

# The Design and Technology Association International Research Conference 2006 – Paper Abstracts

## Further Findings of an International D&T Teacher Education Research Study: the DEPTH2 Project

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### Abstract

This paper reports a series of case studies from the new phase of an international project – Developing Professional Thinking for Technology Teachers (DEPTH2). The first phase of the project was a study conducted with both primary and secondary technology pre-service teacher education students in a number of different countries who were given the same teacher-knowledge graphical framework as a tool to support reflection on their professional knowledge. We discovered that, despite the different country contexts, student teachers of technology could articulate aspects of their developing teacher knowledge using the same framework for teacher professional development. The common graphical tool enabled them to set out their subject knowledge, pedagogical knowledge and 'school' knowledge and was useful in helping them become more self-aware (Banks et al 2004). In this second phase of the project we have developed this line of research in two ways. First, we extended the range of participants to include experienced teachers involved in in-service work connected to curriculum development. Second, we looked at the inter-relationship for pre-service teachers between their developing professional knowledge and their own personal subject construct. In this paper, the framework itself is first described, followed by examples of investigations in train across five case studies showing the way that it has been used to illuminate technology teacher knowledge in each case. Lessons are drawn for each country specific investigation, and

some wider conclusions are made that have implications internationally along with some suggestions for further work.

### Key words

teacher professional knowledge, personal subject construct

## The Personal Response to Designing and Making: Investigating PGCE students' feelings as they move through a designing and making assignment

*David Barlex, Brunel University c/o Nuffield Design and Technology, UK*

### Abstract

The purpose of the study reported in this paper was to investigate the way in which feelings of trainee teachers on a one year post graduate certificate of education (PGCE) initial teacher education (ITE) design and technology (D&T) course changed as they moved through a designing and making assignment.

This paper is in four parts. The introduction presents a brief overview of the literature reporting pupils' emotional response to the secondary school curriculum in science and attitudes toward technology. Second, it describes a pilot study in which a cohort of secondary design and technology PGCE trainee teachers were required to record their feelings in response to a designing and making assignment. Third, the paper presents a preliminary analysis of the data, commenting in some depth on the response of four purposefully sampled trainees. Finally, it considers the possibility of this approach being used with pupils in schools.

### Key words

design and technology, designing and making, emotional responses, feelings, initial teacher education

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## Is Design and Technology Education Really Real?

*John R Dakers, University of Glasgow, UK*

### Abstract

What follows is a philosophical argument that will attempt to explore the notion of school based design and technology as vocational education. This is, for some reason, commonly attributed to its qualities which are regarded as different from other types of education – normally referred to as ‘academic education’. I am mindful that this quest is full of dangers and pitfalls and I expect, as a result, to be challenged in my thoughts, and rightly so for is this not what a conference sets out to accomplish? In my arguments I will give an interpretation that seeks to “correlate things which often are not on the surface connected” (Lovejoy, 2001: 21). Things like philosophy and its necessary, but often neglected relationship, with design and technology serves as an example which, as in Plato’s allegory of the cave can help liberate the learner from the false, pre-determined images presented in the shadowy depths of the cave, and lead her up into the sunlight, thereby revealing a reality which is no longer constructed for her, but rather, by her.

I will consider, as my thesis, the concept of vocational education as being what Coffey (1992) describes as the “passing on of manual skills from one generation to the next. [Where] most people were educated ‘on the job’ in particular by experiencing some sort of formal or informal apprenticeship” (11) Moreover, they are “...traditionally viewed in class terms” (Lewis, 1991: 96-97). By mapping this perception of vocational education onto school based design and technology education, I will present an argument that demonstrates, to those that support the notion of design and technology education as vocational, that this is a false representation of design and technology education. This vocational view I will liken, in some sense, to seeing the world from the depths of Plato’s cave. I will, by way of argument, attempt to bring those who hold these views into the sunlight, so to speak, where they might (or might not), (re)construct their views. I will attempt to offer an antithesis

to these contrary views by using Baudrillard’s notion of hyperreality as a means of explication.

