Encouraging creativity with digital technology in early primary classrooms

ABSTRACT:

Australian schools are expected to integrate various uses of digital technology across all subject areas. In many schools the effectiveness of this has been questionable with little application to the development of students' creativity. This paper reports on a pilot study investigating children's creativity during computer-based activities. Examples of children's work from the early years of primary education are presented to illustrate some of the strategies employed by teachers from a government primary school. These examples focus on students working cooperatively to create simple multimedia products as part of either mathematics or SOSE.

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Introduction

In recent years there has been a trend towards questioning the cost effectiveness of the use of computers in schools. Questions such as, "What and how much do students learn through the use of computers?" are being asked. For some people, both advocates and critics, the acquisition of technical skills and competencies justifies the cost of equipment, time and effort by schools in using digital technologies. However, many teachers now believe the major value of technology in the classroom is in the opportunities technology offers for creativity, thinking and problem solving that are not possible in other media. For many years curriculum documents in Australia have included applications of ICT in most school subject areas. However many classroom teachers are not exploiting the educational potential of multimedia as a tool for children's creative thinking by integrating its use into those subject areas traditionally considered to be "non-computer" or "non-creative".

While teachers and learners often use the terms *creativity* and *higher-order thinking* interchangeably, researchers in the area have identified differences between them. In a recent review of creative thinking and ICT it was proposed that creative thinking is thinking that brings together *principles, ideas, information and entities in new and original ways to generate new entities or ideas,* while higher order thinking involves *the mental skills of reasoning, analysis, synthesis and evaluation* (Harlen & Deakin Crick, 2003, ii). Craft notes that *Creativity is an essential life skill, which needs to be fostered by the education system(s) from the early years onward* (Craft, 1999, 137).

The research reported here arose from an interest by teachers of young children from one school in the development of activitie that would involve learners in creative thinking and higher order thinking as defined above. Both the teachers and the researcher believed that children in the early years of formal schooling are able to think and act creatively while using digital technologies.

Purpose of the study

One aim of this pilot study was to investigate children's creativity during computer-based activities in subjects that are often not linked to creativity. The traditional approach is to expect some creativity in arts subjects such as art, music and literature. However the examples illustrated here were produced in mathematics and SOSE (Studies of Society and Environment) lessons.

The primary aim of the study was to determine whether children in the first two years of school were able to use computer software to produce artefacts that could be considered to be creative. More specifically, the study aimed to investigate the creativity of computer images produced by 5-7 year old children by analysing the images using characteristics of creativity proposed in a major UK report.

Creativity is a multi-faceted concept that has many different definitions. The UK National Advisory Committee on Creative and Cultural Education (NACCCE) reported on creativity in a variety of educational contexts, and defined creativity as *imaginative activity fashioned so as to produce outcomes that are both original and of value* (NACCCE, 1999, 30). The report describes four features of creativity:

- Using imagination
- Pursuing purposes
- Being original
- Judging value (NACCCE, 1999, 31-33)

A recent review of research into creativity, learning and digital technology claims that a *characteristic of creativity with digital technologies would be the recognition of the potential of the features of ICT to be exploited and experimented with to support creative processes* (Loveless 2002, 12). Loveless pursues this

idea by linking features of digital technology with the characteristics of creativity proposed by NACCCE (1999). These characteristics, together with the definition of creative thinking introduced earlier, will be used to discuss examples of children's work produced as part of this study.

Setting and background

Over the past seven years, the staff and students at an inner city Melbourne primary school have worked with a university researcher to develop, trial and put into practice some computer-based activities appropriate for students at each year level. The school uses several multimedia packages, including HyperStudio, Kid Pix, MicroWorlds, and PowerPoint. In particular the school has explored the potential of MicroWorlds being used for some purpose at every grade level. The school is located in inner-suburban Melbourne, approximately three kilometres from the CBD. It was originally constructed more than 125 years ago and currently has almost 300 enrolled students. In socio-economic terms the school is very diverse, with some students living in nearby high-rise public housing while others come from "gentrified" areas of the suburb and have professional parents.

