High-end Creativity

What impact can the use of high-end software have on the creativity of gifted underachievers?

E-Fellowship Research Project
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Introduction

For the last two years I have taught in the ‘discovery class’ of a large urban intermediate school. This class targeted ‘gifted underachievers’, that is students who were deemed not to be realising all that they seemed capable of. It was also rich in information and communication technology, those tools being perceived by me as an effective means to stimulate and extend these kinds of children. The class was a big success; the children were productive, engaged and happy, the parents were thrilled, and educators from all over the place came to visit. But while I knew that things were working I never knew exactly why and thus this research project was born.

Of all the things we tried to achieve in the discovery class I identify creativity as the most important. This is for various reasons ranging from my own strong self-identity as a creative individual to wider professional views of a rapidly changing world where creativity is crucial to success and fulfilment. Hence creativity became the phenomenon I decided to focus on and explore.

Within that room we also had a wide range of information and communication technologies, including hardware, basic school-wide applications, as well as high-end software. I chose the last as the specific context in which to explore the creativity phenomenon, a decision based largely on my knowledge of the children. I knew they loved the high-end approach, they would always choose to work with the fanciest programs available. Based on my own experiences in using applications like Flash and Photoshop I also knew their enormous creative potential.

These interests were combined to create my research question; what impact can the use of high-end software have on the creativity of gifted underachievers?

A question I attempt to answer in a number of ways; Firstly I provide in this research report an overview of the current literature in the areas of High-end Software, Creativity, and Giftedness and Underachievement. Using this literature as a knowledge base, I then describe and examine those creative behaviours displayed by children when working with high-end software. I also attempt to explain just what it is about Photoshop and Flash that inspires and supports creativity and I discuss whether the children’s experience in using the software impacts on them back in their regular class. Finally I offer some suggestions as to what I see happening with these children in regards to underachievement and creativity, placing these behaviours and the children who display them within a wider school context.

I have been interested in working with gifted underachievers throughout my whole teaching career. I continue to feel puzzled and sad that these students, many of whom are among the smartest, funniest, and most unique people I have ever met, should be so unhappy. Education should make these kids feel validated and excited, instead for many it’s a nightmare sentence where they are emotionally and intellectually squashed. Ultimately this project is an attempt to understand these children and to help change their circumstance.
Approaches to Research

As already stated my main research question is:

**What impact can the use of high-end software have on the creativity of gifted underachievers?**

This question is supported by the following sub-questions:

1. How are students creative when using high-end software?
2. How does high-end software facilitate creativity among gifted underachievers?
3. How does the experience of using high-end software and being creative impact on students back in their regular classroom?

Research Context

**Research Setting:**
This research took place at a large Auckland intermediate school. Decile 8, the school is very well resourced both in terms of equipment and staffing.

**Student Selection:**
Initially classroom teachers were asked whether they felt they had any gifted underachieving students with creative abilities in their rooms. Those that did were then asked to observe the student(s) and rate them according to a modified version of the 1996 NZ Council for Educational Research Teacher Observation Scales for Identifying Children with Special Abilities (appendix a). Those children scoring highly in the areas of Self-determination and Creative Thinking, but did not scoring well in the areas of Learning and Motivation were deemed to be gifted underachievers with creative abilities and would be suitable for this study. It should be noted that the Teacher Observation Scales (appendix b) were not originally designed to be used in this way. This approach is completely my own and is perceived of as valid only within the context of this research project.

Five Year 8 children (2 girls and 3 boys) were then selected at random from this group.

**Research Specifics:**
The five children were withdrawn from their regular class one day a week for ten weeks to work in a room purposely set up for the project with five brand new desktop computers. In facilitating the group, no attempt was made by me to integrate the technology into existing classroom topics or specific curriculum areas. I gave some instruction relating to the use of the software but that was the extent of my formal teaching involvement. Students were free to use the software as they wished.

**Philosophical Perspectives**

From a methodological perspective this project sits within the philosophical tradition of Interpretivism. This approach has its roots in the philosophy of hermeneutics, ‘Hermes’ being the messenger of the Olympian gods, the guy who had to master the language of the gods and interpret their meanings to then share with mortal beings (Demeterio 2001).

Although Hermeneutics itself is concerned with the elucidation of texts rather than gods, the key idea remains the same (Myers 1997, Demeterio 2001).
In regards to the social sciences the phenomenon of ‘interpretation’ was first given credence by Max Weber. He postulated that in order to understand a particular economic or social phenomena, one must ‘interpret’ the actions of its participants and not just describe them (Weber 1904), hence the label ‘interpretivism’. Today the essential tenet remains the same;

"Interpretivists assume that knowledge and meaning are acts of interpretation hence there is no objective knowledge which is independent of thinking, reasoning humans" (Gephart 1999:3).

Interpretive research is therefore concerned primarily with subjective knowledge and meaning, specifically how individuals construct and share these within given settings. Myers explains;

"Interpretive studies generally attempt to understand phenomena through the meanings that people assign to them and interpretive methods of research...are aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context” (Myers 1997: 3).

Within my research project I was primarily seeking to interpret how five gifted underachieving students explore the phenomena of creativity with the use of high-end software as a context. I aimed to look at how the software helps the children construct their own meanings for creativity but also at how these definitions influence their further use and interaction with the technology. I also acknowledge that any information I share or conclusions I draw as a result of this project will be my own interpretations of events.

In making my conclusion I also draw upon the philosophy of Critical Postmodernism. This discourse is concerned with revealing and exploring dichotomies of power and the social structures that support them (Gephart 1993, Wells 2004), tending to work at a micro level and investigating hierarchies within a small and specific setting. Acknowledging and exploring school-based power structures are particularly relevant given my project’s interest in ‘underachievement’. In order to explore this concept I must ask, “underachievement according to what criteria?” and then “who developed this criteria and why?” A critical postmodern analysis logically follows.

Research Methodology

This project was a case study operating within the practitioner research discourse that in turn, is part of the qualitative research tradition. The work sits comfortably within these boundaries.

Qualitative Research:
Within the social sciences qualitative research may be described as that research concerned with studying social and cultural phenomena. That is, why and how people perceive, interpret, and act as they do (Yin 1994, Myers 1997, Gephart 1999, Cohen, Manion & Morrison 2000, Schostak 2003). The information gleaned by this type of research is therefore subjective, involving feelings and impressions rather than ‘facts’.
So my research project may be described in the following way; I aimed to subjectively explore how and why gifted underachieving children creatively perceive, interpret and act when presented with opportunities to use high-end software.
**Practitioner Research:**

Traditionally the researcher has sat ‘outside’ of the research topic. They have described and analysed what they’ve seen but not usually participated in it (Dadds 1998, Gephart 1999, Johnston 2000, Metz & Page 2002). Practitioner research stands in opposition to this method. It is about workers studying their own practice and/or working context as they continue to be involved in it. (Dadds 1998, Johnston 2000, Metz & Page 2002). For teacher researchers of this type, the aim is to;

“…understand our work better…the exchange of ideas, theories, practices that help us to make sense of our work and to stop taking our pedagogical practices for granted…to illuminate practice as practitioners themselves understand it” (Metz & Page 2002:43).

Alongside the personal and professional development of the researcher, the approach is also crucially about practitioners affecting change within their organisation, “Good practitioner research helps develop life for others in caring, equitable, humanising ways” (Dadds 1998:41).

In undertaking my research project I was absolutely engaging in practitioner research. I was researching within my current place of employment and also looking at one of the scenarios common to my classroom over the past few years; the use of high-end software to stimulate creativity among gifted underachieving students. My goals were both to develop and extend my teaching practice but ultimately also for some external change in regards to the way gifted underachieving children are catered for at my school.

**Case Study:**

This research project is a case study. Robert Yin defines the case study as, “…an empirical inquiry that investigates a contemporary phenomenon within its real-life context” (Yin 1994:2). Cohen, Manion and Morrison elaborate, stating “Case studies investigate and report the complex dynamic and unfolding interactions or events, human relationships and other factors in a unique instance” (Cohen, Manion & Morrison 2000:181).

Case study researchers do not therefore focus on the discovery of universal laws or absolutes. Instead emphasis is placed on exploring, describing and understanding deeply a limited circumstance, thus allowing “…a researcher to reveal the multiplicity of factors which have interacted to produce the unique character of the entity that is the subject of study” (Haigh 1999:1).

Mavis Haigh says that within education, case studies are, “…the prime strategy for developing educational theory which illuminates educational policy and enhances educational practice” (Haigh 1999:1). Whether or not this is exactly true there does seem to be a consensus about the way specific case studies can illustrate general principles and therefore inform good practice (Yin 1994, Tellis 1997, Cohen, Manion & Morrison 2000).

My case study involved five Year 8 children working with high-end software one day a week for ten weeks. I wanted to explore, describe and understand the impact this had on the children’s creativity. I was also facilitating some of the learning in this context, hence participating in my own case study. Finally, I will use my research to inform my future practice as well as offering it to other educators to do with as they wish.
Data Collection and Analysis

Data Collection:
I collected data in the following ways:

- A literature review of current writing around the subjects of Giftedness and Underachievement, Giftedness and Creativity, ICT and Creativity.
- Structured Interviews with the classroom teachers of the students involved at the beginning and the end of the primary research period.
- Structured interviews with the individual students involved at the beginning, in the middle, and at the end of the primary research period.
- Two unstructured group interviews with all the students involved in the middle and at the end of the primary research period.
- Observations from life, at least one hour per day.
- Observations from video, three half hour sessions from the beginning, the middle and the end of the primary research period.
- The collection of student work samples.

Data Analysis:
The main technique used to analyse data in this project was Pattern Matching. This involves the matching of observed data with existing theoretical knowledge. Internal research validity is enhanced when the patterns ‘match’ (Yin 1994, Tellis 1997, Trochim 2005). This method was used specifically in answering sub-questions one and two of my project;

1. How are students creative when using high-end software?
2. What is it about high-end software that facilitates creativity among gifted underachievers?

For the first of these questions I compared the empirical data gathered from observations (appendix b), interviews and work samples (appendix c) to the NZ Council for Educational Research’s theoretical list of Creative Thinking Characteristics (as explained in the section on Creativity). The list was modified to suit my project and is as follows;

- Produces original ideas and products
- Displays intellectual playfulness, imagination and fantasy
- Creates original stories, plays, poetry etc, or invents things
- Has a keen sense of humour and sees humour in the unusual
- Generates unusual insights
- Demonstrates awareness of aesthetic qualities
- Is not afraid to be different or wrong
- Enjoys speculation and thinking about the future

To answer question two I compared the actual features of Photoshop and Flash against the following list of ICT-related qualities said to promote creativity. The list was developed by Becta (2004) and is furthered discussed in the section answering sub-question number two.
Data Validity:
As with any research project there are issues of data validity. This project should be read and understood with the following aspects in mind:

Artificial Context: Students in this study were withdrawn from the classroom. We worked in a small room, one computer per student, concentrating only on creativity. Again, the ideas and observations made cannot reliably be applied to a regular classroom with thirty children, limited resources and general curriculum concerns.

Teacher Role: This project concentrates on the interaction between children and computers as it pertains to creativity. It was not about my practice as a teacher. But while the project does not concentrate on my role in promoting creativity it is difficult to deny that I did have some influence in this area. While I was never prescriptive, I did offer opinions when asked, I helped, and I reacted emotionally to various students, works, and events. In short I formed relationships with the children and we undoubtedly influenced each other in a myriad of informal, intangible ways.

I have taken the following steps to ensure the accurate analysis of collected data:

Triangulation of Data: Triangulation methods were used wherever possible to authenticate themes and stories. For example, under each creativity indicator I tried to include evidence derived from student process, student product, student and teacher interviews. I also worked to include some or all of these features from more than one child. Constant comparisons between these multiple sources were also made.

Transparent Process: All elements of this research have been open to all interested parties at all times. Parents, classroom teachers, school management were all welcome to visit the students working and to contact me. All were also invited to read and comment on draft write-ups of the project.

Storage of Data: All notes, videos, work samples are kept and available to involved parties for a three-year period. The video in particular forms an authentic archive of what took place, visual ‘proof’ of events. Once the time period is up all data will be destroyed.

Ethical Issues

Surrounding any piece of research involving people is a myriad of moral issues. Cohen, Manion and Morrison discuss the notion of a ‘cost/benefit ratio’. That is the relative weight of the benefits of proposed research as stacked against the potential personal costs of those involved (Cohen, Manion & Morrison 2000). In essence research data scrutinizes a participants actions and when that data is made public,
the effects on individuals involved can range from annoying inconvenience to a complete loss of dignity (Haigh 1999, Cohen, Manion & Morrison 2000, Alton-Lee 2001). In regards to education Alton-Lee believes such a cost is outweighed only when;

“Classroom research is justified when the outcome is educational development –a positive contribution to educational practice and to the daily lives of children” (Alton-Lee 2001:89).

I believe my research project has the potential to change the teaching and learning experience for some individuals. I also hope that with the data authentication strategies already discussed, opportunities for dialogue with all participants, and those ethical considerations I am about to address, the project can be published without causing anyone any harm.

Informed Consent: At the beginning of this project its general aims were provided in writing to the school’s management, classroom teachers and parents. This was supported with contact details and an open invitation for further discussion. I also gained formal written consent to gather and use data from the school principal, classroom teachers and parents. As Alton-lee (2001) suggests I also sat down and discussed the project with the students, asking for their permission and explaining that they had the right to leave the project at any time.

