the projects that have a special section dedicated on creation of a <strong>WAP portal for educational purposes</strong>. As part of Ultralab project, is a project called <strong>LAND (Location Activated Nomadic Discovery)</strong>. It explores the possibility to deliver media-rich context-aware information through mobile devices.</td>
</tr>
<tr>
<td>From E-learning to M-Learning</td>
<td>Long project that aims to create a learning environment for wireless technologies by developing course materials for range of mobile devices. A discussion about the characteristics of the devices that are proper for learning is made when taking the decision what devices to use in the project. An analogy and differentiation is made between e-learning, d-learning (distance learning) and mlearning. In this context they try to foresee the future of m-learning and the methods that should be used for successful m-learning.</td>
</tr>
<tr>
<td>Stanford Learning Lab</td>
<td>Stanford Learning Lab [24] an exploration of mobile learning has been done by developing prototypes that integrate practicing new words, taking a quiz, accessing word and phrase translations, working with a live coach, and saving vocabulary to a notebook. They envisioned that a good approach would be to fill the gaps of time by short (from 30 seconds to 10 minutes) learning module in order to use the highly fragmented attention of the user while on the move.</td>
</tr>
<tr>
<td>Kingston</td>
<td>Kingston University (UK) an experiment was undertaken to research the</td>
</tr>
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</table>
The team has developed a system that sends SMS to students, registered to the service, about their schedule, changes in it, examinations dates and places, student’s marks. After registering the students were separated in 5 different groups. One group was receiving announcements via e-mail, other 3 groups via SMS (but different interaction was necessary in every group) and the last – via web. The conclusions were that students in certain scenarios where a certain type of response is required, preferred SMS as a medium to e-mail or web-based announcements.

University of Helsinki the LIVE experiments, made with SMS system and with WAP phones, were very positive [34]. The project went on by introducing digital imaging and sharing photos between the participants (teachers). The conclusions were that it is very possible that the introduction of MMS and the other 3G services in the large scene will lead to more and more possibilities for mlearning.

evaluation of a (SMS) to support undergraduate students was done at Sheffield Hallam University. The experiment was with 67 undergraduate psychology students. The implemented system was again not for learning, but for managing learning activities.

HyWeb at Griffith University Gold Coast


Minnesota State University, in Canada

mobile web content was specifically created for the Exploratorium museum (an interactive science museum) in San Francisco.

University of Birmingham, biggest initiative communication and on human-
<table>
<thead>
<tr>
<th>Institution/Project</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tampere University of Technology</strong></td>
<td>Tampere University of Technology (Finland), where PDAs are used for mathematical education) of children. The study-content is presented in the form of a game (again the idea of human-centered education is explored) where the pupils can communicate and help each others and the electronic device is used to measure the average students’ knowledge level and to adopt the speed of presenting new material to the learners’.</td>
</tr>
<tr>
<td><strong>KNOWMOBILE project</strong></td>
<td>“Problem-Based” Learning was the aim in Norway Uni, where PDAs and smart-phones were used for experiment in medical education of students from the School of Medicine at University of Oslo. Few weeks of experiment the team found out that the students are using the devices mainly to read information from the digital medical handbook (retrieve it via internet as was expected) and as communication device (to discuss problems with colleagues but mainly for sending SMS messages and to organize social events after hours).</td>
</tr>
<tr>
<td><strong>4. MIT</strong></td>
<td>The team uses PDAs to simulate the real environment (in the form of map) and to use simulation for a game, played by kids. They use PDAs equipped with GPS extensions. The idea is that the virtual world simulated on the PDA (which has the same geographical characteristics as real world) is “polluted”</td>
</tr>
<tr>
<td><strong>eSchoolbag</strong></td>
<td>Advanced wireless technologies (IEEE 802.11, Bluetooth, and GPRS) are used in a project for development of ad-hoc classroom and eSchoolbag system at the Aletheia University in Taiwan</td>
</tr>
<tr>
<td><strong>5. K12 classes</strong></td>
<td>Usa.</td>
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<tr>
<td><strong>COPE at The University of Texas at Austin</strong></td>
<td>A project by Philips has developed a prototype personal communicator and organizer for children, based on the results of</td>
</tr>
<tr>
<td>Participatory design sessions with children aged 7–12</td>
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<td>----------------------------------------------------</td>
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<tr>
<td>Druin and colleagues are developing, in collaboration with Alburquerque elementary school children, a generic mobile interface for children using a “pan and zoom” metaphor.</td>
<td></td>
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<tr>
<td>A team at Simon Fraser University led by Inkpen is carrying out a participatory design study with children to develop handheld computers for collaborative learning.</td>
<td></td>
</tr>
<tr>
<td>The Classroom 2000 project at Georgia Institute of Technology has developed technology to enable students in a lecture theatre to read slides from the screen onto PDAs.</td>
<td></td>
</tr>
<tr>
<td>Projects to design mobile technologies for adult learning include FieldNote from the University of Kent which integrates handheld tools for data collection and re-use, including a GPS device, into a system that enables fieldworkers to capture and share information.</td>
<td></td>
</tr>
<tr>
<td>Fischer and colleagues are investigating software systems to support lifelong learning that allow users to learn as they design artefacts following their unique interests and needs, but these are developed for desktop machines not mobile devices.</td>
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</table>

6. E-Graffiti

<table>
<thead>
<tr>
<th>Nesta Futurelab</th>
<th>Mobile learning projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilearn</td>
<td>Co-funded by the European Commission, National Science Foundation. describes Open Mobile Access Framework. Aims to improve access to knowledge for selected target users.</td>
</tr>
<tr>
<td>DoCoMo</td>
<td></td>
</tr>
</tbody>
</table>
Appendix XV: In-Depth Development of Learning Scenarios (ON CD)