Each school term the researcher collaborates with teachers at a particular level to explore various aspects of ICT in the primary school curriculum. Throughout 2003 and 2004 there was a general interest in children's creativity with computers. In these years the researcher worked with children and teachers from grade Prep and 1 during term 4. While every classroom has computers, there are not enough in any classroom for all children to have access. Consequently the researcher works with one teacher and class for 50 minutes in part of the school library where there are 14 computers. This enables a whole class to use the computers by working in pairs.

Method and results

In 2003 the term 4 theme for grades Prep and 1 was based around buildings and homes. Working in pairs, children aged 5 and 6 produced a pencil and paper drawing and then two directed computer-based drawing tasks. Boden (1992) describes a series of activities with primary age children who were asked to draw something they were familiar with, and then with this drawing out of sight were asked to construct a new conceptual space by drawing something that doesn't exist. Boden claims that creativity *involves exploration and evaluation. The new idea must be compared to some pre-existing mental structure, and judged to be "interesting" by the relevant criteria* (Boden, 1992, 63).

A similar task was given to over sixty young children in three classes. In a computer room, but without using computers, children were given paper and a pencil and asked to draw "a house". When this drawing was finished the paper was turned over and the children were asked to draw "a funny house, a house you have never seen". As can be seen from the examples in Figure 1, there were several ways that creativity was demonstrated in the drawings of houses children had to construct in their minds. Note that names used with these examples are aliases and not actual names of the children.

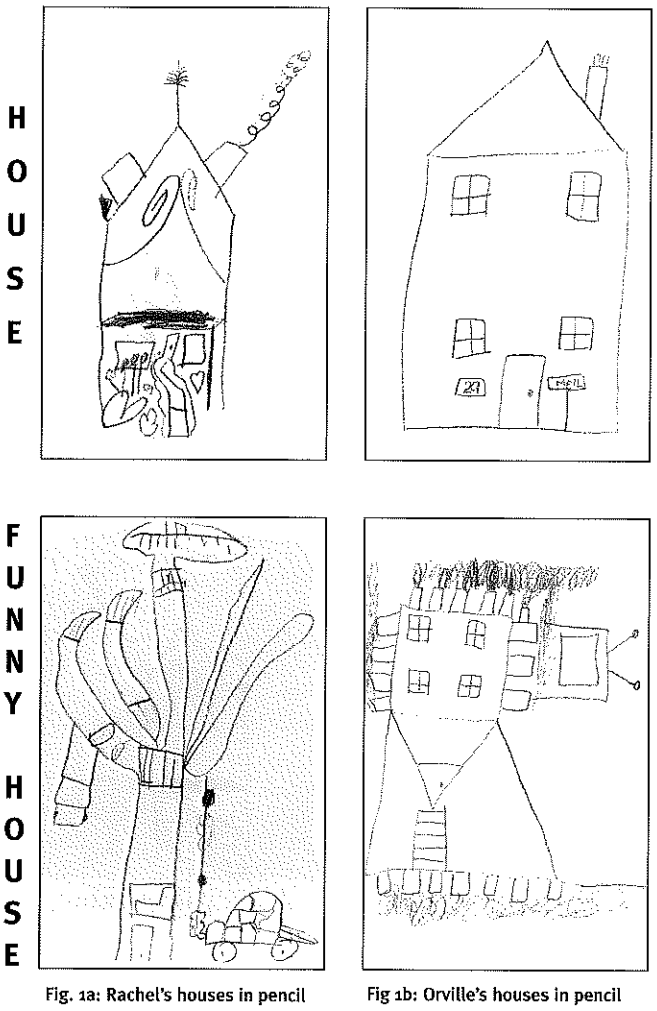

Fig. 1a: Rachel's houses in pencil

Fig 1b: Orville's houses in pencil

Figure 1: Pencil drawings of actual and imagined houses.

In the first session that the children used MicroWorlds they were given the opportunity to explore the drawing tools. For the next session they opened a page containing a green hill (Fig. 2a) and were asked to follow a series of oral instructions. Among the instructions given were: colour the sky blue; draw a tree on the top of the hill; draw a house on the left side of the hill; draw a helicopter over the house. When the teacher decided they had been given sufficient time to complete the drawing the children were instructed to open a new page and draw whatever they liked. The following week they were presented with the second task (Fig. 2b). This time they opened a page containing a set of written instructions in a text box and they were asked to follow those instructions. In the example below the instructions were to draw a red cat, two blue birds, and a tall tree.