Confidentiality: Participant anonymity is protected firstly by the absence of any school or individual teacher’s name. In regards to the students, personally selected pseudonyms are used throughout.
Discussion of Terms

This section discusses those terms crucial to the research project, defining them in this context and reviewing the current literature. These terms are *High-end Software*, *Creativity*, and *Gifted Underachiever*.

### High-end Software

The term ‘high-end’ simply means the best of its kind. High-end software therefore is software that is the most sophisticated (and typically the most expensive) of its type. *Macromedia Flash* and *Adobe Photoshop* represent the top of the range in their respective application fields.

*Adobe Photoshop* is a graphics editor developed and published by Adobe Systems. It is the market leader for commercial image manipulation, and probably the most well-known piece of software produced by Adobe. It is usually referred to simply as ‘Photoshop’.

*Macromedia Flash* refers to a multimedia authoring system that, like Photoshop, is generally known only by its second name. *Flash* is commonly used as an animation tool but also incorporates a native scripting language called Actionscript that allows users to create interactive works like websites and games.

The children in this project use *Adobe Photoshop version 6.0* and *Macromedia Flash MX 2004*. 
Creativity

What is Creativity?

Creativity is a fiendishly difficult thing to define. In ancient times great creative works were generally credited to divine origin or inspiration (Sisk 1989). As Michelangelo is reported to have said, "I saw the angel in the marble and carved until I set him free." From the mid-twentieth century, explanations of creativity became more prosaic. Approaches generally broke the phenomenon down into three parts; the creative person, the creative process, and the creative product, a variety of definitions appearing under each heading (McAlpine & Moltzen 2004, Edwin, Grover, Shepardson, Treffinger & Young 2002, Sisk 1989).

The most recent research on creativity however has moved away from this three-pronged model, emphasising instead "...the social-cultural influences on creativity and the interconnections between who people are, what they do, and in what context" (McAlpine & Moltzen 2004:145). Such theorists have attempted to come up with a unified theory of creativity and include Carl Rogers (1961), Howard Gardner (1993), and Mihaly Csikszentmihalyi (1996).

As Gowan states "Of all the powers of man, that of creativity seems most unique" (Sisk 1989:1). Perhaps it is this uniqueness that has made the concept so difficult to pin down, or perhaps it is the difficulty that causes the uniqueness. Either way it remains a fascinating and complex topic to explore. In this section of the literature review I will investigate creativity as it relates to two areas; that of gifted and talented education, and that of information and communication technology.

Giftedness and Creativity

In the past concepts of giftedness and talent were linked to intelligence and IQ (Gardner 1983, McAlpine & Moltzen 2004, Ministry of Education 2000). Individuals were seen as innately gifted or not. Over time however, this notion has developed into a multi-categorical concept; that is definitions of giftedness and talent that take into account a wide range of abilities, behaviours and domains (Gardner 1983, McAlpine & Moltzen 2004, Ministry of Education 2000, Renzulli 1986). Joseph Renzulli, one of the pre-eminent researchers in this field describes this shift;

"I think it's worth questioning the whole idea of whether or not a person, especially a young person, is gifted in the absolute sense – that is, in the genetic sense that one has blue eyes or red hair or a dark complexion. Is there a 'golden chromosome' that predicts giftedness? I would prefer to change the concept and talk not about the gifted but about gifted behaviours (their emphasis)...." (McAlpine & Moltzen 2004:80).

Within the gifted and talented multi-category discourse, the notion of creative behaviour has become extremely important. There are two main views of creativity in this area; the first is that creativity is a general element of any type of giftedness. The second is that creativity is a unique type of giftedness in itself (McAlpine & Moltzen 2004: 73).

This section of the literature review discusses both perspectives, looking at some of the major theorists, as well as current attitudes to creativity within the NZ education sector, characteristics of the creatively gifted, and strategies for promoting creativity in the classroom.
Four Views

E. Paul Ellis Torrance is sometimes referred to as “the father of creativity” (University of Georgia 2003:1). He believed creativity was a specific form of giftedness that could be measured and then increased through practice in the classroom (University of Georgia 2003, Goff & Torrance 1990). His method for identifying and measuring students, and the single thing he is probably most famous for, is the Torrance Test of Creative Thinking (University of Georgia 2003, McAlpine & Moltzen 2004, Burns, Leppien, Purcell, Renzulli, Kaplan & Tomlinson 2002, Edwin, Grover, Shepardson, Treffinger & Young 2002), “…the benchmark method for quantifying creativity” (University of Georgia 2003: 1).

The Torrance test is made up of two parts; verbal and figural. The verbal involves students inventing new uses for everyday objects and the figural asks students to use simple shapes (lines, circles etc) to make more complex pictures. Responses in both sections are assessed according to Originality, Fluency, Flexibility, and Elaboration (University of Georgia 2003, McAlpine & Moltzen 2004). Although the notion of testing for creativity is today less popular, these categories are often still used as the basis for creative classroom activities (McAlpine & Moltzen 2004, Gardner 1993).

Other contributions Torrance made to the areas of creativity, and gifted and talented education include the invention of the Future Problem Solving Program (Burns, Leppien, Purcell, Renzulli, Kaplan & Tomlinson 2002), the development of the Incubation Model of Teaching (Goff & Torrance 1990) and ‘Manifesto’, an epic forty-year longitudinal study following creative individuals as they progressed through their lives (Children 2000).

In 1983 Howard Gardner published ‘Frames of Mind: The Theory of Multiple Intelligences’. In this influential book Gardner contends that each person’s intellect is made up in greater or lesser part, of different ‘intelligences’. These are musical, bodily/kinaesthetic, logical/mathematical, linguistic, visual/spatial, interpersonal, intrapersonal and naturalistic (Gardner 1983).

Gardner’s ideas on giftedness and talent relate directly to his multiple intelligence theory. That a person is gifted within a specific domain or intelligence. His ideas on creativity follow suit;

“My statement that a person must be creative in a domain (his italics), rather than across all domains, directly challenges the conceptualization of an all-purpose creative trait…I am focusing on the domains or disciplines within which an individual works…”

(Gardner 1993:35).

Gardner explains his domain-specific theory of creativity in great detail through the book ‘Creating Minds’. In this book he examines the lives of seven exceptionally creative people, each one working within a particular intelligence; Freud represents the intrapersonal, Einstein the logical/mathematical, Picasso the visual/spatial, Stravinsky the musical, T.S Eliot the linguistic, and Martha Graham the kinaesthetic (Gardner 1993).

Joseph Renzulli is one of the most influential researchers currently working in the area of gifted and talented education. In 1978 Renzulli published ‘What Makes Giftedness? Reexamining a Definition’ where he outlined his initial ideas. First Renzulli divided ‘giftedness’ into two main categories; Schoolhouse Giftedness and Creative-Productive Giftedness. Schoolhouse Giftedness is the kind traditionally
represented by IQ scores and the kind schools are most competent at identifying and catering for. Creative-Productive Giftedness however,

“...describes those aspects of human activity and involvement where a premium is placed on the development of more original material and products that are purposefully designed to have an impact on one or more target audiences” (Renzulli 1986:5).

Renzulli believes Creative-Productive Giftedness is made up of three attributes; above average ability (not IQ), task commitment, and creativity. It is the interaction of these three general characteristics within a specific domain that determines giftedness (Renzulli 1986, Renzulli 1998, Ministry of Education 2000). Passionate about helping students meet their full potential, Renzulli built upon his initial ideas and developed the Enrichment Triad Model (Renzulli 1998), a practical method for teachers and schools to meet the needs of Creative-Productive individuals.

Possibly the most interesting and practical research into the area of creativity in teaching and learning in New Zealand comes from Elwyn Richardson. He has spent, “…a lifetime sitting at the feet of creativity…” (Richardson 1993:IX), describing his experiences in a series of books, the most famous being ‘The Early Years'. Richardson believes in creativity as a specific type of giftedness and laments the lack of value placed in N.Z on children with creative ability. He says that traditional methods of gifted and talented identification, such as IQ tests, do not distinguish creative people, nor do traditional methods of teaching cater for their needs,

“I have observed teachers who seem to interfere continually or stimulate (his italics) in the belief that they are leading children to creative conclusions. The outcome is usually unsatisfactory and the children are put off completely” (Richardson 1993:1).

Richardson sees the teacher’s role as more of a facilitator, guiding children and providing information as the children naturally require it as part of the creative process. He concedes that this approach is time consuming and requires high levels of student commitment and work. But Richardson believes that both the intellectual and creative products, when they do come, “…transcend the ordinary…” (Richardson 1993: 49). Elwyn Richardson believes this approach benefits all students as “…all children are potentially creative…” (Richardson 1993:16) but that it works particularly well with those identified as gifted and talented in this way. He describes his experience with one young writer;

“I found I had to be very careful to avoid the mistake of holding within my mind some perfect answer to a question. If I did then Rosanna and the other writers would show me other changes to their styles of work, often far better than the ones I had in mind. Beware of establishing limiting behaviours when gifted and talented children are making developments of this kind” (Richardson 1993:14).

The NZ Position

The NZ Curriculum Framework refers to creativity as a process. Elements of this process are detailed under the essential skill ‘Problem Solving’ (Ministry of Education 1993). Here it states that students will:
• Think critically, creatively, reflectively and logically;
• Exercise imagination, initiative and flexibility;
• Identify, describe and redefine a problem;
• Analyse problems from a variety of different perspectives;
• Make connections and establish relationships;
• Inquire and research, and explore, generate, and develop ideas;
• Try out innovative and original ideas;
• Design and make;
• Test ideas and solutions and make decisions on the basis of experience and supporting evidence;
• Evaluate processes and solutions (Ministry of Education 1993:19).

These are general educational goals for all children. In regards to gifted and talented students the Ministry takes a multicategorical approach, viewing creativity as a potential characteristic of any gifted child in any domain. This is illustrated by the New Zealand Council for Educational Research’s Teacher Observation Scales for Identifying Children with Special Abilities (1996). With this scale teachers are asked to observe and rate against five sets of characteristics, one of which is Creative Thinking. Teachers are asked to notice the following in their students:

- Produces original ideas
- Displays intellectual playfulness, imagination and fantasy
- Creates original texts or invents things
- Has a keen sense of humour and sees humour in the unusual
- Generates unusual insights
- Enjoys speculation and thinking about the future
- Demonstrates awareness of aesthetic qualities
- Is not afraid to be different
- Generates a large number of ideas
- Is prepared to experiment with novel ideas and risk being wrong

The attributes used in this scale signify the most common personality traits of creative people as determined by numerous studies. These include Getzels and Jackson (1962), Torrance (1981), Perkins (1981), The Institute of Personality Assessment and Research at Berkley (1989), and Davis and Rimm (1998). They are a clear general guide and provide the basis for the creativity indicators I use in my project.

**Characteristics of the Creatively Gifted**

Those characteristics just discussed represent the positive aspects of creative individuals. Torrance’s research is interesting in that he includes less positive characteristics. According to him, creative individuals also;

- Question and challenge authority
- Are resistant to routine
- Are indifferent to social convention
- Have limited interest in things they perceive as unimportant
- Are uncooperative
- Are absentminded
- Are stubborn
• Display cynicism
• Are disorganised
• Display emotional intensity
• Engage in heightened levels of activity (McAlpine & Moltzen 2004:75)

Both George Prince (Sisk 1989) and Mihaly Csikszentmihalyi (1996) have a more complex view of the creative personality. Based on the notion of paradox, Csikszentmihalyi states that creative people are, for example:

“…smart yet naïve, playful yet disciplined, alternate between imagination and reality…humble yet proud, rebellious yet conforming, capable of great suffering and great joy…” (Csikszentmihalyi 1996:27).

Prince concurs,

“Creative individuals display, among other things, generous selfishness, intoxicating steadiness, disciplined freedom, difficult delight, ephemeral solidity, demanding satisfier (sic), accustomed amazement” (Sisk 1989:13).

The above characteristics pertain to all creative people, both adults and children. Sisk says though, that while the creativity of adults is judged in terms of their, “…quantity and quality of patents, theories, books, works of art or music and scientific hypotheses” (Sisk 1989:4), with children “…the product may be original with the child, but not original with the culture” (Sisk 1989:4). That is, children are deemed to be gifted when things they create are exceptional in relation to their age or their peers, not because it is necessarily original or unique to the wider society.

Māori Perspectives

Multicategorical definitions of giftedness and talent have given rise internationally to multicultural interpretations of the same. In New Zealand, researchers like Jill Bevan Bell (McAlpine & Moltzen 2004) and Cecylia Hyde (2001) have been exploring Māori concepts of what it means to be gifted and talented. Both women believe that Māori take a more holistic view of giftedness where special abilities are inextricably linked to wider cultural concerns and where, “…interpersonal relationships and aspects of spirituality are highly prized and emphasised” (Hyde 2001:2).

It is within this context that Māori notions of creativity must be understood. The following excerpts illustrates this, showing how Māori carver Tuti Tukaokao and his work are linked to the past;

“Tuti is primarily preoccupied with the inner charge of creativity which he feels he shares with his ancestors, but he would deny that his function is to simply maintain or copy what has forefathers did. He justifies his view by saying, ‘We cannot do justice to those things which our ancestors left us. I wouldn’t dare try to carve the things they did with stone chisels. I’d make a mess of it for sure. We can’t accomplish with the steel chisels we have, what they did with stone’ but that does not mean that his work is inferior to that of his forebears. He has simply taken the next step…taken up his more efficient tools and moved forward. ‘We should go further still. Take up the work from where our ancestors left off. I’m trying to’” (Mataira 1984:39).
And how he and his work are part of a wider community;

The pursuit of his own creative inclination is what Tuti would most like
to do, but he has a social conscience and is required to work within
the confines of the traditional mode to meet what he says his people
expect of him. A fully carved meeting house and two traditional war
canoes are testimonials of his social conscience” (Mataira 1984:39).