Appendix XVI: Current Review of Learn Server NM & NT Used in the Design School (ON CD)

Appendix XVII: Mobile Devices, Media Applications and File Formats (ON CD)

Appendix XVIII: Department of Design and Technology Staff Forum

V.L.E Questions

<table>
<thead>
<tr>
<th>Nature of Staff Query And Comments</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems with downloading a large number of files to mark, especially when files are zipped up this creates a lot of work for lecturer! <a href="http://learn.lboro.ac.uk/mod/forum/discuss.php?d=3210">http://learn.lboro.ac.uk/mod/forum/discuss.php?d=3210</a></td>
<td></td>
</tr>
<tr>
<td>Online submission of coursework is an issue because of file sizes of CAD <a href="http://learn.lboro.ac.uk/mod/forum/discuss.php?d=56">http://learn.lboro.ac.uk/mod/forum/discuss.php?d=56</a></td>
<td></td>
</tr>
<tr>
<td>Rollover problems arise as forums are reset every year. Also Rollover process will create a copy of all modules along with all content, and update module codes to the next year. Activities/forums and student information will be reset to start again from a blank sheet. So by default the students won’t see forum postings from previous years.</td>
<td></td>
</tr>
<tr>
<td>Posts don’t get e-mailed to subscribers until the hour. Allowing another hour for the reply, it could take up to two hours for a student to get a reply to a simple question. This is not great for messaging. Note the chat facility was turned off for Learn@lboro.</td>
<td></td>
</tr>
<tr>
<td>Evidence of some advance use in relation to NM &amp; NT. Would you like to put a web link to my Learn blog from the Learn page for my course. Does anyone know how to do this? <a href="http://learn.lboro.ac.uk/blog/?userid=28610">http://learn.lboro.ac.uk/blog/?userid=28610</a></td>
<td></td>
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<tr>
<td>A choice activity is very simple - the teacher asks a question and specifies a choice of multiple responses. It can be useful as a quick poll to stimulate thinking about a topic; to allow the class to vote on a direction for the course; or to gather research consent</td>
<td></td>
</tr>
</tbody>
</table>

List of Staff Room Queries on Learn@Lboro
Appendix XIX: Whether D an T Students Use Facebook to Communicate Design Ideas

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Discussion Topics</th>
<th>No. Of Members</th>
<th>No. Of Wall Posts</th>
<th>Last Post</th>
<th>Evidence of Coursework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Design and Technology</td>
<td>Student Group – Creative Arts</td>
<td></td>
<td>217</td>
<td>40</td>
<td>29/11/2007</td>
<td>link to Youtube animation group from Facebook where students put their Pro E animations</td>
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<td></td>
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<td><a href="http://www.designertechniques.com/designers/robertgallacher1.htm">http://www.designertechniques.com/designers/robertgallacher1.htm</a> Link to graduate of Lough Bio details</td>
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<td></td>
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<td></td>
<td></td>
<td>Dissemination of surveys for data collection in final year</td>
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<td><a href="http://FreeOnlineSurveys.com/rendersurvey.asp?sid=z5m7se9mwdmrw57291331">http://FreeOnlineSurveys.com/rendersurvey.asp?sid=z5m7se9mwdmrw57291331</a></td>
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<td></td>
<td>Links to other Facebook groups on design</td>
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<td></td>
<td><a href="http://lboro.facebook.com/group.php?gid=2233171957">http://lboro.facebook.com/group.php?gid=2233171957</a></td>
</tr>
<tr>
<td>Loughborough Industrial Design Technology</td>
<td>Student Group – Academic Group – Design &amp; after course How to Qs</td>
<td></td>
<td>205</td>
<td>28</td>
<td>28/01/2008</td>
<td>Wall post on Facebook linking to blog</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.dossop.com.es/blog/">http://www.dossop.com.es/blog/</a></td>
</tr>
</tbody>
</table>

This PhD investigates the potential for New Media in Design and Technology Education. The explosion of Facebook over last year has been phenomenal and if educators within Design and Technology could tap into what makes this application useful and engaging, to assist with collaborative communication on design. Firstly, this account sets out to find some evidence that design and technology students are using Facebook. Then this ethnographic account seeks to identify:

- Facebook Groups at Loughborough University on Design
- Are they still in Use?
- Whether there is evidence for using it for their coursework.

Potential: Who are the stakeholders in using Facebook - this type of new media for learning?

What are Stakeholders concerns?

Appendix XX Sustainable Design Module Learning Outcomes

a) Knowledge and Understanding:
On successful completion of this module students should be able to demonstrate knowledge of and understanding of:

- the concept of sustainability;
- key concepts of sustainable design;
- applications of sustainable design;
- the application of methods and tools for sustainable design.

b) Subject specific skills:
(i) Intellectual/cognitive skills:

On successful completion of the module, students should be able to:
- explain the meaning of sustainable design and appreciate associated social, economic, and environmental issues;
- take into account the effect of emerging legislation in their designing.

(ii) Practical/subject specific skills:

On successful completion of the module, students should be able to:
- use creativity to support sustainable thinking;
- use sustainable design methods and tools.

c) Key/transferable skills:

On successful completion of the module, students should be able to:

- study independently and meet deadlines;
- interact effectively with others, for example, through collaboration, collective endeavour and negotiation;
- articulate ideas and information comprehensively in visual, oral and written forms;
- present ideas and work to audiences in a range of situations;
- source, navigate, retrieve, evaluate, manipulate and manage information from a variety of sources;
- employ communication and information technologies;
- use creativity and innovation in problem solving.
Thank you very much for taking part in the questionnaire looking at mobile devices for learning. This questionnaire is designed to gauge your response using mobile devices for learning. This information will be kept confidential in line with laws on data protection.