In subsequent weeks the children were introduced to single-key Logo. This enabled them to use the Logo turtle to draw straight lines, using F or B, and to turn at right angles, using R or L. They quickly began experimenting with combinations of these commands. In weeks 8 and 9 of the term children were presented with challenges

Figure 2. Alan and Jack cooperatively drawing by following instructions.

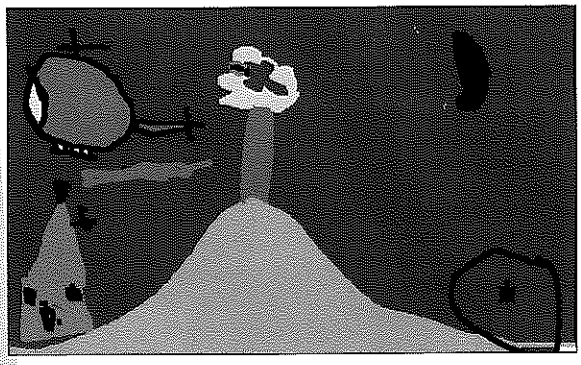

Fig. 2a. Following oral instructions.

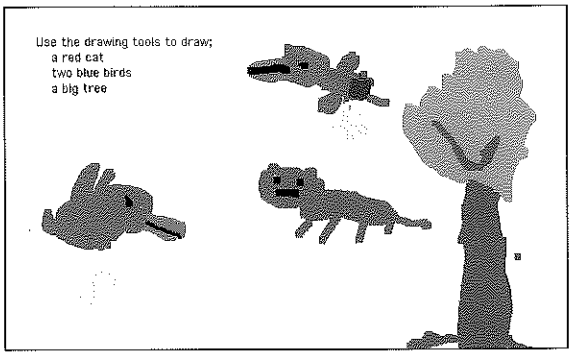

Fig. 2b. Following written instructions.

Figure 3. Ann and Alexs drawing in MicroWorlds using given rectangle procedures.

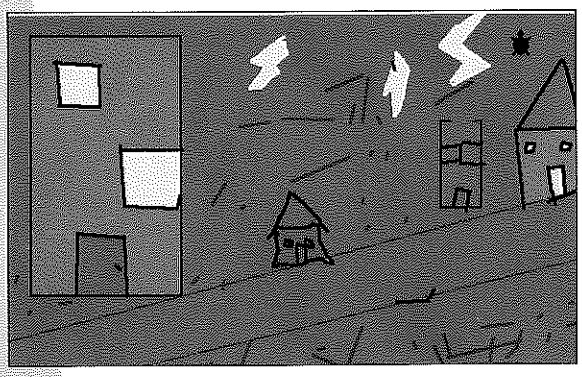

Fig. 3a. Creating a 2-D street scene

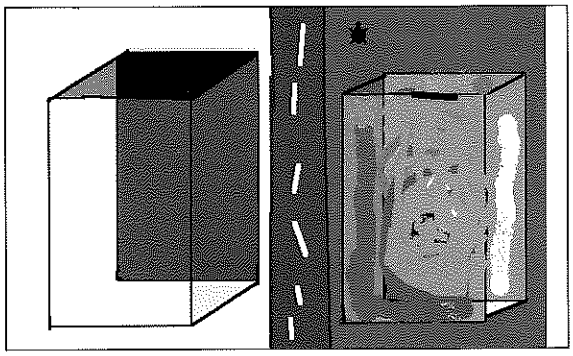

Fig. 3b. Creating a 3-D street scene

based around using a procedure that drew a large rectangle. In week 8 they were asked to drag the turtle to a position towards the bottom left of the screen so that the rectangle procedure, RECT, could draw a large rectangle without going off the screen. This took some practice by all pairs, but eventually it was accomplished. The children were then told that the rectangle represented a building, and they were to add any features they wanted and to make a background. An example from one pair of children is shown in Figure 3a.