**Fostering Creativity in the Classroom**

In his 1996 book ‘Creativity: Flow and the Psychology of Discovery and Invention’
Csikszentmihalyi argues that instead of asking “what is creativity?” we should be
asking “where is creativity?” (Csikszentmihalyi 1996:27). This is a particularly
relevant question for teachers because, “…in identifying those conditions under
which creativity is likely to flourish, educators have some influence in providing an
environment wherein creativity can emerge and be enhanced” (McAlpine & Moltzen
2004:146).

It is important for teachers and schools to provide these kinds of quality
environments both for the individuals involved and for wider society. Gardner states;

“The quality of these early years is crucial. If, in early life, children
have the opportunity to discover much about their world and to do so
in a comfortable, exploring way, they will maximise their potential as
learners and accumulate invaluable ‘capital of creativity’ on which they
can draw in later life” (Gardner 1993:31).

And Renzulli elaborates;

“In a modern, post-industrial world, national goals such as creativity,
inventiveness, and entrepreneurship…will determine which nations
initiate the ideas and provide the leadership for continued productivity
and indeed, even the preservation of a democratic way of life”
(McAlpine & Moltzen 2004:2).

Unfortunately, despite this kind of importance being placed on creativity, studies
have shown that creative children are often less liked by their teachers (The Institute
of Personality Assessment and Research at Berkley 1989, Giles 2004, McAlpine &
Moltzen 2004). Giles believes this estrangement is due to,

“…the different directions that a creative thinking and self-guiding
learner will take, which is usually not where the teacher has planned
to take the class as a whole group” (Giles 2004:3).

The situation undoubtedly relates also to the less desirable personality traits of
creative individuals as discussed earlier.

What then can a teacher do to value and develop creativity within their classroom?
Deborah Fraser says that in terms of their general practice, teachers should do the
following;

- Encourage creative behaviour, attitudes, ideas –celebrate eccentricity
- Make time for students to play with new ideas and become engaged
- Acknowledge there is little that is ‘right’ or ‘wrong’ in life
• Get students to ask questions and pose problems
• Value humour
• Value mistake making
• Allow time for being alone and working with others (McAlpine & Moltzen 2004:163)

There are also several pedagogical ‘tools’ that can assist teachers in fostering creativity. Some of those most widely used include Art Costa’s ‘Habits of Mind’ (2000) (interestingly, many of the intelligent behaviours emphasised here correspond with the personality traits of the creative individual), Edward de Bono’s ‘Thinking Hats’ (Mindtools 2005) (the green hat targets creative thinking specifically), Gardner’s ‘Multiple Intelligences’ (1983) (involve all the intelligences in lesson planning so students have a chance to be creative in their area of strength), Benjamin Bloom’s taxonomy of questioning (Bloom 1956) (the higher order thinking processes generally involve creativity), as well as thinking maps and brainstorming (Pohl 2000), visualization (Sisk 1989), and metaphor (McAlpine & Moltzen 2004).
Giftedness and Underachievement

What is Underachievement?

Traditional definitions of educational underachievement rely on a comparison between an individual’s perceived ability or potential and their actual output (Whitmore 1985, Peterson & Colengelo 1996, Shaine 2000, McCoach & Seegle 2001, Gallagher 2004, McAlpine & Moltzen 2004). McCoach and Seegle provide a typical example:

“Underachievers are students who exhibit a severe discrepancy between expected achievement (as measure by standardized achievement test scores or cognitive or intellectual ability assessments) and actual achievement (as measured by class grades and teacher evaluations). To be classified as an underachiever, the discrepancy between expected and actual achievement must not be the direct result of a diagnosed learning disability” (McCoach & Seegle 2001:3)

They go on to explain Gifted Underachievers as students who achieve ‘superior’ scores in standardized or IQ tests and who therefore have a larger ‘gap’ between their actual and realised ability.

Models like this place the onus of underachievement on the student involved. They have their roots in psychology (Sparks 1993, Gallagher 2004, Centre for Applied Motivation 2005) and essentially operate from a diagnosis perspective where individuals are identified as ‘at-risk’ or ‘suffering from’ underachievement. The concept of a diagnosis naturally carries with it ideas of ‘prescriptions’ and ‘interventions’ and Elizabeth Sparks believes that efforts to ‘cure’ underachievement have,

“…unleashed a burst of energy onto the educational landscape…channelled towards reversing the personal and societal hazards of low achievement and at-school failure” (Sparks 1993:6)

In attempting to limit underachievement schools and educators have worked to identify related trends and factors. Schools then provide special combative programs based on these criteria.

A Diagnostic Approach

One common approach to identifying gifted underachievers is for teachers to match up suspects with a list of student characteristics or ‘types’. Many of these kinds of profiles have been developed. Whitmore provides three categories in which to fit gifted underachievers (Whitmore 1985) while the Centre for Applied Motivation lists four (Centre for Applied Motivation 2005). Rimm has developed a list of twelve “…prototypical stereotypes” (Rimm1995) and alternately Clarke has sixteen (Clarke 1997) and so on.

In N.Z we have our own list provided by the Ministry of Education in the supplement ‘Gifted and Talented Students: Meeting Their Needs in N.Z Schools’. It provides the following profiles of gifted underachievers;

- The rebel, who doesn’t see the value of tasks set.
- The conformist, opting for mediocrity so as not to appear different.
• The perfectionist, who avoids taking risks due to fear of failure.
• The victim, blaming their lack of success on the system.
• The distracted learner, preoccupied with issues in their personal life.
• The bored student, lacking challenge.
• The complacent learner, who won’t push him/herself (Ministry of Education 2000:24)

Once gifted underachievers have been diagnosed there are a number of prescribed mechanisms for ‘fixing’ them. Some of the most common include counselling (Whitmore 1985), parental involvement (McAlpine & Moltzen 2004, Gallagher 2003), behavioural restrictions (Shaine 2000), withdrawal or ability groups (McAlpine and Moltzen 2004, Riley, Bevan-Brown, Bicknell, Carroll-Lind, Kearney 2004 ) and/or a change in the way the curriculum is delivered through extension, enrichment or differentiation (McAlpine and Moltzen 2004, Riley, Bevan-Brown, Bicknell, Carroll-Lind, Kearney 2004 ). Schools may also choose to adopt one or more of a variety of specifically designed gifted and talented education programmes. Examples of these are Renzulli’s Triad Model (Renzulli 1986) and Betts Autonomous Learner Model (Ministry of Education 2000).

### Constructed Success

The diagnostic approach to underachievement has in recent years come under a fair amount of criticism. Detractors have described it as “dehumanizing” (Sparks 1993) arguing that it defines children not by who they are but by what they are not (Rimm 1995, Shaine 2000, Karevsky & Keighley 2003, Gallagher 2004).

Critics also object to the overriding notion of the underachieving student as an inherently flawed individual, suggesting instead that schools and their curricular should take some responsibility (Rimm 1995, Karevsky & Keighley 2003, Gallagher 2004, McAlpine & Moltzen 2004).

The core of this argument is that the diagnosis model focuses only on traditional academic achievement, and that the child is ‘underachieving’ only because it is being measured against an institution’s culturally constructed definition of success. It is all about context. As Nobel Prize winning author Isaac Bashevis Singer states, “When I was a little boy, they called me a liar, but now that I am grown up, they call me a writer.” In both instances he is telling stories. It is simply that the circumstances in which he tells them have changed and better ‘fit’ his activity.

In regards to gifted and talented education there are a number of scenarios that illustrate the bias of traditional school values and approaches.

Firstly there is the fact that world-wide, children from cultural minorities are under-represented in gifted and talented initiatives. (Ford & Thomas 1997, Valencia & Suzuki 2000, Coleman 2003). Gay Gallagher states that,

> “The construct of achievement (and therefore underachievement) differs from culture to culture and may be quite different from that of dominant culture…this…raises doubts over the recognition of valued achievements, adequacy of valued achievements, along with low teacher expectations” (Gallagher 2004:2).

Jill Bevan-Brown says that New Zealand is no exception. She argues that,

> “…in Aotearoa/New Zealand it is the Pākeha male who defines and shapes the direction of society. Under such a hegemonic system, it is the white, male concept of special abilities that is accepted, encouraged and provided for” (McAlpine & Moltzen 2004:183).
According to Bevan-Brown this bias is reinforced by teachers, the majority of whom are "…white, middle-class, monocultural and working in an education system that is predominantly ethnocentric" (McAlpine & Moltzen 2004:184). She finishes by saying that in such a system, "…it is natural that their own culturally laden concept of special abilities will influence who gets identified and what type of programme is provided for them" (McAlpine & Moltzen 2004:184).

Gifted students with physical disabilities in N.Z face similar kinds of challenges. Sue Hermon says that these kinds of students are generally recognised only for their disabling condition. She says there are a number of reasons teachers and schools don’t ‘see’ the gifted aspect of their nature. These reflect the prejudice of the institution and include;

- The use of assessment procedures designed for students without disabilities.
- Students with disabilities may not display obvious signs of giftedness when compared with nondisabled peers.
- Students may be regarded as "slow" because of their disability, thus precluding any recognition of giftedness (Hermon 2002:2).

Ethnic minorities and children with disabilities are two groups very obviously ‘different’ but there are some less conspicuous differences that may also work against children in a conventional school setting.

In 1981 Dr Linda Silverman coined the term ‘visual-spatial learner’. By this expression she meant people who think in images, people who see the ‘big picture’ (Silverman 1990). The visual-spatial learner is the antithesis to those who learn in an auditory-sequential manner. Auditory-sequential types are good listeners, able to express themselves verbally and prefer their information broken down into a logical step-by-step succession. In contrast the visual-spatial child is a good observer, often seeing things as a whole and taking some time to express themselves verbally because they have to translate the pictures in their head into words (Silverman 1990, West 1997, Maxwell 2002,).

Maxwell and West similarly contend that most schools teach in an auditory-sequential style. Both the curriculum and the day are broken down into bits and there is an emphasis on talking and writing as the supreme modes of expression (Maxwell 2002, Gallagher 2004). As a result gifted children who are visual spatial learners may feel neglected, frustrated and “…in some cases the conventional educational system may eliminate many of those who have the greatest high-level talents, especially when these talents are predominantly visual rather than verbal” (Gallagher 2004:11).

Theresa Gallagher also argues a similar case for gifted sufferers of Attention Deficit Hyperactivity Disorder (ADHD). She works to, “…dispel the notion that a brain which can focus on dull things for a long time is more advanced. Bees can do that!” (Gallagher 2004:2).

**Gifted but not Talented?**

Francoys Gagné provides a differentiated definition of giftedness and talent. He says there is a clear distinction between the two concepts;
“Giftedness designates the possession and use of untrained and spontaneously expressed natural abilities in at least one ability domain…Talent designates the superior mastery of systematically developed abilities and knowledge in at least one field of human activity…” (Gagné 1991:1).

So for example someone may be a ‘gifted’ athlete in that they were born with a knack for physical activity, but they are a ‘talented’ soccer player, having learnt the requirements of the game and being able to work skilfully within them.

It is interesting to apply these concepts to those groups of underachieving students just discussed. It would seem that while these children are definitely ‘gifted’ (in intelligence or creativity or social ability or whatever) they are not ‘talented’. That is they have not “…the superior mastery of systematically developed abilities and knowledge in (the) field of human activity” that is education. For whatever reason they have not managed to work successfully within the confines of school.

### Underachievers and Nonproducers

There are many reasons why gifted children fail to realise their talent in a school environment. These include the mismatch of achievement values as already outlined, family pressures (Shaine 2000, Gallagher 2004, McAlpine & Moltzen 2004), pressures from the peer group (McCoach & Seegle 2001, McAlpine & Moltzen 2004), gender expectations (Peterson & Colangelo 1996, McAlpine & Moltzen 2004), a lack of appropriate learning strategies on the part of an individual (Peterson & Colangelo 1996), psychoanalytic issues (Sparks 1993, Shaine 2000) and the emotional and physical ‘oversensitivities’ of gifted children (Tiller 1996).

Children who underachieve as the result of one or more of these scenarios generally do so against their will. That is things feel out of their control and they commonly experience feelings of low self-worth, low motivation, guilt, frustration and negative attitudes towards learning, school and teachers (Whitmore 1985, Shaine 2000, McCoach & Seegle 2001, Karevsky & Keighly 2003, McAlpine & Moltzen 2004).

According to some theorists however, there is another kind of gifted underachieving student. Termed ‘Selective Consumers’ by Delisle and Galbraith (2002) and ‘Nonproducers’ by Karevsky and Keighley (2003) these children consciously and deliberately underachieve in response to a school system that does not meet their needs.

Delisle and Galbraith say that unlike other gifted underachievers, Selective Consumers are self-assured, confident, motivated, creative and have excellent learning strategies. They say that they exercise all these faculties outside of school, “…suggesting their boredom is not dispositional but rather related to a lack of stimulation and challenge in their classes” (Delisle and Galbraith 2002:43).

