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Citation: MURRAY, J., 1992. The relationship between ‘modelling’ and designing and making with food as a material in design and technology. IDATER 1992 Conference, Loughborough: Loughborough University

Additional Information:

- This is a conference paper.

Metadata Record: https://dspace.lboro.ac.uk/2134/1604

Publisher: © Loughborough University

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The relationship between “modelling” and designing and making with food as a material in Design and Technology

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Abstract
Food has been identified as a material in Design and Technology. This has led to the expression of much comment and prejudice especially with regard to the relationship between food and modelling. Five topics relating to modelling and food as a material are discussed in this paper.
Definitions of modelling - are they broad enough to encompass the materials and the functions of modelling?
Modelling of ideas - is fundamental to all materials for developing, expressing and communicating ideas.
Cognitive processes - modelling is part of concept formation and engaging in practical activity and therefore essential.
Representational materials used - must be appropriate for the actual materials, including food, being represented.
Teaching and learning implications - students should engage in imaging, modelling and representing ideas.
Teachers should provide students with opportunities for modelling in ways that are appropriate to the student, the intended audience, the materials and outcomes being considered.
The paper demonstrates the relationship between modelling and food as a material through discussion and specific food examples.

This paper explores five topics related to modelling and to food as a material in Design and Technology. The topics are: the different interpretations of the term “modelling”; the function of modelling in Design and Technology education; modelling and forms of representation; the part that modelling plays in cognitive processes and the significant teaching and learning implications of these topics. Each topic will be considered using “food” as a material.

Definitions of the term “modelling”.
To develop an understanding of the relationship between modelling and designing and making with any material it is necessary to explore the meaning of the term modelling. A dictionary offers definitions of the term “model” giving a variety of usages which cover:

- a replica or representation of:
  - a concrete object to show what it looks like or how it works;
  - an abstract idea to make it more intelligible;
  - a blueprint, design or plan for others to follow or imitate;
  - different brands or versions of the same product.

This definition is referring to the word model as a noun, in Design and Technology the active form of “modelling” is more commonly used.

Modelling is a term used to embrace:
- modelling inside the head - cognitive modelling or imaging; and
- modelling outside the head - concrete modelling.

Modelling inside the head includes the activities of imaging thoughts and ideas and shaping and forming those ideas using images and representational forms. These representational forms might be mental pictures: in stills, in series or moving; in the spoken or written word; or using other forms of language such as number or symbols.

Concrete modelling is the taking of the ideas inside the head and developing them outside the head by sketching, drawing, explaining, planning, exploring, experimenting and manipulating materials and communicating the ideas in a tangible form. Both forms of modelling can be used to develop ideas, explore what things look like or how they might work and test them. The tangible evidence of modelling outside the head are referred to as models, mock ups or prototypes depending on their stage of development.

‘Food’ has been identified as one of the materials in D&T for designing and making outcomes. Much comment and prejudice has been expressed over this and people have questioned whether food is a material that can be used for modelling. There is no conflict between the definitions given here and...
food. The dictionary definitions can be exemplified using food:

- a replica or representation of:
  - a concrete object to show what it looks like or how it works - any food product;
  - an abstract idea to make it more intelligible - nutrition;
  - a blueprint, design or plan for others to follow or imitate - a recipe;
  - different brands or versions of the same product - a cheesecake.1

In relation to modelling, foods can be imaged in the mind and the images can be transformed, and food materials can be shaped, formed and represented through and with other materials and media.

The functions of modelling.

The Assessment of Performance Unit Design and Technology project explored the concept of imaging and modelling, and the relationship with design and technology activities:

"As soon as we begin to perceive the outline of a task, pictures or images of solutions start to appear in our minds."2

This relates closely to modelling inside the head, "in the minds eye", imaging, capturing and holding the images or "temporary spatial displays"3 and then manipulating and modelling them outside the head to produce tangible results. Modelling activity is a tight iterative relationship between imaging and modelling as designing and making proceeds, it is at the crux of all 'practical' activity combining the human ability for thought and action. The concrete modelling fuels the ideas for further cognitive modelling which then need to be tried out in a concrete form.