1. Age: _____

2. Sex: Please Circle: Male/ Female

3. Do you own a mobile device? If so, please circle the type/s below:
   (a) Mp3 player/ iPod  (b) 3G mobile  (c) PDA
   (d) Smartphone  (e) PocketPC
   (f) Other (Please Specify) ____________________

4. Can you name the type/make/model of mobile devices you have e.g. Nokia N90?

5. If you own a mobile phone please specify whether you are on:
   (a) contract      (b) pay-as-you-go

   If on contract when does it expire? ________________________

6. What features of your device do you use?  (Please circle options below).
   (a) Telephone calls: Daily/ Weekly/ Monthly/ Rarely/ Never
   (b) Text: Daily/ Weekly/ Monthly/ Rarely/ Never
   (c) Photo: Daily/ Weekly/ Monthly/ Rarely/ Never
   (d) Audio (e.g. Mp3) Daily/ Weekly/ Monthly/ Rarely/ Never
   (e) Video: Daily/ Weekly/ Monthly/ Rarely/ Never

7. Have you used your mobile phone to go on the Internet before? (Circle below).
   Yes/ No

8. If you have an iPod/mp3 player do you use it for things other than music? (Circle below).
   Video
   Spoken Word
   Other (Please specify) _______________

9. Have you used; (Please Circle)
   (a) Wikis - Yes/ No
   (b) blogs - Yes/ No
   (c) RSS feeds - Yes/ No
   (c) Podcasts - Yes/ No
10. Are there any opinions and/or comments you would like to express regarding the use of your own mobile device(s) to support sustainable design research?


11. Can you tell me about the sorts of sustainable design issues that you are interested in e.g. for a project


12. And FINALLY....
How long approximately have you been using the following:
a) Computer: _________________
WWW: _________________
Mobile phone: _________________
MP3player: _________________
Bloglines or Similar RSS applications _____________

b) If you use Bloglines or a similar RSS application how often?

Daily/ Weekly/ Monthly/ Rarely/ Never

Thank you very much for your help
APPENDIX XXII: Introducing the Research

Sustainable Design Research Tools

Introducing the Research

Investigator: M. Hepburn

The idea behind RSS applications like Bloglines is that there are too many websites to keep track of and new content is always being added to them. Therefore RSS can keep track of all the latest podcasts and new information on websites.

Today we are going to look at how to use bloglines.

HINT! When you see this sign on a website;

Cut and paste the url of the website into Bloglines.

Good luck and thanks for taking part!!
I understand that Marian Hepburn gathers evaluative data on IT related subjects and that the information that it gathers helps to determine the research needs of design and technology students. I also understand that all participants in this study will be asked to take part/ may be asked to participate in one of the following:

- Review of Research plans: what we will do and how (5 mins)
- Pretask Questionnaire: (5 mins)
- Video recorded observations
- A questionnaire sent over email in one month

I have read this consent form and I understand that participation in this study is voluntary. I may refuse to answer any question or discontinue my involvement at any time without penalty. My decision will not affect my future relationship with the university. My signature below indicates that I have read the information in this consent form and have had a chance to ask any questions I have about the study. I consent to participate.

________________________________________
Signature of Participant              Date

________________________________________
Please Print your Name
APPENDIX XXIV: Pilot Study Task Schedule

Sustainable Design Task Schedule

PhD Study

Investigator: M. Hepburn

You are being asked to complete the tasks below. As you move through the interface tell me what you are doing as you are doing it. Thanks for taking part.

- Please complete the following tasks on the computer and tell me what you are doing as you go along

1. Please sign up to Bloglines
2. Locate the help files
3. Add a feed related to sustainable design
4. Go to directories and find ones related to sustainable design
5. Choose and subscribe to a news feed from this directory
6. Find and Subscribe to a Podcast on Sustainability

- Please complete the following tasks on the mobile device and tell me what you are doing as you go along.

7. With the log in you have created, use it to log into Bloglines
8. Go to the directory on sustainable design
9. Choose and subscribe to a news feed that will be useful for your research in sustainable design
10. Create a few clippings on sustainable design
# Appendix XXV: List of Codes used For RSS TRANSCRIPTION