Karevsky and Keighly agree and emphasise the significance these children place on learning:

"Learning is perceived as an essential force in their lives, one from which they derived their sense of identity. Their learning was often self-directed…Schooling on the other hand was generally a tiring, frustrating experience…” (Karevsky & Keighly 2003:7).

They continue, explaining that these students actually find boredom and learning mutually exclusive, “They are never bored when they are learning and they are never learning when they were bored” (Karevsky & Keighly 2003:8).

These gifted children are fed up with the “…copying, memorizing, regurgitating, repetition, waiting…” (Karevsky & Keighly 2003:2) of daily school life. They feel
frustrated by the lack of challenge and opportunity and resent school, confident in
their right to a satisfying education. Sally Reiss therefore concludes “…gifted
students who are not challenged may actually demonstrate integrity and courage
when they choose not to complete work that is below their intellectual level” (Reiss
1998:2).
Karevsky and Keighley concur, “Not working is the most honourable response to the
activities they are offered in the guise of education” (Karevsky & Keighley 2003:8).
It is interesting to note that according to Karevsky and Keighly’s study, these kinds of
gifted children are able to distinguish between individual teachers and school as a
whole. Most of the students involved had had at least one teacher who was flexible,
responsible and caring, and with whom they had had powerful learning experiences.
They “…do not generalize their frustration with uncaring teachers to all teachers”
(Karevsky & Keighley 2003:7).
They do however act out their general school dissatisfaction, challenging authority,
resisting routine, displaying cynicism, stubbornness and indifference (Reiss 1998,
Delisle and Galbraith 2002, Karevsky & Keighley 2003). Their behaviour is in fact an
almost identical match with E. Paul Torrance’s list of that displayed by creative
individuals as discussed earlier in this report (McAlpine & Moltzen 2004:75).

**Loss of Human Potential?**

One of the reasons educators are so concerned about underachievement is the
perceived loss to society of the abilities of the gifted individuals involved (Peterson &
2004). The following statement by Roger Moltzen is typical of this view;

“…underachievement among the gifted and talented is a significant
issue because of the loss to society of unrealised potential…while
the nurturance of special ability is first and foremost a commitment
to the fulfilment of the individual, to overlook the potential of
individuals of exceptional ability to contribute to the betterment of
society is naïve” (McAlpine & Moltzen 2004:371).

Moltzen backs up this statement with another common idea, that is the high
possibility that gifted children who haven’t lived up to their promise will turn to
What follows logically from these arguments is the idea of giftedness ‘at risk’ (Sparks
1993) or giftedness as ‘special needs’ (Ministry of Education 2005) with the gifted
underachiever as the paradigm case. And schools are therefore compelled to
‘reduce risk’ or ‘meet needs’, helping the gifted underachiever to avoid a life of crime
and making society a better place for all.
Underlying this entire model is the assumption that if you succeed at school you will
succeed at life. This is a problematic notion and one that is not borne out by
evidence.
History is full of uncompromising individuals who failed at school, refused to ‘buy in’
but who succeed in various creative fields. From Thomas Edison, whose junior
teacher famously described his brain as ‘addled’ to Mary Wollstonecraft, who was so
affected by the inadequacy of her instruction that she devoted it an entire chapter in
her treatise ‘A Vindication of the Rights of Women’. Frida Kahlo was always in
trouble at her school, Terry Pratchett was indifferent to his. Karl Bunday (1996) has
researched the attitudes of Nobel Prize Winners towards school and 12 of them
hated it. Rabindranath Tagore, winner of the literature prize in 1913 wrote;

“…my mind had to accept the tight-fitting encasement of the school
which, being like the shoes of a Mandarin woman, pinched and
bruised my nature on all sides and at every movement” (Bunday 1996:1).

1953’s winner Winston Churchill echoes these sentiments;

“How I hated this school, and what a life of anxiety I lived there for more than two years. I made very little progress in my lessons and none at all in games. I counted the days and the hours to the end of every term when I should return home from this hateful servitude…” (Bunday 1996:6).

Roger Moltzen quotes a study that tracked 1500 gifted individuals from primary school to adulthood. While the adults did achieve success it was nowhere near that predicted from IQ tests and school achievement (McAlpine & Moltzen 2004). Interestingly one child who was rejected for the study because his IQ wasn’t high enough did go on to win the 1970 Nobel Prize for Physics. So the ‘giftedness at social risk’ argument falls down in this area. Success at school does not mean success at life. But there are other detractors from this model who object to its capitalist basis. Vacca and Padak say the contention resembles nothing so much as an insurance policy, the term ‘at risk’ referring to the probability of loss to the insurer (school on behalf of society at large) (Vacca & Padak 1990). Galagher describes it this way;

“The basic idea presented here is that gifted individuals through their work can expand the total pool of resources available to us all with their creations and discoveries. If we can encourage more of such activity through special educational programs, then we will all have more resources available, even if they are not totally equally distributed. That, anyway, is the rationale for the free enterprise system of the uses of intellect and talent” (Gallagher 1990:286).

Other critics object to definitions of the term ‘at risk’. Elizabeth Sparks understands “…being-at-risk not as a problem to solve but as a way of dwelling in possibilities for giftedness” (Sparks 1993:2). She says that being ‘at risk’ does not have to be negative;

“This other voice agrees that being-at-risk makes us vulnerable, but being vulnerable both opens us to danger from an encounter with the unknown and opens us to delight from exciting new possibilities of that encounter” (Sparks 1993:12).

She says that these ‘encounters’ can be recognized as gifts and that by,

“…giving oneself over to the creative spirit of risk, expecting the unexpected that erupts through the calm and opens the way to adventure in life…the spirit of risk guides us to constantly go beyond who we actually are to live in our potentiality for who we are becoming” (Sparks 1993:26).

Sparks follows this up by arguing for an ontological definition of giftedness. That is discovering the essence of your giftedness and developing it to become the best person you can be (Sparks 1993).
How are Students Creative when using High-end Software?

To answer this question I measured students against seven creativity indicators. Students were observed and interviewed in regards to both their working process and their finished products. For clarity I have used the creative thinking indicators as headings in this section.

(Student) Produces Original Ideas and Products

The students in this group all had very strong personal visions. They never seemed unduly influenced by anything external, either in regards to the way they worked or the objects they produced. This was established on the very first day when each student undertook the making of a small flip-book type animation using Macromedia Flash. All the children instantly did their own thing, there was no interest or concern in the work of others and no ‘what are you doing?’ type questions. As a result five very different animations were produced (Fig 1):

Fig 1.

<table>
<thead>
<tr>
<th>Animation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphing Man by Andrea</td>
<td>Features a man walking along and turning into a bird as he does so. He eventually flies off into the sky. “The classic stick figure falling down a hole,” is how Sarah describes her piece Dumb Guy, and Animation 1 by Cleetis is simply a dripping tap. In Fly Man by Bobby, a man catches a fly with his abnormally long tongue, and the last piece Stuff Stuff by Kirk is an abstract work featuring spirals and swirls.</td>
</tr>
<tr>
<td>Dumb Guy by Sarah</td>
<td></td>
</tr>
<tr>
<td>Animation 1 by Cleetis</td>
<td></td>
</tr>
<tr>
<td>Fly Man by Bobby</td>
<td></td>
</tr>
<tr>
<td>Stuff Stuff by Kirk</td>
<td></td>
</tr>
</tbody>
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Morphing Man by Andrea features a man walking along and turning into a bird as he does so. He eventually flies off into the sky. “The classic stick figure falling down a hole,” is how Sarah describes her piece Dumb Guy, and Animation 1 by Cleetis is simply a dripping tap. In Fly Man by Bobby, a man catches a fly with his abnormally long tongue, and the last piece Stuff Stuff by Kirk is an abstract work featuring spirals and swirls.

There are some superficial similarities between some of the animations. For example the featuring of male figures in Dumb Guy, Morphing Man and Fly Man, or the human/animal hybrids of the last two pieces, but these are accidental. In fact Andrea was surprised that she wasn't the only one to make a cartoon with a fantasy bent. She states;

“I stand out quite a bit in my class...because of my imagination, cos I’m quite into fantasy and stuff like that and when I make anything, drawings or anything they think it’s weird".
All the members of the group continued to take a strongly individual and original approach throughout the entire period of the research, both in regards to the content of their work and also to its form; Bobby for example chose to stick with Flash when everyone else moved on to Photoshop, Andrea chose to use photographs when everyone else drew their images, Kirk decided not to use sound when others were, Cleetis explored simplicity in his work when others were into detail and Sarah preferred to make one really complex piece rather than several simpler ones as created by the rest.

No one in the group even attempted to use clip-art, preferring every time to create their own images. The one time I did supply source files the students complained and modified them, Andrea actually refused to use them so strong was her personal vision. She made her own files instead.

The students also often used the words ‘original’, ‘unique’, ‘different’ and ‘random’ when describing their own work. (The word ‘random’ seems to connotate a positive but unusual idea that came out of nowhere, that bears no relation to anything currently going on in the author’s life).

The strength and uniqueness of these children was something commented on by all their class teachers;

(on Cleetis) "…he thinks outside the square…"

(on Bobby) "He’s a very creative boy. Nobody else does anything like him".

(on Andrea) “She definitely thinks outside the square, she thinks very differently from the rest of the class and she’s never shy to share her opinions in class”.

(on Kirk) "I try talking to him and finding out some way he can do what he needs to do but put his own spin on it".

(on Sarah) “(She’s) going outside that square from perhaps what the other children would interpret from the instructions, she’ll perhaps do something a wee bit different”.

The students all agreed with these statements, stating that one of the reasons they enjoyed working in the research group was that it gave them the opportunity to express their own original ideas. This seemed to be in contrast to their regular classrooms where they often felt frustrated by a lack of freedom;

“...It's just better. It’s just good how you can describe yourself and I don’t like being confined...like (with) what to do, just like working on Maths problems with everyone else doing the same problems...this is pretty flexible and you can just carry on with whatever”.

   Bobby

“...It’s good as well because I think I’m happier at school now because I’m doing lots more exciting things that I want to do because it really sucks when you have to sit in class and do all this boring stuff that you have no interest in and if you have no interest in them you won’t learn properly of them”.

   Andrea
“In the regular classroom...like Maths and stuff, they’re telling you what to do. With this you can be yourself and do whatever you want and you’re still learning at the same time so it makes it quite enjoyable”.

Cleetis

Andrea and Sarah’s teachers agreed with this, stating that the class timetable in particular inhibited the girls’ ability to fully develop their ideas;

(on Sarah) “She has trouble stopping when she starts activities. She gets quite absorbed and it seems like she hasn’t heard the instruction but if you say her name again she’ll go ‘Oh O.K’ and grumbles a bit...Yeh struggles with stopping”.

(on Andrea) “She doesn’t really finish things off and I don’t know whether it’s because the class is too structured for her and we just go onto the next thing and she’s not given enough time to finish things off and explore to her full potential...because we’ve got deadlines and things are due and she might be only halfway through something...she doesn’t just stop where you’re supposed to stop. She just keeps making sure that it’s exactly what she wants and I don’t know if there is an ending”.

(Student) Displays Intellectual Playfulness, Fantasy and Imagination

For clarity I will deal with each of the above three phenomenon in turn.

Intellectual Playfulness I defined as an awareness of the difference between form and content and a conscious referral to that difference in a student’s work. Kirk, Cleetis and Andrea all produced pieces illustrating this idea. The first of these appears in a group piece called ‘Delightful’. Here Kirk makes a visual pun of the project title (Fig 2).

Where all the other children draw pictures of things they found delightful (strawberries, books, money and butterflies), Kirk deconstructs the word itself using the letter ‘D’, a ‘light’ bulb and a ‘full’ glass;

Fig 2.

In his second piece Kirk intersperses commentary about his abstract animation within the animation itself. He imagines his audience watching and undermines their reaction with statements like ‘Stuff’, “What the hell is this?” and ‘I know most of that didn’t make sense. That was the point’ (Fig 3).
Kirk describes this post-structural approach almost as a form of self-preservation;

"It was meant to be something then eventually it didn’t work out so I just added all this stuff…put the words in and did all this stuff. It’s just a habit I have. I always have to confirm that I know it doesn’t make sense. I always like to confirm even if it’s bad that it’s not my fault…If something turns out to be good I just say it’s good but if it turns out to be bad I say it was intentionally bad and I knew it was going to be”.

Andrea and Cleetis’s versions of intellectual playfulness are much more subtle. Andrea created a pond scene where the viewer could click and drag on objects with the mouse, arranging lily pads, stones and other pond paraphernalia to their individual liking (Fig 4). She also changed the usual mouse arrow into a dragonfly and in doing so she draws attention to her work as a constructed object. She acknowledges that the viewer needs tools (the mouse) to access the work but that the tool itself can also become part of the piece. She says;
“I noticed that dragonflies, they fly around ponds and stuff so I thought Oh I'll do my mouse as a dragonfly because it's going around the pond”.

Fig 5.

'Bunch of Circles' by Cleetis works in a similar way. In this animation a ball appears to bounce off the edges of the operating system window. Like Andrea, Cleetis is relating the content of his work to its form –the created world of the ball is part of the actual world of the computer. The work cleverly acknowledges itself as constructed in this manner.

Fantasy I have defined as those elements that relate to the traditional fantasy genre; mystical beasts, anthropomorphism, other worlds and the like. There were examples of this kind in the work of all the children except Kirk. These included a dragon from Andrea, a sun with a face from Sarah, a flying saucer from Cleetis, and a Cyclops from Bobby (Fig 6).