How do people engage in imaging of ideas with foods? Can these ideas be manipulated by cognitive modelling? The following quote shows the possibility of the former:

"Each wine we tasted was accompanied by an imaginary menu, described with much lip-smacking and raising of the eyes to gastronomic heaven. We mentally consumed ecrevisses, salmon cooked with sorrel, rosemary-flavoured chicken from Bresse, roasted baby lamb with creamy garlic sauce, an estouffade of beef and olives, a daube loin of pork with spiked slivers of truffle".4

Use the ‘minds’ eye’ to do the following. Image the food on the table at a children’s party; the children are six years old. What type of potato snack products are on the table? Are they savoury and crisp in texture? Think of a new product that is an interesting shape for the six year olds. What texture, what smell, what taste? Could they be a different colour? Does that work, or is it unappetising? Will the children eat them? What might need changing? This type of guided imagery could be used as teaching strategy to help students appreciate the way in which they can engage in modelling designs for ‘new’ food products.

Modelling as representation.

The National Curriculum order for Technology uses the term modelling in the programme of study and the statements of attainment. The references demonstrate a limited definition of the term modelling and imply that modelling is not fundamental to all design and technology activity, but is somehow restricted to representing ideas in drawings and a narrow range of materials. A broad interpretation that acknowledges the source and development of ideas, and the range of representational forms is required.

The range of forms of modelling as representation includes language, both oral and written and other symbolic forms: number; signs; notation; drawing and three dimensional forms using available, substitute and specific materials.

Modelling of thoughts, ideas or images is essential for demonstrating, developing, clarifying, expressing and communicating ideas with oneself and with other people. Taking the images that have been modelled inside the head to a point outside the head makes them more accessible for oneself and others to predict, to test, to confront, to transform and to appraise. What is expressed by modelling is a result of images in the mind, these are influenced by what can be expressed by modelling outside the mind.

How can images of design ideas in food be drawn out of the mind and shared with others? Sketches of early ideas could be in the form of language as in the spoken or written word. For example could you describe the foods that you would imagine to be on sale in a truck drivers cafe? What happens when someone enters the cafe who requires a vegetarian meal that is low in fat. Ideas for suitable foods could be described in the written or spoken word or through other forms of representation using number, symbols, drawings. As more detail emerges these might need the clarification of, for example, measurement, detail of appearance or make-up, a
recipe. Teaching strategies to help foster this type of thinking can be devised. Less easy is still the question of where the images in the mind are coming from. Are they stored snapshots of previous observations? If so, how does someone who has never observed a six year old’s party or a truck driver’s café, fare?

Modelling and cognitive processes.

Does this concept of modelling tie in with theories of cognitive development? Vygotsky wrote that words follow from objects in speech development. Language, signs and symbols are used for action, and have the potential for reverse action. Vygotsky also writes of the importance of tools in child development. By handling tools and mimicking tasks carried out by others the child learns through observation, action and thinking about what is being done.

"Consequently, the child’s system of activity is determined at each specific stage both by the child’s degree of organic development and by his or her degree of mastery in the use of tools"5

This correlates very closely with the tight iterative process described by the APU and the way in which imagining and modelling is used by humans in order to imagine the world, imagine how it might be different and externalise these imaginings through modelling using tools (including, language, signs and symbols) and materials.

Eisner writes about the importance of symbol systems in the ‘process of concept formation’.

"We can construct models of the world from which we can derive verbal or numerical propositions or from which we can create visual or auditory images. The point is that, while the sensory system provides us with information about the world in sensory form, our imaginative capacities - when coupled with an inclination towards play - allow us to examine and explore the possibilities of this information."6

These writings on cognitive development serve to demonstrate the importance of modelling in relation to all concept formation, and in considering, rehearsing and engaging in practical activity - which is at the very heart of design and technology.

The visual sense is significant but the other senses are also used to observe, interpret and represent thought. Eisner points out that:

"Basic to the understanding of mind is the importance of understanding the functions that the sensory systems perform in the realisation of consciousness...Our sensory system performs an active role in this process by putting us in contact with the world"7

Food, as a material interacts with the visual senses and those of touch, taste and smell. This is important for cognitive modelling in food and responses to these senses can be represented in language and two dimensional forms. In order to pursue the modelling ‘outside the head’ to develop design ideas and the function of modelling, food materials must be used to bring the ideas into a form where they can be tested and modelled to a point of satisfaction in terms of the outcome being developed. Some have argued that using similar materials or the same materials in different ways undermines ‘representation’, but to engage the senses fully in concrete modelling with food usually requires the use of edible materials. The interaction between thought and action is enhanced by the use of food as it enables the breadth of senses to be used and the possible outcome being represented to be appraised appropriately.