<table>
<thead>
<tr>
<th>No.</th>
<th>Code</th>
<th>CODE MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aff</td>
<td>confirmation by researcher</td>
</tr>
<tr>
<td>2</td>
<td>Cis</td>
<td>Content of learning resources</td>
</tr>
<tr>
<td>3</td>
<td>Cti</td>
<td>Confusion over task/navigation/interface</td>
</tr>
<tr>
<td>4</td>
<td>d&amp;t</td>
<td>Design and technology education specific comments</td>
</tr>
<tr>
<td>5</td>
<td>Dwe</td>
<td>Does not work as expected</td>
</tr>
<tr>
<td>6</td>
<td>Edb</td>
<td>Educational benefits</td>
</tr>
<tr>
<td>7</td>
<td>Edp</td>
<td>Educational potential</td>
</tr>
<tr>
<td>8</td>
<td>Fig</td>
<td>Figures it out from the website instructions</td>
</tr>
<tr>
<td>9</td>
<td>Gqr</td>
<td>General question/answer by researcher</td>
</tr>
<tr>
<td>10</td>
<td>Ibr</td>
<td>Intervention by researcher</td>
</tr>
<tr>
<td>11</td>
<td>iet/sit</td>
<td>Instigates education transfer</td>
</tr>
<tr>
<td>12</td>
<td>Inp</td>
<td>Interface/navigation problems</td>
</tr>
<tr>
<td>13</td>
<td>Mtc</td>
<td>Comments on mobile technology for learning</td>
</tr>
<tr>
<td>14</td>
<td>Neg</td>
<td>Negative view of mobile technology for learning</td>
</tr>
<tr>
<td>15</td>
<td>Ngr</td>
<td>No good resources</td>
</tr>
<tr>
<td>16</td>
<td>Nkn</td>
<td>No knowledge on how to use</td>
</tr>
<tr>
<td>17</td>
<td>Pmf</td>
<td>Problems with mobile device functionality</td>
</tr>
<tr>
<td>18</td>
<td>Rep</td>
<td>Repetition of task</td>
</tr>
<tr>
<td>19</td>
<td>Sar</td>
<td>Student asks researcher</td>
</tr>
<tr>
<td>20</td>
<td>Sgr</td>
<td>Student gets it right</td>
</tr>
<tr>
<td>21</td>
<td>Sih</td>
<td>Student learning habits</td>
</tr>
<tr>
<td>22</td>
<td>Snm</td>
<td>Reference to a type of NM and/or NT</td>
</tr>
<tr>
<td>23</td>
<td>Snt</td>
<td>Student not using internet tools</td>
</tr>
<tr>
<td>24</td>
<td>Sw</td>
<td>Student wishes</td>
</tr>
<tr>
<td>25</td>
<td>Ta</td>
<td>Task abandoned</td>
</tr>
<tr>
<td>26</td>
<td>Tc</td>
<td>Task completed</td>
</tr>
<tr>
<td>27</td>
<td>Tec</td>
<td>Technical issues/technology issues</td>
</tr>
<tr>
<td>28</td>
<td>Ui</td>
<td>Unexpected incorrect try</td>
</tr>
</tbody>
</table>
Appendix: XXVI Foundation Technology Module Learning Outcomes

a) Knowledge and Understanding:
On successful completion of this module, students should be able to demonstrate knowledge and understanding of:
- basic electricity / electronics - current, voltage, resistance, Ohm's Law and Kirchoff's Laws; series and parallel resistors, potential divider, input/output resistance, circuit loading and power;
- the use of software to model simple electronic circuits and basic measuring equipment to analyse and them;
- basic power supplies - batteries, bench power supplies and alternative energy sources;
- basic semiconductor and integrated circuits in simple timing, operational amplifier circuits plus simple sensors and actuators;
- basic programmable devices.

Basic mechanics: statics, centroids, centres of gravity and stability, representation of forces, including friction; basic structures, strength, stiffness, deflection;
- basic mechanisms such as levers, linkages, cams, gears, pulleys;
- graphical, mathematical and computer modelling of mechanical systems;
- constructing mechanical system for analysis;
- calculation for mechanical advantage of simple and variable velocity ratio machines;
- analysis of propriety mechanical products.
- Basic materials: properties of metals, polymers, composites and wood, developments in 'modern' and 'smart materials, processing methods, matching materials to task, materials in service, environmental issues and recycling.

b) Subject Specific Skills:
(i) Intellectual/cognitive skills:
On successful completion of this module, students should be able to:
use scientific principles in the modelling and analysis of electronic and mechanical systems.
(ii) Practical/subject specific skills:
On successful completion of this module, students should be able to:
- design simple electronic circuits using basic discrete components.
- produce simple schematics of electronic circuits using standard symbols.
- use electronics simulation tools to design circuits.
- construct and test simple prototyped electronic circuits.
- use graphical methods to model mechanical force systems.

c) Key/transferable skills:
On successful completion of this module, students should be able to:
- study independently and in teams, set goals, manage workloads and meet deadlines.
- articulate ideas and information comprehensively in visual, oral and written forms.
- use scientific evidence based methods in the solution of problems.

**Appendix XXII - Lecturer Informal Interview Schedule on Vodcasting**

Q.1 The first question concerned graphically reworking the electronics glossary. Regarding this alphabetical walkthrough of all of the electronics symbols, the lecturer was asked would this be a useful addition to the learning materials on the learn server and whether there would be any value for putting this glossary on ipods?

Q.2 The second question which was posed to the lecturer required him to review the digital version of the Workpackages created, which were divided according to the appropriate lesson objective. The lecturer noted there were four types of learning objects;

- mobile video of the whiteboard and other lecturer demos,
- mobile video of the captured screen with the electronics software the lecturer used for demo,
- the DandTVideobasics and
- the podscoll.

Q. 3 Which format would you expect students learn best with and do you expect this will be the same in Design Education in Schools?

Q4 - Do you formally consent to having these videos put on the learn server?

Q5 0WP1 is broken down into 6 examples. Do you think this decomposition will help the students?

Q6 - Would you like the videos to be played on computer as well as the Ipod?

Q7 - Could you cast your eyes on the print out of the learn server changes- Do you approve?

Q8 - One of the proposals is to get videos of all the practical things which you do in the lab, using the equipment, Do you have any things students keep coming back to you for help or questions you always get asked?

Q9 – Does the video zoom and pan effects add to learning
Appendix XXVI: Transcript of Observational Video Data from RSS Study (ON CD)

Appendix XXVII: Vodcast PreTask and Post Task Questionnaire

Student ID: (On Uni Card)

Research Questionnaire

PhD Study 2008

Investigator: M. Hepburn

Pre-Task Questionnaire

Thank you very much for taking part in the trial. I am interested in your views on some D & T videos for learning using mobile technology. The first questionnaire is designed to assess what features you use of your media player/mobile device. This information will be kept confidential and in line with laws on data protection.