Fig 6.
Andrea in particular had a strong interest in all things fantasy. As her classroom teacher states, “From mythical animals to Pokemon, her fantasy world just goes on…”. There were two other pieces of work that, while you could not describe them as ‘fantasy’, definitely contained elements of the fantastic. These were Sarah’s Apple and Screwbolt by Cleetis (Fig 6). These pictures were both made in Photoshop and in both of them ordinary objects are made magical through the addition of bright colours and bold background patterns.

The most interesting information around the notion of Imagination came through a discussion between Andrea, Sarah and Kirk one day in class. They debated the meaning of the term, Kirk arguing that imagination is something inside your mind, something that doesn’t exist in the real world like an imaginary friend. Andrea and Sarah took a much more practical view, seeing imagination as a tool for making things actually happen;

Sarah “…imagination can allow you to see things before it’s done. It can help you make a movie…so you can see how you’re going to play it out more than just playing with it at the time. Sort of going into unknown territory”.

Andrea “Inventors had imaginations. They’d go ‘Oh I can do this one day and that tomorrow…”

Sarah “Exactly”.

29
Andrea "When something’s going to be invented the person goes ‘Ooooh I think I’ll…’ or ‘I wish I could do this…’. They go through different stages like ‘I can’t…’; ‘I think I might…’; ‘I’ll try…’; ‘I’m better…’; ‘I’m great…’ you know it’s gradually (she points upwards)".

Sarah "Imagination, it’s when for example, I decided to make a pen…I would think of the design and then I would imagine it in my head. I would imagine the finished product, the curves, the details”.

Both Sarah and Andrea used this imagining technique routinely when working, visualizing their finished work before they actually began to make it;

"Well I sort of have a picture in my head like I want some eyes that look dark and mysterious and then I play around until I get them”.

Sarah

“I just picture it in my head…I don’t expect it to come out because I don’t expect things straight away but I usually plan, plan ahead just to make sure…in my mind, if this works or that doesn’t work”.

Andrea

There is one last advent I would like to explore in this section, almost as a footnote, and that is the anthropomorphism of the computers by the children in the group. They often spoke to their machines as if they were sentient, using words like ‘caring’, ‘helpful’ and ‘stubborn’. They also became very attached to individual computers, returning faithfully week after week. The following exchange illustrates Cleetis’s reaction when he arrives to find Sarah on ‘his’ workstation;

Cleetis "How come you’re on there?”.

Sarah “That one’s not working”.

Cleetis “Yeh but that one won’t work for you either. He only likes me”.

Research in this area (Sethuraman 2004, Turkle 1984) seems to indicate that while users of my student’s age do not sincerely believe the computer is human, they do perceive of the object as worthy of social behaviours because it is ‘smart’ (can do lots of things) and ‘helpful’ (assists them in creating something) (Nass 2000). Technically then this phenomenon may be viewed as the subconscious acting out of social etiquette rather than the example of imagination or fantasy it initially appeared to me to be.

(Student) Has a Keen Sense of Humour and sees Humour in the Unusual

The children in this group all definitely had keen senses of humour and there was always much laughter as they worked and shared the things they had created. I have identified four main types of humour as enjoyed and illustrated by these students. The first of these may be termed Obscurity. This relates to the children’s notion of ‘randomness’ as explained earlier, that is ideas and objects that seem to come out of nowhere and have no discernable connection to any current context. It is humour in the nonsense-absurdist tradition like that of the Goon Show or Edward Lear. Kirk was the master of this kind of humour and all of his work in some way reflects this random aesthetic. Kirk combines words and images, figurative objects with
abstract ones, movements, colours, sounds and patterns, and a distinct lack of narrative (Fig 8). He explains;

"Usually when I make stuff I just put all kinds of stuff together…I don’t know why I put it there I just like the way it looks…it’s just a random notion…I just put random stuff in it and sort of just build it up around this idea that it isn’t going to be just like somebody doing something".

It is the unexpectedness and isolation of the different elements that makes the work funny and although the other students never approached Kirk’s levels of intelligibility in their own animations, they all seemed to ‘get it’ in his. His films were generally considered very amusing.

The second type of humour I noticed was Physical Humour. In this group I include slapstick, violence and ‘gross-out’ gags. Sarah dabbled in this area with her Dumb Guy animation (Fig 1) but it’s most consistent proponents were Bobby and Cleetis. These boys made countless animations in a physical humour style, titles like UFO Attack, Man Getting Shot and Bird Eating Him, Shark Attacked, BOOM! And Death by Car reflecting the contents of the works.

While many of these cartoons were straight forward (for example Death by Car where a man is simply run over by a car) there were some that stood out as being more thoughtful and complex. Two examples of this are Shark Attacked and BOOM! (Fig 9).

In these examples the humour, although still physical, is more sophisticated and illustrates philosopher Blaise Pascal’s ‘incongruity theory’. This theory states that “Nothing produces laughter more than a surprising disproportion between that which one expects and that which one sees” (Gruner 1997:36).
So in *BOOM!* We expect to see a crane demolish a building but instead it smashes itself, and in *Shark Attacked* the goldfish we expect to see eaten by the shark turns and devours the larger fish. Both cases work by subverting the viewer’s preconceptions of a physical activity in a given context. The animations featuring physical comedy are interesting also for their use of sound effects. In most cases these were very comic and extreme; a loud burp when the small fish finishes eating the big one for example. In the eyes of the research group such noises only serve to make these kinds of episodes funnier.

The third approach to humour I term **Cute and Cartoony** and this featured mostly in the works of Sarah and Bobby (when he wasn’t making physical comedy). ‘Cute and cartoony’ is exactly as it sounds. It refers to work in the tradition of Disney or Japanese manga. That is, simple and exaggerated features (big eyes, big feet etc) in bright colours and designed to be amusing and pleasant to the eye. Sarah’s *Sun Scene* (Fig 6) is a prime example; the colours are bright and flat, the eyes are round, the pupils large, and the rays reduced to lines. In this cartoon the sun also has a distinctive personality which Sarah describes;

Sarah “I think it was after the rays sort of formed it almost gave it some sort of characteristics, hair or something…I thought it looked a bit boring with just the rays so I added the eyes and this sun is very lazy so it turned into a female and got eye-shadow”.

Me “Why is the sun lazy?”

Sarah “I’m not sure because the real sun is very powerful…I just sort of thought of waking up and yawning and I thought it would be a bit better if it was a girl and so I just thought it would make it more comical”.

The fourth and final type of humour I observed within the group was **Irony**. In this category I include sarcasm, cynicism, self-deprecation and drollness. These qualities revealed themselves more in the work process than in the finished products but were incredibly prevalent. This sense of irony was described by two of the group’s classroom teachers as a main part of their pupil’s personalities;

*(on Sarah)* “A very mature individual who…has quite a dry sense of humour. She’ll say jokes that a lot of the others in the class wouldn’t pick up on”.

*(on Kirk)* “He has a really dry, cynical sense of humour which is very adult and a bit Eeyorish, bit melancholic”.

These teachers use the words ‘mature’ and ‘adult’ and indeed irony and its variations do strike me as a more sophisticated form of humour than those discussed earlier. It requires an understanding of the ‘gap’ between content and form, that how something’s said is as important as what’s said and that the meaning of something may well be the opposite of what it appears to be. There were numerous daily examples of this humour and they came from everyone;

*(as he scribbles on the screen)* “I’m making a piece of modern art. I’m going to sell it for a million dollars!”

Bobby
“Is there an elephant in the room? Dunno, what does it look like?”.

Cleetis

(commenting on her own rather crude drawing of a bird) “Great drawing. Great skill. The magnificent coconut bird”.

Andrea

(while reviewing a mistake in her work) “Oh I’m sooooooooo cool”.

Sarah

(when someone suggests he put one of his abstract animations on the school TV show) “Ooooh yeh. The kids’ll love it. They just love weird. Weird is their life”.

Kirk

Aside from the droll commentaries in Kirk’s cartoons (Fig 3 & 8) there was only one piece of work that really utilized sarcasm. This was Nature’s Wonders by Andrea (Fig 10). She describes the animation, delighting in the contrast between sunny title and dark content;

“Mine is the loving story of a vicious hawk killing a baby bird. I did a baby bird that’s hatching out of this egg and it sees something flying across the sky, it’s a giant hawk and it eats the baby and poos it out and it says ‘Nature’s Wonders’ (laughs)’.

Bobby “I’ve modified this (computer) game…I changed the ship and you’ve got to shoot down the aeroplanes but I changed the planes to smiley faces”.

(Student) Generates Unusual Insights

This was probably the area where these students amazed me the most. It overwhelmingly happened during the work process where each child, without exception was able to regularly see past the obvious and to articulate clearly their insights.

One of the areas in which they were most knowledgeable and insightful was in regards to their own learning. The following conversation illustrates Bobby’s approach to figuring out how to do something new on the computer. He acknowledges both ‘playing around’ and ‘accidents’ as effective learning strategies;
Me “How did you know how to do that?”

Bobby “I figured it out by playing around…I just get bored waiting so I try and figure it out myself”.

Me “Are you usually successful?”

Bobby “Not all the time, but sometimes I try to figure out a certain thing and I end up figuring something else out accidentally and that’s just as good”.

Kirk also has a good understanding of his own approach to learning. Here he discusses the difference between process and product, clearing valuing the process more;

Me “How important is it to you to have something at the end?”

Kirk “To have something completed at the end?”

Me “Yeh, and of a standard you thought was good”.

Kirk “For me, I usually don’t think of the end…maybe that’s why I like video games that don’t have ends”.

Me “So for you it’s the doing?”

Kirk “Yes. It’s the actual doing the thing. Like something could be finished in someone else’s eyes. It’s good. I could present it but that wouldn’t be the final thing. I’d still want to do more stuff…I don’t really see things as finished I just think that it’s time to stop”.

In the following conversation Andrea and Sarah discuss their ability to learn something quickly. They also express frustration at the failure of others to recognize this;

Sarah “In my class I don’t think I’m learning anything at all. I’m just repeating it all again”.

Andrea “Yeh. I usually learn stuff instantly and that’s why I don’t hardly do homework cos I’m just repeating it all again”.

Me “That’s one of the things about gifted kids, processing speed. It takes people like you a fraction of the time to ‘get’ something”.

Sarah “Yeh but you still have to do it a million times. Like in a maths sheet there’ll be how to do some specific thing with fractions, or something complicated, anyway you learn it and then it’s like ‘O.K now do a million of those’”.

These children were also insightful on a whole range of other topics of which I provide only a sample;

(on the school enrichment classes) “The only real difference is there’s more work and it’s slightly harder. It seems like it’s made for
people who want to be smart rather than people who already are”  

Kirk

(on the difference between pictures and words) “Pictures is easier but doesn’t get the message across as well...if somebody looks at a picture they can see either what they want in it or not see anything at all whereas if you say the words people get exactly what you mean. If it was something you wanted people to think about you’d do pictures, but if it was something you wanted people to know you’d use words”.

Sarah

(on video versus animation) “I don’t really like video, just wandering around trying to find what you want. It’s easier just drawing stuff. What I want’s in my head and I just make it appear”.

Bobby

(on me observing them work and writing things down) “We’re like laboratory guinea pigs!”

Andrea

(on creating images in Photoshop) “It’s weird how you can have photos of real life, like the picture’s a copy of real life or in this you can make a picture that isn’t a copy. The picture can only exist in the computer, it’s impossible to copy it with reality”.

Cleetis

Fig II.

Mix and Match by Bobby

In regards to finished work the most obvious piece of insight on display was the independent realisation by some students that you could use a combination of techniques and approaches in one piece. The two best examples of this are Lily Pond by Andrea (Fig 4) and Mix and Match by Bobby (Fig 11). Lily Pond I have already described. Mix and Match is similarly a drag and drop game, the user provided with a naked man and a supply of clothes, hair styles and facial features with which to dress him. The piece is unusual though in that most of the draggable items are also animated, so for example you can give your man teeth that gnash together or jewellery that sparkles. Both Lily Pond and Mix and Match include a
sophisticated combination of still image, moving image, sound and interactive elements.

**Student** Demonstrates Awareness of Aesthetic Qualities

For the purpose of this discussion I am using a defining the term ‘aesthetic’ as something that appeals to the senses. That is, the beauty and satisfaction associated with how something looks, sounds, and operates and the overall emotional impact of these elements combined. This definition suits perfectly the multimedia nature of the computer.

Throughout the work process the students all engaged in a variety of behaviours indicating they had these kinds of aesthetic sensibilities. Some of the more common actions were:

- Leaning in closely to the computer monitor in order to draw something in greater detail.
- Wearing headphones in order to cut out excess noise and to better concentrate on working with sound.
- Using and exploring the various tools available (software and hardware) in order to achieve the best possible version of something.
- Asking for and offering opinions on the way things looked, sounded and worked.
- Asking others to show them how they had achieved a particular effect.
- Continuing to return and work on pieces started in earlier sessions.
- Spending a long time getting something ‘right’ (as Andrea stated “My arms are sore from drawing!”)

The satisfying results of these types of labours can be seen in the finished works. I would like to take one example from each child, discussing its aesthetic qualities in some detail.

The first piece I would like to look at is *Bunch of Circles* by Cleetis (Fig 7). In this deceptively simple animation a ball bounces slowly around, seeming to rebound off the edges of the operating system window. From an aesthetic point of view, *Bunch of Circles* is very satisfying. The piece is successful in terms of creating an overall ‘feel’. There are very few elements but those there are all work tightly together; the smooth monotony of the bounce, the gradually changing colour and tone of the ball, the mechanical repetition of the soundtrack all combine to produce a slow hypnotic atmosphere.