Modelling and teaching and learning.

What are the issues and implications for teaching and learning concerning students and teachers? If modelling is fundamental to the development of capability in design and technology how should teachers address the issue of supporting students’ development of modelling strategies?

An important aspect of modelling in D&T is that both students and teachers need tangible evidence of cognitive modelling. Students use modelling to bring their ideas into the ‘real world’ and test them; teachers observe the modelling procedures for evidence of the conceptual modelling that the student has engaged in. However, there is a danger that the outcome of the modelling activity becomes the most significant part of the experience at the expense of the process. Modelling then becomes a series of prerequisite steps that students are expected to take to provide evidence for teachers.

The most important teaching and learning points must be that teachers encourage students to engage in imaging and modelling and support future situations by providing opportunities for observation, drawing upon as many experiences as possible. Modelling images in a rich range of representational methods and materials, not a sterile, hoop jumping, linear route that merely requires conforming to a prescribed convention, is necessary.
Gunstone writes of science:

“Traditional practical work has features which can inhibit the possibility of students restructuring personal theories. For these students, successful assembly of the apparatus became the only significant task. Once this was achieved the rest of the practical was completed in ritualised fashion, with little or no serious thought.8

This could equally apply to traditional school-based work with food. Working to recipes and methods prescribed for particular situations is not necessarily going to foster the imagination in designing with food as a material. Students need to be considering the properties of food materials and how they can use, develop, extend or change those properties in the designing and making of ‘new’ products.

The references to modelling in Design and Technology seem to be largely based on the conventions of a part of the process used historically in craft, design and technology. These raise similar issues to those highlighted above in reference to science and traditional home economics. The wider concept of imaging and modelling is something that all teachers of Design and Technology need to embrace. The range of representational materials must be broad and appropriate for the actual materials being represented. Modelling in food serves the purposes of minimising waste and expense in terms of materials as ideas are developed, trialed and tested; or finding out if the ideas that are being taken out of the head and into ‘concrete’ form will actually ‘work’. However food materials are distinct with some very specific qualities and properties that require it to be handled differently from other materials. Foods are nearly always designed and made to be eaten. This raises the issue of the appropriateness of models. Will a beautifully modelled food item made of a non-edible material be of much value for testing?

“A particular symbolic system is useful for some types of information, but not for others and vice versa. Thus when we choose to become ‘literate’ in the use of particular symbol systems, we also begin to define for ourselves what we are capable of conceiving and how we can convey what we have conceived to others”.9

Conclusion

In conclusion modelling is at the heart of design and technology. This is not just in its facility to enable students to image the world in which they live, consider changes and use thought and action in designing and making responses to these changes; but also in the development of understanding in relation to all the activities being engaged in.

The iterative processes of thought and action, imaging and modelling inside and outside of the head are fundamental to design and technology when working with any of the materials identified in the statutory order (construction, graphic media, food, textiles). Food designers, technologists and home economists engage in modelling with food when they image possibilities for new products and develop and test those images both inside and outside the head. Some interpretations of “modelling” seem to have excluded using food as a material for modelling. The difficulty is not with the material but with the narrow interpretation.

There are implications for teachers and for students. Students must develop the capacity to handle a range of images and use modelling strategies to do this, either by concentrating on snapshot images in the mind, or by encouraging the ideas to flow and synthesising them, then communicating them. Teachers should take responsibility for setting up situations and activities that require students to think and be analytical, to give them opportunities for creating images and for modelling those images in a range of ways that are appropriate to the student, the intended audience, and the materials and outcomes being considered. This involves methods of teaching that contextualise activities, encourage creativity, support designing, reflecting and evaluating and the use of appropriate modelling strategies and representations.

Teachers of Design and Technology could benefit from appraising their understanding of the term “modelling” as used in National Curriculum Design and Technology. The range of materials is broad and there are significant differences between all of them which means that narrow definitions and interpretations of the terms used in designing and making are unhelpful and restrictive. It is essential that “modelling” is interpreted in such a way to clarify its breadth, and that the interpretation encompasses the range of materials in D&T, the range of methods of representation and the functions required from the activity of engaging in modelling.
References