1. Age: __________

2. Sex: Please Circle: Male/ Female/ Rather not say

3. Do you own an Mp3 Device or Ipod which can support video? YES/ NO
   If so, do you know the make and model?
   ____________________________________________________________

4. a) Have you used RSS applications before when using the Internet? YES/ NO

4. b) If so, do you use any of the following Feed Readers?
   1. Google Reader
   2. Netvibes
   3. Bloglines
   4. Other (Please Specify) __________________________

5. a) Do you use podcasts from the Internet? YES/NO
   b) Have you ever used video podcasts before? YES/NO
   c) If so, please specify which podcasts?
6. Do you own a mobile device? If so, please circle the type/s below:

(a) Mp3 player   (b) Mobile Phone   (c) PDA/ Smartphone
(e) PocketPC     (f) Digital Camera  (g) iPod/ mp3 with video  (h) Other (Please Specify)
____________________

7. What features of your device do you use?  (Please circle options below).

(a) Telephone calls: Daily/ Weekly/ Monthly/ Rarely/ Never
(b) Text: Daily/ Weekly/ Monthly/ Rarely/ Never
(c) Photo: Daily/ Weekly/ Monthly/ Rarely/ Never
(d) Audio (e.g. Mp3) Daily/ Weekly/ Monthly/ Rarely/ Never
(e) Video: Daily/ Weekly/ Monthly/ Rarely/ Never

Thanks for the info. Can you spare 5 mins now to look at the video on these devices.
Thankyou very much for completing the video learning resources trial. Just a couple of quick questions on your views on the video you have been watching.

1. Did you find the videos useful? YES/ NO

2. At what point in the FT course do you think they would be most useful?

3. Would you use these and similar videos in the lab whilst designing and completing assessments? YES/ NO

4. Do you have any comments about using videos on a small screen to help you design in the lab? For example, quality, screen size etc

5. Can you think of any other D & T modules where you would find mobile video learning resources like the ones you watched useful?
6. a) Do you access the learn server to download and use D & T learning resources? YES/ NO

    b) If so how often and which ones?

7. We are embarking on the D & T Basics program, where mobile video resources would be on-hand to the student. Do you think students would use them in the lab? YES/ NO
Appendix XXX: Participant Responses to Vodcast Pre and Post Task Questionnaire (ON CD)

Appendix XXXI: Review of Costs of Mobile Devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Screen Resolution</th>
<th>Screen Size (Diagonal)</th>
<th>Video Formats</th>
<th>Price (ex vat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPod Classic</td>
<td>320x240</td>
<td>2.5 Inch</td>
<td>MPEG4, H264 (.m4v, .mp4, .mov)</td>
<td>£123 (80GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£182 (160GB)</td>
</tr>
<tr>
<td>iPod Nano</td>
<td>320x240</td>
<td>2 Inch</td>
<td>MPEG4, H264 (.m4v, .mp4, .mov)</td>
<td>£92 (8GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£125 (16GB)</td>
</tr>
<tr>
<td>iPod Touch</td>
<td>480x320</td>
<td>3.5 Inch Wide</td>
<td>MPEG4, H264 (.m4v, .mp4, .mov)</td>
<td>£142 (16GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£199 (32GB)</td>
</tr>
<tr>
<td>iPhone</td>
<td>480x320</td>
<td>3.5 Inch Wide</td>
<td>MPEG4, H264 (.m4v, .mp4, .mov)*</td>
<td>Varies</td>
</tr>
<tr>
<td>Windows Mobile 6.1</td>
<td>Up To 800x480</td>
<td>Varies</td>
<td>Windows Media Video (.wmv)*</td>
<td>Varies</td>
</tr>
<tr>
<td>Creative Zen X-Fi</td>
<td>320x240</td>
<td>2.5 Inch</td>
<td>Windows Media Video, MPEG4</td>
<td>£199 (32GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£139 (16GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£109 (8GB)</td>
</tr>
<tr>
<td>Creative Zen</td>
<td>320x240</td>
<td>2.5 Inch</td>
<td>Windows Media Video, DivX, Xvid</td>
<td>£119(16GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£89 (8GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£69 (4GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£60 (2GB)</td>
</tr>
<tr>
<td>iRiver E100</td>
<td>320x240</td>
<td>2.4 Inch</td>
<td>MPEG4, Windows Media Video</td>
<td>£89 (8GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£69 (4GB)</td>
</tr>
<tr>
<td>iRiver Clix 2</td>
<td>320x240</td>
<td>2.2 Inch</td>
<td>MPEG2/4, Windows Media Video, Flash</td>
<td>£129 (8GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£89 (4GB)</td>
</tr>
<tr>
<td>iRiver B20</td>
<td>320x240</td>
<td>2.2 Inch</td>
<td>MPEG2/4, Windows Media Video</td>
<td>£129 (4GB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£99 (2GB)</td>
</tr>
<tr>
<td>Microsoft Zune</td>
<td>320x240</td>
<td>1.8 Inch</td>
<td>Windows Media Video, MPEG4, H264</td>
<td>£164 (16GB)</td>
</tr>
<tr>
<td>(4, 8 and 16)</td>
<td></td>
<td></td>
<td></td>
<td>£139 (8GB)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£109 (4GB)</td>
</tr>
<tr>
<td>Microsoft Zune</td>
<td>320x240</td>
<td>3.2 Inch</td>
<td>Windows Media Video, MPEG4, H264</td>
<td>£199 (120GB)</td>
</tr>
<tr>
<td>(80 and 120)</td>
<td></td>
<td></td>
<td></td>
<td>£184 (80GB)</td>
</tr>
<tr>
<td>Sony PSP</td>
<td>480x272</td>
<td>4.3 Inch Wide</td>
<td>MPEG4</td>
<td>£129 **</td>
</tr>
</tbody>
</table>

