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Kelly's repertory grid: a technique for developing evaluation in design and technology

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Abstract
The paper discusses the potential of applying repertory grid techniques in response to the introduction of the 'Product and Applications' and 'Quality' programmes of study in the new national curriculum for design and technology. The paper draws upon research carried out as part of a series of pilot studies carried out in initial teacher education workshops during the past year. This is an ongoing study currently being extended into infant classrooms. The paper also discusses Phillips (1985) problematic attempt at applying repertory technique in the context of the secondary school design education of boys and girls. The paper concludes by arguing that a modified version of the classic 'triad elicitation method' provided by the repertory grid technique provides a powerful means of revealing students personal constructs of technological products and artefacts.

While the repertory grid technique was initially developed in the field of clinical psychology and is normally applied to elicit the personal constructs of individuals, a group, or 'commonality construct' approach was found to be most suitable in the context of product evaluation. The technique has been found to offer a means by which the researcher/ educator may identify the fundamental categories by which a range of products or artefacts are differentiated by individuals and groups. It also provides a pedagogic device by which alternative evaluations may be challenged in group discussions. It is argued that when adopting this strategy, strongly held, conflicting values may be identified and an open, dialogic approach is required. An educational climate of tolerance and mutual respect must be developed. This also has implications for the degree of 'laddering', or depth of elicitation undertaken in classrooms and workshops.

Traditionally, technology education has been concerned with the production of artefacts, and the development of craft skills and specialist knowledge and technology as a social-cultural phenomenon has generally failed to be recognised. Technology has even been seen as a phenomenon that lies outside of 'culture', an inescapable and largely uncontrollable, sometimes even undesirable but essentially 'natural', by-product of human enlightenment.

Such perspectives see history as a linear process where humanity progresses in the acquisition of knowledge about the world and how it works. According to this account, as the scientific knowledge is applied, new technologies emerge and these, in turn, influence the ways in which we live. From this perspective technology is often seen as shaping society rather than being shaped by it. Thankfully, a very different, and ultimately more optimistic perspective on technology has gained ground in recent years. This is a view that sees technology as simply a social product, determined by human needs and wishes. This view has been strengthened by historical and sociological studies that have shown that scientific progress has not, in fact, followed a simple linear pattern at all. That far from revealing an ever more complete reflection of reality, science has merely developed a succession of elaborate alternative paradigms or models with which explanations of observed behaviour may be made. Technological development has often preceded scientific development and the over simplistic concept of technology as 'applied science' has thus been largely discredited. A much wider recognition of the risks that are faced from ecological disasters in recent years (e.g. The Chernobyl disaster, Global Warming, Oil pollution) have led scientists, politicians and citizens to call for greater control in the production, and responsibility in the use of, technologies.
In first learning how to evaluate the things that they make themselves in terms of the 'needs and/or opportunities' provided by an explicit design brief, students consider their product's suitability for the purposes initially identified. The evaluation of other technological products is, however, a much broader concern. This is a concern associated with the need for education to develop childrens' technological literacy as citizens. The national curriculum 'Quality' and 'Products and Applications' programmes of study require just this, and it is these elements that provide the most persuasive reasons for including technology as an element in the general education of all students. It is in the contexts of teaching these programmes that the undesirable technological side effects of products may be discussed and the ‘winners and losers’ of technological implementation identified. The Nuffield Design and Technology Project has recently published a range of evaluation techniques that may be employed to take pupils from a user-centred viewpoint through to one which considers the appropriateness of a design and its impacts on a wider audience (Barlex 1994).

The Repertory Grid technique also offers a potentially very powerful pedagogic tool. The technique was originally developed by George Kelly in the 1950s. At that time Kelly was employed as a school psychologist and was interested in those described as ‘problem children’. What he wanted to develop was some way of identifying how the teachers who referred the children to him ‘construed’ the children’s problems themselves. What he came up with was a complete theory of ‘personal constructs’. This is a theory that many psychologists believe constitutes a psychology in itself, a psychological paradigm defined formally according to one fundamental postulate and a number of corollaries. The fundamental postulate of the theory is that: a person’s processes are psychologically channelized by the ways in which he or she anticipates events. The theory is thus based upon the notion that far from being programmed ‘rats’ in a maze, human beings create their own network of pathways (cognitive structures/systems). Our major motivation is our need to predict and thus personal constructs are the dimensions that are used to conceptualise aspects of our everyday world. Kelly’s theory suggests that these dimensions are continually being developed, and that those that prove good ‘predictors’ are elaborated, while those that are not reinforced by successful application are ultimately discarded.

The ultimate explanation of human behaviour (for Kelly): ‘lies in scanning people’s undertakings, the questions they ask, the lines of inquiry they initiate and the strategies they employ’. We each construct an idiosyncratic hierarchical system between constructs - where superordinate constructs act in the same way as a ‘class’ in traditional logic. But constructs are bi-polar and always identify a preference. It is important here to understand that these constructs are not considered categorical, they provide only reference axes, the basic contrasts between groups. This distinguishes constructs from concepts. A construct is a personal invention, it says what is similar, what is contrasting and what is relevant.