*Skull Mix* by Bobby (Fig 12) has a similar over-all appeal. In this interactive work the viewer clicks on the black square with the mouse, dragging it around the window to reveal the skeleton and working inner organs of the Cyclops. Bobby is very skilled at reducing an object to its most basic elements yet maintaining its recognisability. In *Skull Mix* the fact that the main character is a cyclops is indicated simply by the single circle on his face. His skeleton has been reduced to only the major bits, as have his inner organs, yet in both cases their identity is unmistakable. As the comedic and literal centre of the piece the organs are very successful. The use of tone makes them stand out from the flatter background and their exaggerated pump action is very funny. Bobby has also taken on an extra responsibility by making this work interactive but the mechanics work smoothly and intuitively. Once again all the elements combine for a successful overall impact.
Kirk’s animation *Stuff Stuff* (Fig 1) is like the previous two examples in it’s single-idea emphasis but different in that it’s an abstract work. Within the group Kirk was unusual in his non-figurative approach, he seemed intuitively to understand that animation does not have to be narrative. That it can be about form and movement and colour, or as he puts it “I don’t like drawing people”. *Stuff Stuff* contains various design elements that work well. Firstly is the use of a limited palette, the two-colour plan never overwhelms or detracts. Second is the repetition of the circle shape creating a theme or constancy within the work. Finally there is the way the two lines move in different directions. This provides visual complexity and interest.

The next piece of work is by Andrea. It’s entitled *Electric Flowers* (Fig 13) and was made in Adobe Photoshop. This image is interesting in that it involves real objects (flowers and grass) presented as abstract elements. Its major features are its colour and composition. In this piece Andrea has consciously explored her knowledge of contrasting colours. As she worked on it she periodically ran next door into the art room to check on the colour wheel hanging on the wall. She has also tried to make the colours mean something and feel differently, describing the top half of the image as “daytime” and the bottom half as “night”. In terms of composition this piece works very differently (but no less effectively) to the three previously discussed. Those works very clearly have a central focus. *Electric Flowers* however operates all over the area in which it is contained. The eye moves from place to place and no one part is more important than another. In this way Andrea echoes the work of painters like Jackson Pollock. It is another very aesthetically gratifying work.
**Fig 13**

*Electric Flowers by Andrea*

*Funny Face Game* (Fig 14) by Sarah is the last piece of work I would like to look at. This is an interactive work where the viewer can drag different facial features with their mouse and make a face, like a digital Mr Potato Head.

**Fig 14**

*Funny Face Game by Sarah*

Sarah describes the point of this piece;

“…you can make your own person or make a star as well. You can basically make your own person including hair, eyebrows, eyes, lips, noses, ears and jewellery. There are different eyes and lips so every
picture you make is unique and you can make what you like or what you seriously dislike. It’s a fun, laid back, easy thing to do”.

Like the other works this piece has a successful over-all feel described by Sarah as “...fun and a bit cheesy”. The accompanying disco soundtrack reinforces this. Sarah has also been victorious in her ability to draw lots of different kinds of facial features within an over-reaching ‘cartoon’ style. The main thing I would like to point out with this piece though is the effort Sarah has gone to to make the work functional as well as visually appealing. Earlier versions saw the selection of features all over the place. Sarah decided this wasn’t working and so organised them into categories. The use of the coloured boxes works well. She has created function without sacrificing style.

Of all the children, visual aesthetic is probably most important to Sarah. She understands instinctively that “the medium is the message” (McLuhan 1964) and she feels frustrated that external factors mean she is not always able to meet her own standards in this area. She explains;

Sarah “I like paying more attention to things so I can get them just right so taking it slow’s nice because you don’t have to rush it and you can present it nicely”.

Me “So is how something looks important to you?”

Sarah “Yep because it’s not just what’s in it but it’s always nice to look at something that’s attractive. If there was a bland picture that had writing on it as opposed to a bright purple picture with lots of writing, you’d probably go for the purple. Basically the more attractive it is the more appealing it is to look at”.

Me “When you’re in the classroom do you run out of time?”

Sarah “Sometimes I get annoyed because I get the work done but I don’t have time to ‘prettify’ (makes gesture) it”.

Sarah also understands the difference between an aesthetically gratifying product and the process of creating it, as well as the role of an audience in this scheme. Her ideas come across most strongly when she discusses the use of technology by people who don’t have an aesthetic awareness;

Me “Do you think that someone that had no clue artistically…would still enjoy using this kind of software?”

Sarah “I think they’d enjoy it (her emphasis). I think if they knew they couldn’t draw and they tried to draw on computer they would still have fun and enjoy themselves. It’s just their work would not be enjoyable to others”.

(Student) Doesn’t Mind being Different or Wrong

None of these students minded being different or wrong, at least within the context of this research group. As discussed earlier in the section on originality, this was illustrated through the different kinds of projects individual students undertook. It was also apparent however in the kinds of behaviours the children displayed during the work process.
Andrea was probably the most dramatically uninhibited student. She frequently whistled, clicked her fingers and sang as she worked (‘Funky Town’ usually the anthem of choice). She would also roar “Woo Hoo!” when things were going well. While she never sang, Sarah did talk to herself at a fairly audible volume. Her conversations seemed to relate to the work in hand with comments like “Let’s try…” or “What if I…” or “That’s just freaky”. There was also one exceptional afternoon when Sarah, for no discernable reason, seemed to take on the persona of a cartoon-type witch. Her eyes squinted, she rubbed her hands in glee and cackled before threatening her computer with her awesome powers;

“I am in control now (laughs) I have the power of life and death over you. Bend to my will lowly machine!”

Kirk’s lack of tact may also fall under this heading. He was very blunt with his comments to others, for example asking Sarah, after she had worked for hours to get something looking right “What is it?” He also often chose to wear headphones, limiting social contact and effectively removing himself from the group for periods. The amazing thing is that none of the children seemed to mind any of these kinds of behaviours. They smiled indulgently at Andrea, didn’t really notice Sarah and shrugged off Kirk.

All the members of the group also shared a complete lack of fear of any authority. My being a teacher did not impress them one bit. They never asked if they could stay and play games at lunchtime, they just did it. When I introduced Photoshop to the group and Bobby wanted to stay on Flash, he didn’t ask if he could. He just did. And again when Cleetis bought an Eminem CD from home (complete with a ‘Parental Guidance Advised’ sticker on the cover) he just played it. This behaviour was in marked contrast to other timid groups I have worked with and I asked the students how it was that they were so fearless. Their answers seemed to indicate both a desensitization to the discipline process, and an ability to play the system;

“You do what you want and you just get into trouble and then the teachers don’t care any more”.

Kirk

“I can always manage to talk my way out of detentions and stuff”.

Sarah

“Sometimes I get a little bored in class and drift off and yeh, I get bored so sometimes I’m naughty”.

Cleetis

Cleetis’s classroom teacher agrees. She thinks Cleetis is sometimes misunderstood;

“He’s the type of kid that, say we ask him to move away from so and so, he’ll ask for justification. He wants reasons…A lot of teachers think that he’s cheeky or he’s sarcastic but it’s actually because he has a global view of stuff and he wants to know the ins and outs of everything…With work we struggle, he doesn’t see why he should have to do things he knows and he’s right”.

The above comment draws attention to Cleetis’s curiosity. This is another attribute shared by all group members and another avenue through which the children demonstrated they didn’t mind being different or wrong. It was particularly noticeable (and useful) in the way the children used the software. When they needed to know
how to do something they played around and tried things. They had no fear of ‘wrecking’ their work or ‘breaking’ the computer. Closely related to this was the constant process of review and re-evaluation the children undertook as they worked. They tried something, analysed it and then discarded, adapted or kept it as appropriate. This was an omnipresent, very fast, and instinctive route taken by the children. No critical analysis scaffolding was required. It follows that this phenomenon was the result of the strong individual visions carried by each child. They knew whether something ‘fitted’ or not and were unafraid to make the necessary changes.

I have stated that within the confines of this research project the students didn’t mind being different or wrong. I am unsure as to whether the same is true in other contexts, for example back in the classroom. While all were aware that they were ‘different’ to the other kids, they had individual ways of dealing with this. Andrea used humour;

“Everyone in my class says I have no shame because I shout all the time and no one really cares. They just think it’s funny and I laugh at myself too cos I do pretty funny things”.

Sarah relied on self-pride and intelligence;

“I actually don’t mind being an individual because I’m not really that much of a social person so that suits me just fine and I’m proud to say I know what 12 x 12 or 8 x 9 is”.

Kirk adopted an ‘under the radar’ approach;

“Say you have a crap smile and you don’t want people to know you have a crap smile, then you don’t smile. If people think you’re weird then you don’t be weird. You can still do stuff, actually be that person, but you just make it so they don’t notice”.

Contempt was Bobby’s main strategy;

“...usually I think other people are worse...if somebody thinks something about me that’s negative then I can usually think of a million things worse about them”.

And finally Cleetis was downright defiant;

“We’re weird. I like being weird. Normal’s too boring”.

The students’ regular teachers also recognised these children as ‘different’, and while acknowledging this meant some difficulties, seemed to regard it ultimately as a positive thing. Andrea’s teacher especially, described her pupil with detail, warmth and enthusiasm;

“The first time I noticed her amazing personality was at our class camp and we were having a concert...all of a sudden this girl got up in front of everyone, there was about four classes, and said she was going to sing a song and we didn’t know if she could sing or what but a she got up there and didn’t care what anyone thought and started singing this amazing song. She was a little bit out of tune but had this amazing presence and when she finished, after everyone straining to
hear her, they just erupted in applause and from that day Andrea just gained this amazing respect from all the kids.

(Student) Enjoys Speculation and Thinking about the Future

Speculation about the future and other things was a general characteristic displayed by all children through the way they worked or their finished products or both. Ideas about the Future were explicit in the content of Boom! by Bobby (Fig 9), UFO Attack by Cleetis (Fig 6) and Auckland Being Blown Up by a Foreign Country (Fig 3) by Kirk. UFO Attack and Auckland Being Blown Up by a Foreign Country are set in a technologically sophisticated Earth future where spaceships, deadly weapons, and conflict are the norm. Boom! begins its story in the present, on an ordinary building demolition site but then leaps ten years into the future to deliver an ‘explosive’ conclusion (Fig 15).

Fig 15

Boom! by Bobby

Examples of Speculation also appear in finished works and in two different ways, either it is implied through the content of the work or it is inherent in its form. Nearly all of Kirk’s pieces work in this first way, as do Screwbolt by Cleetis and Apple by Sarah (Fig 7). Kirk’s abstract shapes and words like Sarah’s apple and Cleetis’s screw are presented without familiar context, all are characterised by the children’s notion of randomness as mentioned earlier. In each of these examples the meaning is ambiguous and the audience is forced to speculate upon what it might be. A more personal form of speculation is apparent in two other images. These are Animals and Me by Andrea (Fig 16) and Me with a Half Stack by Kirk (Fig 17).

In both cases the author is speculating on their own future. Andrea is currently torn between the desire to be a vet and the desire to be a filmmaker. In this image the vet has won out. Andrea says:

“You know like, I think it’s in Snow White or one of those movies, and the princess always has animals around her. Birds land on her hand and stuff. Well I kind of fantasize being a vet is like that and all the animals will be my friends”.

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Kirk is a musician and pictures himself holding a heavyweight guitar and amp. He contrasts vibrant colour with a classroom setting, an exciting rock star future with the mundane present. However he knows it is a future he might not have.

There are three works where speculation is a crucial part of how the piece operates. *Lily Pond* (Fig 4), *Mix and Match* (Fig 11) and *Funny Face Game* (Fig 14) are all interactive forms where the audience is required to choose and arrange different elements in order to make a picture. To play the game the viewer has to speculate,
to ask themselves questions like “what if I put this here?” or “what if I swapped this bit with this?”

There was also lots of speculation happening every day as the children worked, including the use of speculation as a problem-solving tool used to help get the computer to do the things they wanted. Here are some examples;

“When you’re adding sound you wonder where to put it. You don’t know where it will sound best. You just have to keep testing it”.  

*Cleetis*

“I wasn’t sure how to work the scanner but there was a big button there and I thought it looked likely so I pressed it”.  

*Andrea*

Finally there was also a wide variety of speculation on a whole range of fascinating topics and contexts. I include a cross-section of statements here to illustrate the range;

“Is there such a thing as phobia of money?”  

*Bobby*

“Does anyone know who put all the answers in a calculator?  

*Andrea*

“Maths, I really hate maths…in the future we’ll all use calculators anyway. They’ll probably be implanted in our brain or something”.  

*Cleetis*

“I know how to crash computers I think. You just change the name of C drive and it’ll freeze. This huge message’ll pop up if you change it from C, even if you change it to C dot…I think it will”.  

*Kirk*

And the following conversation,

*Andrea* “We need better software that is easier to explain to people and you don’t have to go here, then go here to do this, shift F8 blah blah blah…Say if computers were more understanding like you type in what you want and it responds to that and tries it’s best to do that”

*Kirk* “If computers thought like that then they really would be very advanced. Computers if they could think like that…”

*Sarah* “I’d be worried”.

*Kirk* “Yes! They would be very dangerous”.