Conceptually this was a difficult task for many of these 5-7 year-old children. While the building (rectangle) was aligned vertically and horizontally, the children attempted to draw a road not aligned this way. For many children this caused a form of cognitive conflict because the different alignments did not reflect the reality of the buildings around the school. Note how Ann and Alexs in Figure 3a have aligned the two free-drawn houses with the street, but were unable to do this with the two rectangles created by MicroWorlds procedures.

The final task was planned as a cognitive challenge in both perception and execution. In math classes students had been making and building with cubes and rectangular solids. A whiteboard was used to demonstrate and explain the process of drawing two rectangles, joining up corresponding vertices, and then deleting some lines. A large cardboard box with each face painted a different colour was used as a model. Children were encouraged to view the box from several directions and agree with their partner how many faces they could see at any one time. Then they went to a computer and attempted to represent the box on the screen. The set task was to use the rectangle procedure from the previous week to create the illusion of a 3-D solid on a computer screen. As can be seen in Figure 3b, what children produced was not always what the teachers anticipated. Making the rectangles and joining corners turned out to be a relatively simple exercise, however determining which lines to delete caused problems for most groups.

Implications

What can we learn from analysing examples such as those shown above in terms of the NACCCE (1999) four features of creativity? There are certainly instances of children using their imagination, in both pencil and digital drawings. Even in the quite structured activity illustrated in Figure 2 the children have made the drawings their own while satisfying the set requirements. In Figure 3b the drawing of this pair of girls suggests the mental effort involved in determining which edges of the solid were visible and which were hidden.

In all activities the children, working in pairs, were encouraged to take control of what was asked for by planning together to satisfy the stated requirements and to then personalise their drawing. Perhaps because the activities were different to what they had previously done on computers, there seemed to be acceptance of the tasks as something they wanted to do.

The computer classes always ended with children walking around the room looking at what everyone else had drawn. The computers were turned off, and the children sat on the floor to discuss what they had done, things they liked that others had done, and difficulties they had encountered with MicroWorlds. This brief time for reflection was most informative for teachers, as the young children tended to be open in their comments about their perceptions of the activities.

It was evident that the children valued the computer drawings they produced. Every week there was discussion about whether to save or discard work. In the end it was agreed that pairings for computer work would last for at least three weeks, and each week the pair decided whether or not to add the page they had been working on to their MicroWorlds project. Apart from an occasional disagreement between a pair, almost all pages were saved, suggesting feelings of ownership and value in what was being created. The computer room used for these classes had a laser colour printer. Although the children knew they had a printer limit of two coloured pages per term, they always asked if they could print their MicroWorlds pages to take home and show what they had been doing on the computers.

This study shows teachers that even young children are capable of creativity when working in a computer environment. Throughout this study there was ample evidence of children using their imagination in the artefacts they produced. While the creativity and imagination displayed with computers was different to that demonstrated in the pencil and paper drawings, these characteristics were still obviously present. There is also no doubt that most children were capable of mixing original ideas with the sharing of ideas that characterises computer activities in general and MicroWorlds type activities in particular.

Conclusions

In general, teaching young children tends to be more intensive than teaching in upper grades. Using computers with a class of young children does not lower this intensity. Young children's computing experience is often limited to game playing where there are specific rules and known procedures. When they come use content free software such as MicroWorlds they are confronted with an empty screen and a set of menu and tool bars. For some young children this can be daunting, and they are uncertain about how and where to start.

This did not appear to have any effect on children using their imagination when drawing at the computer. The examples indicate that these five and six year old children were capable of constructing an image in their imagination and then representing their mental construct in either pencil or digital drawings. For teachers this means that both traditional drawing by hand and new digital drawing are capable of providing an appropriate canvas for children to express their creativity. Perhaps this study suggests that teachers need to ensure they offer children opportunities to be creative in both modes. The digital mode is novel and strange to many teachers, but considerably less so for children, even 5-7 year-olds.

Although there is considerably more to creativity than has been investigated in this project, it is clear that young children are able express themselves creatively in various media. In her major review of research into creativity and ICT Loveless (2002, 5) notes, design of strategies for assessment of pupils' creativity with ICT will be complex, and will need to recognise the ways in which our understanding of the interaction between creativity and digital technologies is emerging from practice and reflection. For those of us who work with children the challenges are how to encourage creativity, and then how to recognise and acknowledge children's creative thinking and actions.

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