## “Ground Control to Moonbase”: Communications technology in primary D&T

*Dan Davies, Bath Spa University, UK; Steve Heal, Neston School, Wiltshire, UK*

### Abstract

This paper reports on a case study of a four-year project undertaken by a Wiltshire primary school, with the aims of enhancing pupils’ use of information and communications technology (ICT) in their learning of design and technology, whilst increasing their confidence in speaking and listening. The work was supported by a grant of £36K from the National Endowment for Science, Technology and the Arts (NESTA) and took as its theme the topic of communication in space. Observations of pupils designing and prototyping geodesic structures in preparation for the moonbase construction have exemplified what Siraj Blatchford (1996) described as a ‘design collective’, in which children draw on earlier experiences and learned skills to design and make with autonomy alongside their peers. The school design and technology co-ordinator was observed to put in place elements of what Harrington (1990) described as a ‘creative ecosystem’, fostering a social or distributed creativity within the school by, for example, involving pupils in collaboratively prioritising design criteria. Observations of pupils working within the moonbase environment and its linked classroom interface have demonstrated methodical yet creative approaches to problem-solving, and a relatively high degree of autonomy, providing evidence of what Loveless (2003) refers to as the “conjectural paradigm” for learning experiences mediated by control technology.

### Key words

control technology, primary, whole-school, context, cross-curricular

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## **Creating a Community of Learners in Design and Technology Education: Triumphs, disasters and lessons learned!** *Wendy Dow, University of Glasgow, UK*

### **Abstract**

This paper is an evaluation of an attempt to create a community of learners in an Initial Teacher Education course. Students who participated were in their third year of a four year Bachelor of Technology Education degree at a Scottish university. As part of the Educational Studies component of the course, students were required to work collaboratively to produce a unit of work based on the Scottish Higher Grade arrangement documents in one of three areas of Technology Education (Product Design, Technological Studies and Graphic Communication). The end of year assessment, however, was to be based not on the actual unit of work produced but on student reflection on the process of collaborative learning and their ability to establish links between practice and theory in the field.

There is a large body of research which demonstrates the importance and value of collaborative working. The many benefits that have been shown to accrue include: superior problem solving (Johnson and Johnson, 1989; 1999); the development and improvement of interpersonal relations (King & Sorrentino 1983); the depth and quality of communication (Deutsch, 1973); increases in self esteem (Slavin 1990); higher achievement, creativity and productivity (Johnson et al, 1978) and increases in intellectual growth (Light, 1992). Arising from Vygotsky's (1978) social constructivist theories of learning and further developed by Wertsch (1984) Rogoff (1990) and Lave and Wenger (1991) the concept of a community of learners extends the notion of both collaboration and mediated learning to address fundamental issues such as equality and identity. Interdependence at a personal, as well as a functional level is therefore considered a necessary criteria for success (Fielding 1999).

Creating this type of community of learners can, however, be more difficult than is sometimes envisaged. Where the predominant ethos of an institution is based on a behaviourist, transmission model of learning, where assessment procedures have the effect of encouraging social comparison and competition, and where implicit epistemological beliefs are already deeply embedded, there can often be strong resistance to change. If future teachers of technology are to create the structures necessary to develop successful communities of learners in their school classrooms therefore, it is important that they should be encouraged to both explore and reflect on alternative ways of working for themselves.

Throughout the year, students were asked to keep a journal of their reflections on the process of collaborative working. Analysis of these journals and interviews with the class tutor provided the data for evaluation of the process. Analysis was carried out using the principles of Interpretive Phenomenological Analysis (IPA) in which the concern is with the individual's perception, as opposed to an objective description of events.

Results of the analysis demonstrated that although the process was very successful in some instances, it was by no means successful for all students. Reasons for this are explored within a theoretical framework relating to group processes (e.g. Tuckman & Jensen, 1978) and implicit theories of epistemology (e.g. Hofer (2001) Schommer-Atkins (2004). Implications for Initial Teacher Education courses are also considered.

### **Key words**

collaboration, learning communities, implicit theories, epistemology, Initial Teacher Education

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## **Game-based Learning in Design and Technology: An evaluation of a multimedia learning environment** *Ester Ehiyazaryan, Sheffield Hallam University*

### **Abstract**

This paper reports on an evaluative study of an interactive learning environment entitled ecoWarrior. The learning environment, aimed at D&T A level students, aims to introduce learners to issues in eco-design and sustainability.