* File formats supported “out of the box” 3rd party software can enable playback of other formats

** PSP requires separate memory stick to store video files on
APPENDIX XXXII: NEW MEDIA AND NEW TECHNOLOGIES GUIDE FOR STAFF

USER GUIDE TEMPLATE
Department of Design and Technology

New Media and New Technologies User Guide for Staff

Embedding RSS into Your Module: A Practical Guide to the Benefits and Implementation of RSS into Design and Technology Undergraduate Education

2009
# Table of Contents

<table>
<thead>
<tr>
<th>Section Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Title Page</td>
<td>1.</td>
</tr>
<tr>
<td>ii. Table of Contents</td>
<td>2.</td>
</tr>
<tr>
<td>1. Getting Started</td>
<td>5.</td>
</tr>
<tr>
<td>1.1 The what, where and why of RSS for Education</td>
<td></td>
</tr>
<tr>
<td>1.2 Creating an Account with an RSS Reader</td>
<td></td>
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<tr>
<td>2. &quot;How To&quot; Summary</td>
<td>5.</td>
</tr>
<tr>
<td>2.1 How to use the Feed Reader Homepage</td>
<td>6.</td>
</tr>
<tr>
<td>2.2 How to add a subscription (or RSS “feed”)</td>
<td>9.</td>
</tr>
<tr>
<td>2.3 How to manage the content from your feeds to enhance your University modules</td>
<td>10.</td>
</tr>
<tr>
<td>2.4 How to Export Your Browser Bookmarks to a Feed Reader (Firefox)</td>
<td>13.</td>
</tr>
<tr>
<td>4. Contact Details</td>
<td>16.</td>
</tr>
</tbody>
</table>
RSS Terminology: Quick Reference

- “RSS” refers to Really Simple Syndication and is a web technology embedded on websites to help you keep track of “syndicated” websites. Syndicated websites have “feeds”.

- Feeds are new information posted on any different forms of “new media”, such as website, blog, wiki or podcast which can be collected in one place through a feed reader.

- “Feed Reader” refers to the application which reads the stored feeds you collect.

- “Subscription” like a link, it allows you to Subscribe to a Feed.

- “Directory” link bar across the top of the webpage and the drop down menus.

- “button” : button style links on the webpage which take you to another screen.
Welcome to a quick reference guide to RSS for your modules. This user guide provides practical know-how on how to use RSS in education, embedding it with the Loughborough University’s existing Virtual Learning Environment (VLE) architecture.

This user guide provides a brief instruction manual with details on how to use RSS in education.

Educational benefits of RSS are many, such as on-hand information about the modules you teach. Other benefits include:

- Managing all types of new media on the WWW
- Minimizing the time spent on important websites
- Communicating important information to students
- Vetting sources from the Internet for students.

This user guide will also keep you on the right track with quick hints and recaps. The user guide comprises four main sections;

1. **Getting Started:** First steps explained, to help you on your way.
2. **“How To” Summary:** To help you with the important tasks you can perform with RSS.
3. **Guidelines:** Some things you need to know about using this technology.
4. **Contact Us:** Any questions on how to use RSS technology

The Colour Guide table and the Website Terminology table, (in Table of Contents above), provide some help to navigate around this user guide. We will be using Google Reader to access all web feeds, you can use one of your choice. **So let’s get started!**
1. Getting Started

Log on to a Feed Reader

Open a browser window of your choice and please go to Google Reader. Please use the log in screen to log in with your username and password. If it the first time you are logging on to the website, a username and password in the first instance, which you change to one of your choice.

First Time Users: Validate Your Details

The first time you log on you will be asked to supply an email address and a user name and password.

2. “How to...” Guide

This brief “how to” guide is based on the important tasks you want to achieve. The tasks which are covered in Section 2 of the User Guide are:

2.1 How to use the Feed Reader Homepage
2.2 How to add a subscription (or RSS “feed”)
2.3 How to manage the content from your feeds to enhance your University modules
2.4 How to Export Your Browser Bookmarks to a Feed Reader (Firefox)

This “how to” guide will help you get the most out of your learning whether you are a lecturer or a student. It provides an innovative way to organise you Internet searching and research, keeping you up to dat with the latest news in a particular field.
2.1 How to Use the Feed Reader Homepage

The first time you enter Google Reader you may have no feeds and your Home page will look pretty empty unlike Figure 1: Google Reader Homepage.

The basic premise of Google Reader is that it works like an Explorer on your computer. The left hand side helps you manage the feeds which you collect and the right hand side of the browser displays some of the content. The Feed Reader homepage will provide a quick glance at the newest feeds which have been updated recently.
Figure 1: Google Reader Homepage

Individual Feeds
2.2 How to add a subscription (or RSS feed)

The concept of subscribing to new media such as a blog is similar to subscription to a magazine. The process is also known as adding a feed. There are several different ways you can add a feed to your feed reader.

1. You can search for a feed or directory of feeds.
2. You can add a feed or directory of feeds manually on the homepage.
3. If you are using new media or a website and you see this symbol
2.4 How to manage the content from your feeds to enhance your University modules

Once you have a few feeds or subscriptions related to you modules you should put them into the relevant module folders, such as "Sustainable Design".