“In a modern, post-industrial world, national goals such as creativity, inventiveness and entrepreneurship…will determine which nations initiate the ideas and provide the leadership for continued productivity, and indeed, even the preservation of a democratic way of life” (McAlpine & Moltzen 2002:2).

This situation in turn has lead to a worldwide interest in educating for creativity. The role of the school is changing from one of student socialization with a view to membership in an existing world, to,

“…a vehicle to unleash the creative potential of young people and to engender them in a role that leads to the making and shaping of society as well as merely participating in it” (McAlpine & Moltzen 2002:1).

While there is little research into the specific role high-end software might play, Information and communication technologies in general have begun to be viewed as a powerful means of implementing and achieving this new kind of ‘creative education’.

In New Zealand the Ministry of Education launched the Digital Horizon’s Strategy (2002) in part to achieve just that. In its vision statement the document says;

“All learners will use ICT confidently and creatively (my emphasis) to help develop the skills and knowledge they need to achieve personal goals and to be full participants in the global community” (Ministry of Education 2002:3).

In an effort to answer the research question heading this section I explore these ideas; how are creativity and ICT related, both in the world and in the classroom? I will examine the role of technology as it relates to both the creative product and the creative process. I will also discuss the unique characteristics of high-end software, trying to discern exactly what it is about this technology that inspired and facilitated such levels of creativity within my research group.

ICT and the Creative Product

There are many definitions of the creative product but all seem to have two things in common. These are that a creative product must be *novel* (original, unique, new) and that it must be of *value* (use, benefit) to others (McAlpine & Moltzen 2004, Edwin, Grover, Shepardson, Treffinger & Young 2002, Sisk 1989). Information and communication technologies themselves fall into these categories, but are also responsible for inspiring and creating other new forms and objects.

Recent examples of creative products as spawned by computers and other related technologies include web sites and web design, computer gaming, robotics, the mp3
format, broadband internet access, and digital video and photography; a whole raft of novel items that continue to be of value to society at large.

Computers also impact on existing products, often altering them in some way. Colin Beardon and Lone Mamborg (2002) present ‘Digital Creativity: A Reader’, a book concerned with explaining and illustrating the various ways ICT has influenced The Arts. In this work are articles titled ‘The Students’ Construction of Artistic Truth in Digital Images’, ‘Art of Virtual Bodies’, ‘Remediating Theatre in a Digital Proscenium’ and ‘Interactive Dance-making: Online Creative Collaborations’. They are pieces dealing with the meeting of the traditional and the digital, and the new products that appear at this juncture.

In the classroom, computers enable students to express themselves and their understandings in new ways. Although some of these products are not ‘new’ in the sense of wider society, they are ‘new’ in relation to the classroom. Computer games, animations and movies for example, are forms that were previously too complex or costly to make, and were therefore the domain of ‘experts’. Modern desktop computers mean that now these creative products can all be made by children at school (Becta 2004, Heppell 2000) as indeed they were by the students in my research group.

ICT and the Creative Process

Within the new knowledge age education paradigm much attention is paid to the learning process. Notions of metacognition and ‘learning to learn’ (Wegerif 2002:3) sit alongside creativity and all have become more important than any finished product (poster, essay, website etc) a student may create. Stephen Heppell explains this shift;

“We need to focus on process ahead of product. As technology marches forward the task for children of delivering product targets (‘finished’ work) becomes easier and easier, breeding complacency in education. If we are to offer formative advice and support progression, we need to look at how they complete tasks rather than what they have completed” (Heppell 2000:5).


“…the research shows that the predisposition of environments that envisage learning supported by multimedia and telematic technologies can stimulate students to improve…(in) the skill of finding more than one solution for the same problem, imagining, discovering and inventing” (Allegra, Chifari & Ottavanio 2001:49).

There is also a general consensus however that the computers on their own cannot achieve this, that it is the way people use them in classrooms that brings about effective teaching and learning. Jamie McKenzie emphasises the role of the teacher, “Great tools do not in themselves create great writers and thinkers. Good teachers can make the biggest difference” (McKenzie 2004:4) while Jones highlights the student,
“Creativity is in the child rather than the medium, but some children respond to a particular medium (ICT) and demonstrate behaviours not seen in other contexts” (Jones 2004:1).

It seems there are four main views of the relationship ICT has to the learning process and to the creativity within that process. I have termed these and I will examine each one in turn;

1. ICT as a teaching machine
2. ICT for content construction
3. ICT for concept construction
4. ICT as a “…support for learning conversations” (Wegerif 2002:3)

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This model has its roots in behaviourism and productivity. It encourages a view of learning that is content based and sequential, where students are suitably reinforced as they master each step (Roblyer & Edwards 2000, Wegerif 2002, Wiburg 2004). ICT as a method for implementing this system may be traced to BF Skinner and his seminal article ‘The Science of Learning and the Art of Teaching’ (1954). In this work Skinner described the deplorable conditions of the average classroom, “A single teacher cannot individually and appropriately reinforce thirty or more students at the same time” (Skinner 1954:4). His answer was a teaching machine for use by individual students. The machine would present information, reinforce appropriately and then move on to the next level of difficulty depending on the pupil’s responses. Today’s Integrated Learning Systems (Roblyer & Edwards 2000, Wegerif 2002) have friendlier names and prettier graphics but operate along very similar principles. ICT as a teaching machine is not concerned with promoting creativity at all. Rather it is a means for developing low-level skill and/or content knowledge within a very specific context. Because of this the model is often criticized, seen as, “…the teaching machine of Huxley’s brave new world –uniform, quantifiable, controlling and predictable” (Heppell 2000:2). As such this perspective has no place in my research project.

| ICT for Content Construction |

Advocates of this approach to teaching with ICT generally take a constructivist view of learning. This philosophy can be traced back to John Dewey, working in the1890’s to prove that thinking was a direct result of physical experience (Dewey 1896). Other important contributors to the paradigm include Jean Piaget (1969), Lev Vygotsky (1962), and Jerome Brunner (1986), their ideas combining to influence probably the most widespread approach to education in modern New Zealand. Simply put, constructivism perceives of learning as an active process. It is about making mental links between concepts and ‘constructing’ meaning according to your individual place in the world (Roblyer & Edwards 2000, Brunner 1986). The role of the teacher in this process is to provide the learner with ‘scaffolding’. That is initial information and opportunities to construct new knowledge upon it, ‘knowledge’ generally meaning curriculum-related content. Within this context computers are perceived of as an effective vehicle for providing scaffolding. They become a stimulating and interesting tool that learners can use to build subject knowledge. One prominent researcher working in the area of ICT for Content Construction is David Jonassen. Jonassen coined the term ‘mindtools’ (Jonassen 2000) which he uses to describe any computer application used by learners to explore what they know. He provides more detail;
“Mindtools…necessarily engage (learners) in critical thinking about the content they are studying. Mindtools scaffold different forms of reasoning about content. That is they require students to think about what they know in different, meaningful ways. For instance, using databases to organise student’s understanding of content organisation necessarily engages them in analytical reasoning, where creating an expert system rule base requires them to think about the causal relationships between ideas” (Jonassen 2000:13).

Morsund elaborates on Jonassen’s ideas using the mathematics curriculum as an example. He says that the largest potential ICT effect in Maths is that calculators and computers can solve instantly a wide range of problems, for example figuring data equations or making graphs. Morsund says that when learners are freed from these kinds of procedural duties they are better able to concentrate on developing knowledge about mathematical meaning, about what a graph or a piece of data actually represents and the implications of this (Morsund 2005).

ICT for Content Construction is often referred to as ‘integration’, meaning the incorporation of information and communication technologies into an existing educational system. The model does not seek to challenge the system at all, accepting the acquisition of subject-related content as a worthy educational goal. As Jonassen infers, the routine does involve concepts like creativity and thinking but they are seen primarily as useful methods for constructing and understanding content. Within this model they are a means to an end, not a valuable educational end in themselves.

ICT for Concept Construction

This perspective rises also from constructivist philosophies and like the last model it emphasises the idea of the active construction of knowledge by the learner. Unlike the previous approach though, the valuable knowledge it believes ICT can help learners to construct is conceptual rather than content-related. ICT for Concept Construction reverses the hierarchy in the last section, perceiving of curriculum content only as a convenient context in which the really important things like creativity can happen.

In this model it is the technologies themselves that supply the scaffolding and allow the discovery and development of intangible approaches like communicating, collaborating, analysing and creating for example. Within this discourse these kinds of conceptual skills are valued as transferable tools that children can continue to use to make meaning throughout the rest of their lives.

The British Educational Communications and Technology Agency (Becta) is the English Government's key partner in the development and delivery of its e-learning strategy for schools. This organisation believes ICT promotes and facilitates the concept of creativity in the following ways:

- Provisionality (different options can be tested, backup files keeping the original work ‘safe’).
- Interactivity (between machine and user, between multiple users)
- Capacity (storage and memory)
- Range (of approaches and functions providing the user with choice)
- Speed (allowing users to work more rapidly and thus present more complex ideas)
• Accuracy (of software features and products as a result of those features)
• Quality (the ability to create a wide range of products potentially of industry standard)
• Automation (the computer can perform menial tasks freeing up the human to do more interesting things)
• Multi-modal (image, text, sound, code etc. all combine to make meaning)
• Neutrality (a context where ideas can be explored without judgement) (Becta 2004:3)

Many advocates of the computer as a conceptual construction tool have concentrated on working with one function or application. One of the earliest and most influential is Professor Seymour Papert. In 1980 Papert first published the significant book ‘Mindstorms: Children, Computers and Powerful Ideas’. In this work he postulated that through learning and using the programming language LOGO, children could ‘construct’ their own knowledge and in the process develop both cognitively and creatively. He lists some of the specific gains as:

• Increased ability in problem finding and problem solving strategies (eg: braking a problem into parts or relating it to something previously solved).
• Increased ability in formal reasoning and representation (eg: thinking of all possible combinations or constructing mathematical models).
• Increased cognitive abilities (eg: precision and reflection).
• Increased enthusiasm and tolerance for meaningful academic engagement (Papert 1993).

Many educators have focused in a similar way on the creative and cognitive potential of alternative applications. For example, graphic organisers (Denner, Lin, Ray & Strickland 2004), Multimedia (Allegra, Chifari & Ohaviano 2001, Neville 2004) databases (Mathematics Group 2002), and image creating software (Jones 2002). In recent years studies have also examined these notions in relation to computer gaming, an area traditionally considered ‘outside’ of teaching and learning. In his book ‘Digital Gamed-based Learning’ Marc Prensky (2004) examines the role of games in fostering concepts like motivation, complexity, co-operation, engagement and thinking (Prensky 2004). In New Zealand the I-Paint ICT Professional Development cluster has also been exploring the educational benefits of computer games, specifically to meet the learning needs of gifted and talented students. Cluster facilitator Pam Hook says;

“…students avidly describe how they have learnt to see the world in a new way, collaborated with others and developed problem-solving strategies through simulation games like Sim City, strategy games like Civilisation and real time strategy games like Age of Empires. When games offer a chance to collaborate with like minds, to provide authenticity, to develop critical thinking, address global issues, become involved in-depth investigations and are highly motivating they seem highly appropriately learning experiences…” (Hook 2004: 19).

ICT for Concept Construction is a fairly new paradigm and one that challenges traditional definitions of learning as a content-acquiring activity. This is the discourse
that I both built my research project on and place my research project within; How do the specific applications Flash and Photoshop impact on the concept of creativity when used by this group of gifted, underachieving children?

**Flash, Photoshop and Creativity**

Neither Macromedia Flash or Adobe Photoshop are shy about using the term ‘creative’ in their hype. The Macromedia website describes the latest version of their product;

> “With Flash Professional 8 creative (my emphasis) professionals design and author interactive content…Get full creative control. Flash provides full design control to maximize creativity…Share creativity with everyone” (Macromedia 2005).

And Photoshop, part of the Adobe Creative Suite 2 bundle of software, does the same;

> “Delivering the next level of integration in creative software…Groundbreaking creative tools help you achieve extraordinary results…Take advantage of more creative options…” (Adobe 2005).

Clearly the concept of creativity is crucial to the images of both products but it is an advertising image that is fairly truthful to the reality. This is illustrated by measuring Flash and Photoshop against Becta’s list of creativity-promoting ICT features;

**Range:**

Both Photoshop and Flash offer an almost infinite number of tools and approaches to users. This is immediately apparent on the interfaces of both programs, where around the work area are a myriad of tool panels and windows. This however is just the first layer of choices and I will use Photoshop to illustrate my point.

To the left of the default Photoshop screen sits the main tool window. On this are thirty different options and if you click and hold down each icon, a list of available variants will appear (Fig 1). Hence under the pen tool is a range of 5 different ‘nibs’.

**Fig 1**
Photoshop Tool Window with Pen Variants

With each nib selection a different menu appears across the top of the screen. For the ‘free transform’ pen variant it is a menu with 7 more choices and if you select ‘Magnetic’ a further 4 appear (Fig 2):

Fig 2

In 4 of the above boxes you determine the variable by entering a number so there are effectively as many choices as there are numbers. Once you have done all this you need to select a foreground colour and then a shade and then if you're an expert, you can decide if your colour mode will be HSB, RGB, CMYK or CIE L’a*b*. Then repeat for background colour….

Photoshop and Flash also offer a wide range of end products. In Photoshop for example, you can save images as 16 different file types. Students from the research group discuss some of their favourite Flash options;

“I want to be like a Director or a Movie Maker when I’m older, that’s why Flash is cool. It’s really cool to make little movies”.