The paper discusses the implications of using interactive media and game-based learning as a way of delivering the abstract concepts which constitute the area of 'sustainability' to learners. The benefits of the interactive medium in terms of stimulus and motivation to the learner are discussed. Through the evaluation of ecoWarrior, evidence is provided of the advantages of using game-based learning in the context of the D&T classroom.

The implications which the interactive digital medium of delivery makes for learning theory are explored. The constructivist paradigm is taken as the basis for the pedagogical design of the learning environment. The specific roles of socio-cultural constructivism and cognitive constructivism are explored as making a distinct and necessary contribution to learning and teaching practices.

The evolving roles of teacher and learner in a setting which includes an interactive learning environment are discussed. As interactive learning environments are a relatively new phenomenon in classroom teaching and learning practices, the degree of intervention which is necessary by the teacher and the nature of this intervention are currently unresolved. The findings of the ecoWarrior evaluative sessions make practical suggestions, based on evidence from observation data, on how this intervention can be resolved.

### **Key words**

game-based learning, constructivism, interactive learning environments, D&T, teachers' role, exploratory talk

## **The Application of Computer Aided Design and Manufacture in School-based Design** *Alister S Fraser and Tony Hodgson, Loughborough University, UK*

### **Abstract**

The increased provision of digital media to facilitate design activity in commercial practice, Higher Education and schools, has led to the need to consider what the likely impact has been on design education.

The potential for Computer Aided Design (CAD) to impact the activity of 'designing' within an educational context is clearly established and it has been identified that many of the activities associated with project-based design could be undertaken using CAD technology. This paper aims to examine the extent to which the potential identified is being effectively implemented in design activity within education. To do this, the paper reports further research on a survey distributed to design and technology departments nationally (Hodgson and Fraser, 2005) and describes the role and impact that CAD may have on aspects of design and technology education.

It reports both teacher and pupil opinions arising from interviews and analysis of student work. It provides relevant case studies to support any conclusions drawn. It notes that CAD/CAM is having a significant and positive impact on the activities undertaken in design and technology education and that, at the very least, this allows participants to make and manufacture items that would not have been possible either by more conventional means or within the time constraints of a modern curriculum. Despite this, the paper suggests the impact of Computer Aided 'design' and the role it can play in the activity of 'designing' is an area of potential not very well established or often recognised. It notes an increasing awareness of how the technology may be used to better facilitate 'designing' and that the use of CAD in design development activity could be seen as furthering the potential already well established.

### **Key words**

CAD, designing, making, manufacture

# The Design and Technology Association International Research Conference 2006 – Paper Abstracts

## **Post-16 Design and Technology Project Work: What are students learning and what is being assessed?**

*Professor Tim Lewis, Sheffield Hallam University, UK*

### **Abstract**

Several sources, such as the Office for Standards in Education (OfSTED) reports and Data News, record the continuing success of post-16 design and technology (D&T). However, there has been a recent debate within the profession about creativity within D&T and how it can be assessed. This apparent success and its links to the creativity debate prompted this research.

Analysis of an AS/A2 specification using Gagne's categories of capability indicates a comprehensive learning experience for students. Gagne (1985) defines five categories for capability, he refers to these collectively as Varieties of capability. Initially this paper explores how these can be applied to the post-16 D&T learning experience.

To gain further insight into post-16 D&T three survey research methods outlined by Wiersma (2000), were used. The first concerned collecting data from teachers by a rapid response questionnaire titled 'Less than a minute of your time'. The second was through semi-structured interviews of students who had recently completed their D&T A' level course. Thirdly triangulation was introduced by the researcher working with a group of AS level students engaged in project work.

The findings indicate that assessment criteria in examination specifications could be limiting learning opportunities particularly where subject knowledge is applied within project work. There is variation in teachers' views of present assessment criteria, many indicating that they would like to apply assessment criteria which reflect the more creative aspects of D&T.

### **Key words**

design and technology, D&T, post-16, AS/A2 level D&T, teaching and learning, capability

## **The Development of Optimisation Decision-making Skills Within the Area of Technology Education Through a Technology Fair**

*Alexandros C. Mettas and Constantinos P. Constantinou, University of Cyprus*

### **Abstract**

The ability to make effective choices and decisions is one of the most important competencies that students need to be successful in life. This paper suggests the idea of using the technology fair as a means for promoting students' decision-making skills. The purpose of the study was to investigate the influence of a procedure of working with primary school children to complete and present a technology fair project, on the decision-making skills of undergraduate primary education students. Pre-tests, mid-test and post-tests were administered to undergraduate students before, during and after the preparation of the technology fair, respectively. Data were also collected from reflective diaries kept by the university students during the preparation of the technology fair. A number of students were selected and interviewed after the completion of the technology fair. The analysis of the results indicates that the technology fair has an influence on improving students' decision-making strategies within the domain of design and technology.