Repertory Grid techniques were first developed by Kelly to elicit and assess the relationships between personal constructs. Since then repertory grids have been used in a wide range of educational research contexts, and they have also been used in industry. In one study, for example, individual members of a group of quality control inspectors were made more aware of the personal criteria used in judging faults in knitwear garments. In the sometimes obscure language of personal constructs theory, the simplest method of obtaining constructs is referred to as ‘triad elicitation’. The technique is, perhaps deceptively, quite straightforward; one first identifies a number of ‘elements’ that provide an overall context for the study, for example, different personal cassette models. The respondent or respondents are presented with the elements in groups of three and asked to ‘think of a way in which two of the elements are similar yet different from the third’. Having identified some term or phrase used to discriminate between the elements the respondent is then asked what they would consider the opposite to be. The words and
phrases used to determine the differences are thus used to develop the constructs. For example, a respondent may say ‘these two are heavy’ - ‘the opposite is light’ and thus identify the construct heavy - light. While elaborate statistical procedures have been developed to analyse the relationships between constructs an adequate account would be beyond the scope of this introductory paper (see Cohen & Manion, 1980). Having identified the constructs, which, in the case of personal stereo’s might include references to the facilities offered, the sound quality, the products ease of use, and the aesthetic appearance, individuals and groups may be asked to select which end of the bi-polar construct they favour and then to give the reason why. This is a process called ‘laddering’, and it can be used to elicit deeper constructions, in the above example a student(s) might choose the ‘light’ polar extreme - ‘because its more portable’. Thus the deeper construct ‘portable - non-portable’ is identified. Before going on to discuss the ways in which this technique has been used in the classroom/workshop, something must be said about the Sociality corollary. For Kelly; to the extent that one person construes the construction processes of another, s/he may play a role in a social process involving the other person. Despite this recognition, most uses of the technique have, in the past, been restricted to the identification of individual constructs. Perhaps this is not altogether surprising given the psychological basis of the theory. The method does, however, lend itself to social (or sub-cultural) grid construction. As Fransela (1984) put it:

...the individualist standpoint taken by Kelly does not preclude one from construing aspects of life from a group or cultural standpoint. (p160)

Phillips (1985) provides an illuminating illustration of the technique as it has been applied to study secondary school students who were the victims of a curious timetable arrangement that meant that girls were prevented from taking up the ‘design’ option until two years after the boys. Phillips project aimed:

(1) to investigate how children construe designed objects;
(2) to see if children construe objects in a similar way;
(3) to compare a group of children with two years’ design education with a group new to the subject;
(4) to compare the childrens’ perception of the designed objects with that of their teachers, and to test the childrens’ assessment of their teachers’ perception of ‘good design.

(p277)

A good deal of the analysis of the paper is contentious, not least its conclusions, yet it provides some very useful suggestions for classroom/workshop activities. In one phase of the study students were presented with triads drawn from a set of postcards showing a range of historic artefacts. One showed the ‘Mummy cover and coffin of Henutmehit’, another the ‘Venus de Milo’. Each student completed their own grid, and then shared their findings with the group. The grids were supplied by the teacher with the names of the elements provided on one axis and spaces left for the constructs along the other (see Fig 1).

Phillips also suggests:

“Another way of using the grid is to collect construct scales and draw up a large matrix on the blackboard. Then the ticks and crosses are filled in by the group as they reach consensus for each element. This exercise encourages discussions which educate people into seeing alternatives to their own preconceived ideas, while broadening the range of possible future ways of assessing and evaluating objects and ideas”. (p281)

In another phase of the study, the students were presented with triads drawn from a range of ‘elements’ including a saw, a toy duck, a bicycle, a machine valve and a marmite jar, for which they completed their own individual grids. The pupils were then asked to rank the objects on a 10 point scale, a ‘10’ being given for a very ‘good design’, ‘1’ for a bad design. They were also asked to carry out the same procedure predicting how their teacher would rate the objects. Phillips drew out the common
‘consensus’ constructs identified by the students for analysis. The data showed that the boys tended to have simple bi-polar constructs while the girls identified more complex or continuous versions. It is suggested that this is due to the additional two years of design education (presumably having knocked all of the evaluation skills out of them). However, it might just as well be that this is another illustration of the reductionist tendencies of males that are of such concern to feminist epistemologists. Phillips found that despite their being little or no correlation between the boys’ rating of the objects and their teachers, there was a significant correlation between the boys’ estimates of their teachers ratings and the teachers actual ratings. Phillips suggests that this was because the boys have learnt what constitutes a good design ‘in their teachers eyes’. The girls by contrast, with no previous design education, actually held very similar views regarding the quality of the designs as the teacher. Phillips explains this by arguing that the boys are more confident and able to form their own ideas about what constitutes good or bad design. According to Phillips the teachers involved in the study found the technique valuable and were anxious to use it with other groups. The major strength of the technique as they saw it was in encouraging the students to talk about things that would not normally be made explicit, in: ...encouraging the children to focus on some specific features of a group of objects and get them talking(p293 op cit).