A lecturer can easily share their feeds with students by making available something called an OPML file. This type of file can be generated/ imported and exported between all of the feed readers so that you can share websites and new media that is RELEVANT to the module learning materials.
2.4 How to Export Your (Firefox) Browser Bookmarks to a Feed Reader

If you have new media bookmarked in your browser you can import those websites etc. which are "live", i.e. have regular updated content into your feed reader. First in Firefox browser you have to use an Add On which allows you to export all live feeds to an OPML file. Then you can import this file which will retain the folder structure if you want it to in your feed reader.

Go to Google Reader, then settings, then Import/Export and you can import the live bookmarks.

3. Guidelines for Use
1. Students need to be aware how to use RSS.

2. Students and lecturers need to be in good habits of using RSS.

3. Students have to see some link between the pedagogic value of individual RSS feeds and module learning outcomes.

4. Update Feeds Regularly and Remove Defunct ones

5. Obtain Good Web Sources

6. Encourage RSS Use as Part of Academic Skills

4. Contact Us

If you have any queries on using the guide please contact:

Marian Hepburn
cdmrh@lboro.ac.uk

Thank you for using this guide. Any questions please do not hesitate to contact us!
This research will be concerned with the development and implementation of communication and learning objects within the department of design and technology. A key issue in this research is how to evaluate this implementation of scenarios to ensure that learning is enhanced.

3.9.1 Barriers to action research, elearning and mobile learning

This literature review has sought to highlight potential barriers to this research; these are methodological, organisational and technological.

3.9.1.1 Methodological Barriers

Hearn and Foth (2004) argue that the “action” nature of action research challenges prior theory, leaving the results to “perceptual openness”, thus leading to dialogues between different traditions and paradigms. Methodological barriers can exist where there is difficulty in positing the research within the appropriate research camp. This researcher had many discussions with other lecturers on the value of mixing action research approaches with design science, HCI and other fields.

“Nevertheless, the situation regarding the results of action research may be less bleak. For example, a look at Communications of the ACM finds numerous articles discussing the lessons learned from particular projects, variously described as case studies, systems design, software engineering projects, and more. This stream of work might loosely be classified as of an “action research type,” even though the term “action research” is never used in the articles” (Avison, 1999, p.96).

Avison (1999) explores the use of action research for information science describing how qualitative approaches, such as grounded theory, ethnography and case study research have now gained acceptance within information science. The author argues for the iterative cycle of action research to address complex problems within organisations. She concludes for a more comprehensive framework or “research monograph” (p.99) similar to case study research.

Similarities between design research and action research, (e.g. Buchanan, 2001) was a barrier to this research, in so far as it was difficult to justify initially which research camp this fell into. The use of NM & NT brings about new ways of learning design and technology, and thus new knowledge in this field of education. However, the links between design research and action research are highlighted by Cole, Purao, Rossi and Sein (2005), because they both
directly intervene in “real-world” settings and perform changes in these domains. Järvinen, (2007), compare research paper references to show how design research is similar to action research. They use seven characteristics to compare the two disciplines and draw on a wealth of literature to show how similar they are.

Design research and educational research are typically located in the same methodological camps, being practitioner-based.

1. Practitioner based: a first-hand understanding of the task and domain from an educational or design perspective
2. Cognitive scientist: studies efforts of designers, analysing the processes of design by humans
3. Design theorists or methodologists: principles of design abstracted from human processes (Yi-Luen Do & Gross., 2004).

Thus the educational practitioner who is thinking about doing research into new media in design might want to know how it could be implemented in such a way as to facilitate their goals, i.e. good education. Similarly, a design practitioner would expect research outcomes which are tailored to ensuring "good design" of new media, in accordance with their learner goals.

Buchanan (2001) sums up the reflexive position of design researchers best: “Some see no need for design research, and some see in the problems of design the need for research that is modeled on the natural sciences or the behavioral and social sciences as we have known them in the past and perhaps as they are adjusting to the present. But others see in the problems of design the need for new kinds of research for which there may not be entirely useful models in the past—the possibility of a new kind of knowledge, design knowledge, for which we have no immediate precedents. We face an ongoing debate within our own community about the role of tradition and innovation in design thinking” (Buchanan, 2001, p.7).

3.9.2 Organisational Barriers
The researcher is an agent of change. But if change is not seen as strictly necessary, there will be many challenges. Olesen and Myers, (1999), describe an action research project which failed, and their research highlights some of the difficulties with action researchers who face resistance to change and restrictions out- with their control.

These organisational barriers may arise from a valid perspective, based on what stakeholders see as best practice. Walters, Chamberlain, Press and Tomes (2004), urge not to focus too heavily on computer technology when designing, and call for product design to remain about all of our five senses. They highlight the dangers; claiming human immersion with computers will lead to designs which are not user-friendly. Citing a direct relationship between knowledge and prototypes created by hand, they suggest that the student using the computer too heavily to design will forget the evolutionary nature of the design. Thus they urge keeping the human in human-centred design. Similar position in this department is apparent;
papers by McCardle, () suggest that the reliance on computers will mean that students will not know how to perform simple design tasks such as technical drawing.

3.9.3 Technological Barriers
Zemsky, and Massy, (2004), in exploring what happened to elearning and why, reveal some unfounded assertions behind elearning. The first assumption; - if an elearning architecture was put into place then students would automatically use it. Part of the problem is that there is no consistency in the design which makes learners comfortable with using them. The second assumption, the authors refute the notion that students will be able and want to use elearning. The third assumption was that e-learning would create a new way of teaching. Most teach how they were taught.