### **Key words**

decision-making, design and technology, problem-solving, technology fair, optimisation

# The Design and Technology Association International Research Conference 2006 – Paper Abstracts

## **Young, Able (Talented) Pupils and Visual-Spatial Intelligence**

*Dr Jim Newcomb, University of Wales,  
Newport, UK*

### **Abstract**

At Key Stage 1, the programme of study for Design and Technology in the National Curriculum in Wales, in relation to 'Designing Skills', simply states that:

'Pupils should be taught to record their ideas, e.g. using words, pictures, sketches and ICT' (ACCAC 2000 p.8)

This paper provides details of a pilot research study, focused on the extent to which young children (infants), as guided learners, can develop competent sketches, as a means of generating, communicating and recording ideas. Here, the emphasis is on young children's management of more formalised drawing formats (orthographic projections) and how these might support the development of pupils' visual-spatial awareness; not least, the ability to visualise objects, or parts of an object, from different perspectives, in a realistic way.

One of my aims was to try and distinguish children whose work demonstrated 'relatively exceptional performance', that is, an aptitude for 'visual realism' and the importance of valuing and nurturing such aptitude across the curriculum.

As such the teaching of design drawing skills is seen as an important element of classroom practice because it can help children to move beyond a pre-schematic stage (4-7 years of age), where their drawings usually demonstrate 'failed-realism' or 'visually unrealistic' depictions of objects (Anning and Ring (2004 p.17), citing the work of Lucquet).

Moreover, as Golomb's (2004) has noted, if teachers structure tasks effectively, then children will adopt unfamiliar orientations and instead of drawing what they know/understand about certain objects, will draw what they see. This may help children to avoid common misrepresentations including: segregation, transparency, mixed views, fold-out and a failure to indicate that one object may be hidden or partially obstructed (occluded) by

another; that is, to use hidden line elimination.

Past experiences have indicated that very young children (six years old and above) are able to secure a sound correlation between two and three dimensional images of an object (product) and to utilise these representations, together with associated talk, to move ideas forward. Mechanisms to support/scaffold children's design drawing output, that I have previously used, include:

- Drawing like a photograph: discussing and labelling photographs as a means of supporting children's three dimensional representations and associated annotation.
- The use of clip art: to support children's recognition of differing viewpoints.
- Exemplar models: allowing children to view a product from a range of perspectives.
- Part-drawings and exemplar drawings: to help children think orthographically, about the relationship between front, side and plan views.

Of these support mechanisms an exemplar model, clip art and photographs were utilised during the pilot study.

### **Key words**

visual-spatial intelligence, relatively exceptional performance, talent/giftedness, orthographic projection, occlusion, visual realism

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## **Student Teachers' Impressions of Primary Design and Technology in English Schools: A pilot study**

*Marion Rutland, Roehampton University, UK; Maggie Rogers, Goldsmiths, University of London, UK; Gill Hope, Canterbury Christ Church University College, UK; Bhav Prajapat, Brighton University, UK; Debbie Haffenden, Brighton University, UK; Martin Seidel, Roehampton University, UK; Dorothy D'Urban Jackson, St Mary's College, UK; Sally Aston, St Mary's College, UK*

### **Abstract**

This paper arose from a joint Nuffield Foundation and Design and Technology Association seminar in February 2002. One of the recommendations was that primary initial teacher education (ITE) trainers, together with teachers in schools, would use their normal working activities to generate data that can be used as the basis for academic papers. Initially it provides the background to the present research project, focusing on concerns regarding the position and status of design and technology in English primary schools since the introduction of D&T as a compulsory subject of the National Curriculum in 1990.