In a trial of the technique carried out in initial teacher education (Siraj-Blatchford, 1995a), groups of 3/4 students drew random triads from seven elements; a home made jumper, pocket computer, a boot and Indian bow and arrow, a fluorescent bulb, an electric epilator and a dhava (used to cook chappatis). Fig. 1 shows the grid that the students were given to complete. Having generated a number of constructs the students were then asked to apply each of these to each of the elements as shown in the example. A ‘Y’ or ‘N’ denotes the categories of inclusion non-inclusion, and scores 0 - 10 are applied to those constructs continuously variable (e.g. light - heavy). Finally the differences between the grids of individual and groups were discussed and those areas of consensus identified. The most common constructs applied to the artefacts (in order of frequency) were:
- Modern/Advanced - Ancient/Primitive
- Dependent on Electricity - Non-electrical
- Natural - Unnatural/synthetic
- Clothing - non-clothing item
- Environmentally friendly - Non-
- Environmentally friendly
- Expensive - Cheap
- Basic/survival - luxury item
- Hand made - machine made

The grids provided a context for discussion, and in many cases, having committed themselves to value positions, individuals and groups were anxious to defend those positions; the debate was therefore particularly challenging. The activity also opened up a wide range of issues that would otherwise never have been discussed. It provided a context within which alternative constructs could be introduced, notions of ‘technological advancement’ were questioned in the context of the students concern for the environment. Alternative conceptions of ‘technological appropriateness’ were discussed. One student applied the construct ‘technological - non technological’ which led the group to discuss definitions at some length. The laddering of the constructs led one group of students to argue the case for avoiding the use of electrical energy, this led to a deeper discussion of ecology and the appropriateness of saving labour during periods of unemployment. The importance of conserving non-renewable resources was identified as a major issue and student preferences regarding machine/hand production, reliability and appearance were all identified.

Conclusions

It may be that an awareness of another person's values may be a necessary prerequisite for recognising their needs and thus providing adequate designs in response to them. The Repertory Grid technique has been found to offer a means by which the researcher/educator may identify the fundamental categories by which a range of products or artefacts are differentiated by individuals and groups. It also provides a
Reperitory Grid

Take three of the elements at a time - at random. Think of a way in which two of the elements are similar yet different form the third. The ways in which the elements are similar or different are the constructs.

<table>
<thead>
<tr>
<th>Bipolar constructs (words or phrases)</th>
<th>Dhaa</th>
<th>Electric Graph</th>
<th>Fluorescent bulb</th>
<th>Walking Boot</th>
<th>Bow and Arrow</th>
<th>Pocket Computer</th>
<th>Homemade Jumper</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Non-ecological (0) - ecological (10) sound</td>
<td>7</td>
<td>0 9 5 6 0 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Using Natural Resources - Not</td>
<td>9</td>
<td>0 2 9 10 0 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Need electrical power to use - Did not</td>
<td>Y</td>
<td>N N N Y N Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Natural fibres - Not</td>
<td>10</td>
<td>0 3 8 10 0 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Use to mountain - Not</td>
<td>0</td>
<td>0 Y Y Y 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Advanced Technology - Primitive</td>
<td>0</td>
<td>10 2 2 0 10 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Articles of clothing - Not</td>
<td>N</td>
<td>N Y Y N N Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Battery operated - Not</td>
<td>N</td>
<td>Y N N N Y N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now complete the grid - for categoric constructs use ticks and crosses. For continuous constructs use the scale 1-10.

Finally, for any two constructs of your choice, decide which polar extreme you consider better. Now consider your reason for preferring this end. Why do you think this? This 'laddering process' should elicit further (deeper) constructs.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Dhaa</th>
<th>Electric Graph</th>
<th>Fluorescent bulb</th>
<th>Walking Boot</th>
<th>Bow and Arrow</th>
<th>Pocket Computer</th>
<th>Homemade Jumper</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maintaining life - death</td>
<td>7</td>
<td>0 6 0 1 0 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Products of Nature - manmade</td>
<td>3</td>
<td>0 2 8 10 0 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Needs energy to function - manmade</td>
<td>N</td>
<td>Y Y N N Y N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Wear clothes - summer clothes</td>
<td>N</td>
<td>N Y N N Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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pedagogic device by which alternative evaluations may be challenged in group discussions. This will help students to recognise how things may look from another person's point of view, and hopefully educate them to be more flexible in their own judgements. Of course, strongly held, conflicting values will sometimes be identified and an open, dialogic approach is required of the teacher. An educational climate of tolerance and mutual respect must be developed. This also has implications for the degree of 'laddering', or depth of elicitation undertaken in classrooms and workshops.

Some of the value issues that may be drawn out are particularly demanding and some teachers may feel that further professional preparation may be required. There can be little doubt that this kind of work on values is worthwhile and that design and technology education has a great deal more to offer our students education than any vocationalist account would allow.

References