Smeaton & Keogh, (1999), also argue that there has been little impact of NM & NT on mainstream teaching in our universities and colleges, due to the shift in normal student and lecturer arrangement, which requires too large an effort on the part of the lecturer. They turned one module into virtual lecture and analysed log file and exam marks from one year to the next. What they found was when virtual lectures are used instead of traditional delivery methods there is no significant difference in grades, as measured by end of year examination marks. It also costs a lot in time and effort to produce the lectures and the server technology is not great.
Appendix XXXVI: Appendix Outlining Cognima Project

Early on in the project steps were taken to identify companies who could partner with this research. Despite two meetings with companies, this never got past scoping stage, due to costs involved passed on to the students.

The picture below details the system architecture for using Shozu software.

Handset costing
Using this software for assessment would involve taking a module with approximately 50 students and dividing them into groups of three or four which would require one device per group. This would mean employing approximately 17 devices. The device chosen for this assessment which is compatible with the Shozu software is the Nokia N90 on O2 network. This device is especially suitable for taking photos. Obtaining a good value contract on this phone would cost £45 per month for a year which amounts to £540 per year per device. Multiplied by 17 = £9180

Photo messaging cost
Photo messaging costs 18.5p per photo. It has been averaged that a group will take approximately 30 photos for the assessed exercise for 17 groups this would amount to £5.55 multiplied between 17 groups £4.35

1. Costs
Getting everyone up to device standard

2. Potential cost for Shozu
Cost 1: There may be faults in device or Shozu setup for access that requires technical support. cost of calls to mobiles
(There are five requirements for use of Cognima software
- your phone's connection settings are pointed to an Internet access point -

Cost 2: the initial outlay for file download of Shozu software. your mobile service
tariff/bundle you may or may not incur a one-off cost, billed by your network operator for
this.

Cost 3: Uploading photos: (for those not on a low data rate tariff, recommended that you
adjust your photo quality and size to the 'medium' setting to save costs.) Compared to this
standard setting, a full size, highest quality photo will typically cost 5 to 6 times as much to
upload. Recommended standard photo is approximately 80kB in size so you can work out
your own upload costs. A high resolution (2Megapixel), high quality photo is typically in the
region of 500kB (but based on the actual image can vary from 200kB to more than 550kB
without any change in the camera settings).

Eg Tariff

Vodafone UK: GBP 18.5p (USD 32.5c)
T-Mobile UK: Less than 4p ("web n walk" tariff)

Potential Cost 4: Small amounts of data are transferred when photo descriptions or tags are
added, images are sent to email addresses or photos are deleted from the phone, or a contact
is transferred. The costs of these are generally insignificant

Potential cost 5: Minimal !use ShoZu instead of the email client on your phone to send
photos via email to friends. With ShoZu, you can send any photo you have already uploaded
to your online sharing site to as many email addresses as you like, as many times as you like
without incurring an additional photo upload charge. You pay only for the cost of transferring
the small amount of data in the destination email address
<table>
<thead>
<tr>
<th>Type of New Media or New Technology</th>
<th>Suitable for the Following Module Learning Outcomes</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wikis</td>
<td>Student controlled: Information – intensive: Any group-based assessment</td>
<td>Useful for a Design Wiki where students go over design ideas and correct each other’s work: Good research tool for peer design projects – allows for critical reflection.</td>
</tr>
<tr>
<td>Blogs</td>
<td>Information – Intensive: Any Individually assessed Los: Student controlled</td>
<td>Useful for individual students design research and shows development of design ideas over a period of time - allows for critical reflection.</td>
</tr>
<tr>
<td>RSS</td>
<td>Information intensive: Useful for either individually or group assessed LOs. Student and/or lecturer controlled</td>
<td>Useful for sharing NM &amp; NT links, could allow lecturer to specify which websites are useful to look at. Auto- updated information ensures latest research on a topic. Demonstrates appropriate research.</td>
</tr>
<tr>
<td>Email/ Instant messaging</td>
<td>Information intensive: Avoid using as time consuming for lecturer / students</td>
<td>Students often ask the same questions in email/ messaging. They should look on the V.L.E for FAQs. Not really good for supporting Los</td>
</tr>
<tr>
<td>Websites</td>
<td>Information intensive: Either as design research tool or to showcase student work.</td>
<td>Websites tend to be too generic for module learning outcomes and lecturers are not happy that some dubious sources from the web are used to inform design research.</td>
</tr>
<tr>
<td>Discussion Forums</td>
<td>Information intensive or hands on learning: Generic research for group or individually assessed work.</td>
<td>Useful to obtain design trends or troubleshooting tips for designing.</td>
</tr>
<tr>
<td>Email Newsletter</td>
<td>Information Intensive: Assists lecturers/ students in their research areas but becomes like spam if regular.</td>
<td>Useful for wider dissemination of information and resources.</td>
</tr>
<tr>
<td>Social Networks</td>
<td>Either Hands on Learning or information intensive: Supports either group or individual learning outcomes.</td>
<td>Some social networks contain a repository of design applications to enable students to design. E.g. Teachnology at <a href="http://teachnology.ning.com/">http://teachnology.ning.com/</a></td>
</tr>
<tr>
<td>Mobile technologies, Phones, MP4 players</td>
<td>Hands on Learning: Individual or Group Los</td>
<td>Useful for just-in-time delivery of learning content at the point of need.</td>
</tr>
<tr>
<td>Gaming Technologies e.g. Kinect</td>
<td>Hand on Learning: Individual or Group Los</td>
<td>Useful for interactive learning and designing.</td>
</tr>
</tbody>
</table>