As a result of the seminar a group of ITE providers in South East England from the University of Brighton; Canterbury Christ Church University; Goldsmiths, University of London; Roehampton University and St Mary's College, Twickenham first met in the Summer of 2004. The aim of the research was to develop a clearer understanding of the position and character of D&T in each ITE provider's partner schools. Each provider piloted a questionnaire, developed by the group, in 2004-2005 to gather data of primary student teachers' impressions of D&T and working practices in their placement schools.

The paper presents a summary of data from individual institutions and attempts to analyse and highlight some common key issues across the ITE providers. Finally, the paper draws some conclusions from the research and considers their implications for the planning and teaching of the ITE providers' courses and

partnership links with schools in the future. The paper concludes by considering ideas for further research.

### **Key words**

primary, design and technology, schools, student's impressions, curriculum, resources, initial teacher education

## **Developing a Conceptual Framework for Auditing Design Decisions in Food Technology: The potential impact on initial teacher education (ITE) and classroom practice**

*Marion Rutland, Roehampton University, UK  
David Barlex, Brunel University, UK*

### **Abstract**

The paper presents the final findings and recommendations of the second of two previously reported small scale research and development projects (Barlex and Rutland, 2004; Rutland, Barlex and Jepson, 2005) with specific reference to food technology.

The paper refers briefly to the background to the research activities including key findings from the first research project and preliminary findings (Rutland, Barlex and Jepson, 2005) from the second research project. It outlines the development and refinement for food technology of the conceptual model. This paper focuses on the third food technology interventional curriculum activity implemented during the course and the trainee's use of the food technology conceptual model as a tool to audit their design decisions. It reports on the findings from the interviews with six trainee teachers following the activity. Finally, it reports on the findings from lesson observations during their school practice for the six trainee teachers in the later part of the course.

The paper concludes by considering the impact on ITE and classroom practice of the research projects with specific reference to the conceptual model for designing in food. It comments on the positive use of the conceptual model with the current year group of PGCE Secondary food technology and BA

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Primary Education with Design and Technology trainees and the impact of imbedding the interventional studies into the courses. Reference is made to reflections of teachers and school based mentors of the potential impact of the model as a tool to audit and track the development of design decisions.

## **Key words**

designing, food technology, initial teacher education, secondary, primary, curriculum intervention

## **Developing a Framework for Analysing the Effectiveness of Sustainable Design Websites in Influencing Design Decisions** *Peter C. Simmons, Loughborough University, UK, Kevin Badni, Loughborough University, UK*

### **Abstract**

Sustainable design websites have become a key information gathering tool both in the classroom for students and also within design consultancies.

This paper aims to highlight key issues concerning sustainable design decisions and their impact on design outcomes. These are illustrated by exploring the apparent focus areas of various kettle designs, which demonstrates how weighting factors differently can have a significant impact on design outcomes. A method was devised for creating spider diagrams based on the '12 features model of a sustainable society'. This has been used to analyse the content of 25 leading sustainable design websites. The paper then proceeds to outline the key elements of effectiveness relating to website design. The report suggests further research that will be carried out to aid in the analysis of the effectiveness of sustainable design websites in influencing design decisions.

### **Key words**

sustainable design, effectiveness, websites, sustainability, decisions, usability

## **Who's in Control (of the teaching of computer control)?**

*Torben Steeg, The University of Manchester, UK, Mary Ling, Informatics Computer School, Brunei*

### **Abstract**

The UK National Curriculum (NC) review that led to the 2000 NC Orders (DfEE, 2000) had an emphasis on 'slimming down' the curriculum and removing areas of overlap between subjects. However, computer control was one of a very few content areas that was left explicit in the National Curricula of two different subjects; Design and Technology (D&T) and Information and Communication Technology (ICT).

Previous research by one of the authors (Steeg, 2003) has noted the different approaches to the teaching of control in the two subjects (led largely by the dissimilar ways that control is described in the Programmes of Study for the two subjects) and highlighted some of the implications that this can have for pupils' learning.

At a time when the NC is under review and there is renewed interest in the ways that subjects (and D&T in particular) in schools interact with each other (Barlex, 2000, 2005), it is timely to examine in more detail not just the differences in the teaching of control between ICT and D&T departments but also the ways that schools and departments within them deal with these differences.

To this end, the pilot study reported here examines in detail the ways that the teaching of control is conducted in the ICT and D&T departments of six schools, with a focus on two main questions:

- How is control taught and how, if at all, does the teaching differ between D&T and ICT?
- What collaboration exists between D&T and ICT departments in the teaching of control?

The main data collection was through detailed interviews conducted with the heads of department of both ICT and D&T in each school. This was supplemented by classroom observation of 'control' lessons and scrutiny of the schemes of work for control in the departments.

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The data indicate that there is little collaboration between D&T and ICT departments and that it is common for pupils at Key Stage 3 to be exposed to control ideas in both subjects, but in ways that often have little in common. The implications of this for pupil learning and their attitudes towards D&T are explored.

## **Key words**

control, systems, microcontroller, PIC, ECT, teaching approaches, cross-curricular

## **Ethical Practitioner Research in Design and Technology Education: Developing a position and checklist for an action research project**

*Mike Thomas, Blaengwawr Comprehensive School, UK, Howard Denton, Loughborough University, UK*

## **Abstract**

This paper reviews the ethical issues that need consideration when carrying out a piece of research as a practitioner/researcher. This is based on the lead author's own action research. The paper presents the background to the ethical debate and the practitioner/researcher's professional role and the potential for bias – objectivity/subjectivity. Ethical issues are reviewed in connection with the subjects of the research – school staff and pupils with reference to their confidentiality, anonymity and possible withdrawal. The paper concludes with consideration of the legal implications of carrying out practitioner research in the UK. Finally the authors present a framework for checking ethical issues.

## **Key words**

ethics, design and technology, practitioner research

## **Ideation in a Virtual Reality Learning Environment: A pilot project from Iceland in Innovation Education**

*Gisli Thorsteinsson, Iceland University of Education, Howard Denton, Loughborough University, UK*

## **Abstract**

Innovation Education (i.e.) is a new subject area in Icelandic schools. The aim is to train students to identify needs and problems in their environment and to find solutions: a process of ideation. This activity has been classroom based but now a specific Virtual Reality Learning Environment technology (VRLE) has been created to support ideation. This technology supports online communications between students and teacher and enables them to develop drawings and descriptions of the solutions. The VRLE is Internet connected and the students work online with their ideas in real time. As this learning environment is new it is important to evaluate and explore its use and value in supporting ideation in the context of i.e..

The primary author has run a series of pilot studies to identify the pedagogical issues of using the new VRLE to support ideation within i.e.. In this paper, he discusses the background of Innovation Education in Icelandic Education and reports the pilot studies.

The main aim of the pilot studies was to explore the ways in which ideation was developed in students when using i.e. materials within the VRLE. The researcher used the following research questions:

- What are the pedagogical issues of using the VRLE for ideation in Innovation Education?
- Which issues influence the ideation process in the VRLE in Innovation Education?
- How can the teacher effectively manage such issues?

These questions were explored using a range of specific techniques in an action research model. Data was gathered from three, triangulated, pilot studies. This was analysed and used to prepare a new set of research questions and a more developed exploration using a subsequent series of case studies.

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## Key words

Innovation Education, Virtual Reality Learning Environment, ideation, ideation process, pedagogical model

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## Elementary Students' Beliefs About Designers and Designing

*Malcolm Welch, Queen's University, Canada*

*David Barlex, Brunel University, UK*

*Erin O'Donnell, Queen's University, Canada*

The book of research papers is also available for purchase from the Association, Tel: 01789 470007, email: [pam@data.org.uk](mailto:pam@data.org.uk)

## Abstract

This paper will describe Phase 1 of a three-year study that is investigating how students learn to make design decisions. Three research questions drove this phase of the study: (a) What do students believe designers do? (b) What do students believe about the knowledge and skills designers must possess? and (c) What do students believe about the design decisions made by the designer of a given product?

Data was collected using two questionnaires administered to one class of Grade 6 students. The first, administered prior to students attempting a Capability Task, has provided base-line data for the remainder of the study. The second questionnaire was administered after students had completed a Capability Task and its associated Resource Tasks. Analysis of the data involved descriptive statistics and thematic analysis.

Analysis of the data has revealed that students, who had no previous experience of design and technology education, demonstrated a considerable knowledge of not only what designers do, what skills they need to have and their personal characteristics, but also substantial knowledge of what designers need to know in order to design a range of products. It appears as though their experiences and perceptions of the designed world provide a significant fund of knowledge relevant to learning to design.

## Key words

design education, design decisions