Andrea

“I have to say I’ve liked working with Flash and out of Flash in particular I’d have to say I've liked making games”.

Sarah

“I just like mucking around with the animation”.

Bobby

“I liked drawing with Flash. That smoothing out tool thing made your pictures look better”.

Cleetis

In 2003 Dr Geoff Dallow worked with a number of schools in the London and Liverpool Area, teaching staff and students to “…experience problem solving and explore creativity…” (Dallow 2003:1) through Macromedia Flash 4. Dallow says the diversity of projects that can be made with Flash render other pieces of software obsolete, for example Microsoft PowerPoint which he describes as “…very limited by comparison” (Dallow 2003:4). This contrast with PowerPoint is interesting and is one some members of my group also made, coming to a similar conclusion;

Andrea “I don’t like Microsoft PowerPoint. It’s just sound effects and slides. That’s all it is.”
Kirk “You can’t control motions, they just have set effects…PowerPoint’s really cumbersome because it’s just like one frame at a time and to put frames together you have to link them with certain things”

Closely related to the concept of ‘range’ is a phenomenon I would like to describe as ‘Freedom’. This I see as a state of mind inspired by the wide assortment of choices within the software. It is about the excitement and possibility of being able to make whatever you want and knowing you have the power to do so. Stephen Heppell understands how Flash can do this;

“(I get) excited about the way this software gives children real control over their computers and lets them make things rather than consume things” (Dallow 2003:3)

The children in my research group concur and bestow Photoshop with similar qualities;

“You don’t really have any boundaries of what you can do like you sometimes do with a video camera in your back yard. With Flash you can make people fly, you can make things blow up”. 

Sarah

“Flash helps you make original things, well, you’re using your own mind. You’re using your own ideas which comes from, I don’t know, things you’ve seen in the past or something or ideas you’ve seen on movies and you go ‘Oh I think I’ll try that but I’ll change this and this and make it like this’…You keep on using more ideas”. 

Andrea

“Photoshop was pretty good, just messing around with pictures and stuff. It’s just good how you can express yourself, do whatever you want”.

Cleetis

“I like this process because I am able to use my own ideas and not just do what another adult tells me to do”.

Kirk

“You don’t have to get other pictures and that, you can just draw your own. You can just do what you want”.

Bobby

This last statement is an interesting one. There are no clipart facilities in either Flash or Photoshop. Jamie McKenzie is scathing in his criticisms of these kinds of computer features;

“Many of the offerings brought to us be technology companies undermine the creativity and quality of student work as they step forward with too many quick fixes, silver bullets and templates. Their fondness for shortcuts and clever little tricks dilutes the culture, reducing so much production to a tawdry level of cheap plastic glibness…I sit on airplanes and watch hundreds of business people producing slide shows that are horrible from an artistic point of view” (McKenzie 2004:4).
Not having the clipart, template or ‘wizard’ option may therefore force students to be more creative and to produce a more original and aesthetically pleasing product.

**Range** may therefore be said to directly support the following specific creative behaviours;
- Produces original ideas and products (by providing access to mediums previously unavailable)
- Generates unusual insights (by providing opportunities to combine a number of mediums)
- Is not afraid to be different or wrong (by providing many pathways to achieving the same end)
- Enjoys speculation and thinking about the future (the user is able to speculate on the different pathways before actually using them)

**Accuracy:**
Both pieces of software offer incredible visual accuracy, giving you the ability to zoom in and work at pixel level (a pixel being the smallest unit a regular computer can address). Andrea describes how this function helped her realise her personal aesthetic vision;

**Me** “And that bee you’ve drawn is incredibly detailed, how did you do that?”

**Andrea** “I zoomed in heaps and I was planning it to be smaller so no one could see it”.

**Me** “So if no one could see it how come you spent all that time doing all that beautiful detail?”

**Andrea** “I just did detailed for fun. I like doing detail”

**Me** “Would it bother you if you hadn’t? Would it mean every time you saw the animation you’d go ‘Oh I coulda done that better?’”

**Andrea** “Yeh it probably would”.

As well as image, Flash also provides you with amazing accuracy in regards to movement and sound. Most importantly it allows you to accurately combine all three elements. Cleetis describes the process of adding sound using frames to sync it correctly;

“You just have to keep testing it. You just go along the key frames until the animation starts and then you insert the sound right at the frame where it starts”.

**Cleetis**

**Accuracy** may therefore be said to directly support the following specific creative behaviours;
- Produces original ideas and products (user is able to create something that would have been unrealistic previously eg: animation with sound etc)
• Demonstrates awareness of aesthetic qualities (user is able to precisely convey and aesthetic vision)

**Quality:**
I talked earlier about the ways computers and related technologies have inspired new creative products and opened up access to existing modes of expression. Because of Flash and Photoshop, animation and photography were a real option for the children in my group. In previous decades when you needed an expensive dark room and film camera and a whole lot of dodgy developing chemicals, they wouldn’t have been. But not only could these children make an animation they could make a quality animation. One of the reasons Industry uses Flash and Photoshop is because they can render products in quality formats. The children in my group had access to that same possibility; they could export their movie as a small smooth web-friendly shockwave file rather than a large clunky animated GIF. Similarly students could create high-resolution images with Photoshop, suitable for printing.
Sarah describes how with Flash you can make a quality-consistent movie;

> “With Flash you can make people fly, you can make things blow up and it all looks the same. Like sometimes in movies when someone flies it’s all ‘graphicy’ and fake and you can tell. On the computer it sometimes look fake too but with Flash it’s all the same. It doesn’t change. It doesn’t go blurry or ‘graphicy’ or something like that. It just stays the same, 2D or whatever”.

She also explores the professional potential of Flash in a conversation with Kirk, comparing the software again with Microsoft PowerPoint;

**Me** “Is PowerPoint easier to use than Flash?”

**Kirk** “No. It’s less powerful and it’s harder to use”

**Sara** “It’s more flowing…

**Me** “What, Flash is?”

**Sara** “Yeh”

**Kirk** “Slides are like if you got a piece of cardboard and wrote something on a piece of cardboard, or say a few pieces of cardboard and you just put one up and put it down and put another one up and put it down and put another one up. But Flash is like if you shot a film except it’s on computer.

**Sara** “So you’re basically saying PowerPoint is like a whole lot of photographs and you’re showing them to people one by one and then Flash is like a movie version of it, like a video”

**Kirk** “Yeh. It’s like comparing a few photos taken within seconds of each other to someone filming it”.

**Quality** may therefore be said to directly support the following specific creative behaviours;
• Produces original ideas and products (user is able to create something that would have been unrealistic previously (eg: animation)
• Enjoys speculation and thinking about the future (user is able to make interactive objects involving speculation as part of their make up, eg: strategy games)
• Demonstrates awareness of aesthetic qualities (user is able to realise their expression more effectively)

Automation:
Both Flash and Photoshop offer numerous features to free users from menial chores but here I will give just single example from each application.
In the past, animation was the most monotonous of pursuits. Traditional cell animation required artists to painstakingly redraw thousands of frames, identical but for one tiny change. Flash can take you away from all that! Every drawing you make you can store in the library for repeated use, you can copy and paste images from one animation to another, import pictures you drew in another piece of software, rotate, stretch, flip, repeat items with just the press of a few buttons.
Similarly the clone tool in Photoshop means that no longer do artists have to search and remember and experiment to recreate a colour, pattern or texture. They can simple click on the area they want to repeat and the machine will understand, automatically providing you with what you need. In both cases users are liberated from mechanics and free to work on ideas.

Automation may therefore be said to directly support the following specific creative behaviours;
• Produces original ideas and products (user is able to create something that would have been unrealistic previously because of the laborious mechanics eg: animation)
• Demonstrates awareness of aesthetic qualities (user is able to concentrate on aesthetic issues because they’re freed from monotonous ones eg: frame by frame animation)
• Generates unusual insights (because the user is freed up from monotonous tasks they have time to look for these)

Neutrality:
As discussed earlier, none of the children in the research group were shy about trying new things and both Flash and Photoshop gave them a neutral place in which to do so. The following discussion with Bobby illustrates both their level of comfort with the technology and their willingness to take risks;

Me “You guys try stuff out with the software and if it doesn’t work you don’t fall apart. You’re not scared to get it wrong”.

Bobby “If the option’s there it isn't wrong for you to do it. It can be done”.

Me “It might be wrong in terms of not achieving the thing you wanted to achieve”.

Bobby “Yeh but then you just get sidetracked and you can still do the thing you want to achieve later”.

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These students did not need any positive reinforcement from the computer either, no smiley faces or dancing animals on the screen when something went well. The children were satisfied to watch their work progress, willing even to struggle because they thought it was worth it, as Andrea describes;

“The first animation I did…it’s when this man, he’s walking along and he turns into a bird and flies away. I drew on a piece of paper and then used a scanner. It was really hard to colour in and continue drawing because heaps of it didn’t show up so I had to go over it all again…there were too many tiny sheets of paper that I had to scan and I was impatient…(I feel) really glad because that was like the first animation I made”.

Andrea

*Neutrality* may therefore be said to directly support the following specific creative behaviours;

- Produces original ideas and products
- Displays intellectual playfulness, imagination and fantasy
- Has a keen sense of humour and sees humour in the unusual
- Generates unusual insights
- Demonstrates awareness of aesthetic qualities
- Is not afraid to be different or wrong
- Enjoys speculation and thinking about the future (all these behaviours involve giving something of yourself, making something private into something public)

**Multi-modal:**
Both pieces of software offer the user information through image, text, interactivity and code. Neither Photoshop nor Flash use sound, although in Flash you can of course create something aural. The lack of audio was not an issue for any of the children in the group. They compensated by having music playing and by chatting to themselves, to each other, to me, and to passers-by.

*Multimodal* may therefore be said to directly support the following specific creative behaviours;

- Demonstrates awareness of aesthetic qualities (can create and receive through all senses, the real definition of ‘aesthetic’)

**Provisionality:**
At some stage all the students took advantage of the provisionality aspect of both pieces of software. Cleetis was especially thorough however, saving a new numbered version of his work whenever he changed anything he deemed significant (Fig 3).

**Fig 3**

Four Versions of *UFO Attack*
He explains that he did this both as a precaution against loss but also so that he had a record of something’s evolution;

Cleetis “I didn’t want to lose all the information and it’s easy to see how I made it cos you can see like how you start, you just draw the objects, then colour it in, then make it move and I just saved like ‘start’ ‘middle’ and ‘ending’.”

Me “Oh so like the ‘start’ version and the ‘middle’ version and the ‘ending’ version”.

Cleetis “Yeh”

Me “Were you worried about, you know, you change something and then you don’t like it and you can’t go back?”

Cleetis “Yeh sort of just like back-up copies”.

_Provisionality_ may therefore be said to directly support the following specific creative behaviours;

- Produces original ideas and products
- Is not afraid to be different or wrong (In both cases the user can try things out, keeping, changing or deleting the effects)
- Enjoys speculation and thinking about the future (user can speculate on different computer effects and functions by trying them out)

**Interactivity:**
Interactivity refers in part to the place where the person and computer meet and relate; the interface. Although initially intimidated by the Flash interface the students quickly learnt to navigate through it as the following conversation illustrates;

Sarah “When I first saw it I thought it actually looked rather complicated, but when you get used to it it’s actually very clear, a good format that you can work on”.

Me “What’s clear about it?”

Sarah “Well, with all the frames at the top it made it look really complicated, like you had to do some typing, but it’s actually a lot simpler than what it first comes across and as soon as you get used to it you can do it really easily I guess”.

Me “Did it take long to get used to it?”

Sarah “Not really”.

The group found the Photoshop interface more difficult to master but believed the potential of the software made it worth the effort. They discuss the issue by comparing the two applications;
Cleetis “On Flash it shows everything. On Photoshop it’s more like you have to go into this, then this from there and it’s just more complicated. Photoshop does really amazing stuff…”

Andrea “…You just need to know how”.

Cleetis “Yeh. But it’s hard to learn. I still screw up heaps on it”.

Me “So you think Photoshop’s harder to use than Flash?”

Bobby “But it does more amazing stuff”.

Sarah “It’s like more complex but more difficult”.

Cleetis “Sometimes you loose your ‘layers’ box and you have to go and find it. That kind of stuff.”

Sarah “Yeh. you have to into ‘File’ or ‘Edit’ or that kind of stuff and sometimes you just loose your place, compared to Flash where’ it’s always there and you know where it is”.

I suggested that some people might feel these pieces of software were too complicated and difficult for children to use. The group reacted indignantly to this possibility, explaining that the complexity was a positive thing in terms of their learning;

Andrea “Yeh. If someone said ‘You shouldn’t be doing Flash. It’s too complicated for your age’. I’d just go ‘well it’s really fun and once I got to know it and learnt it I made this’. It’s just really really fun and it’s strange that they would say that. Some kids really like complicated achievements”.

Me “Kids like complicated things?”

Andrea “Not all kids…but if you take on a challenge or something, you know…”

Kirk “I like being challenged and doing different things and if the end result’s good I’ll feel good with myself…”

Sarah “…And if it’s not you want to improve it”.

There has been some interesting discussion on the role of the interface. Media commentator Lee Manovich describes it as an ‘information surface’. He hypothesizes that all modern digital information surfaces owe their aesthetic to the European avant-garde art movements of the 1920s. He states;

“The techniques invented by the 1920s left-wing artists became imbedded in the commands and interface metaphors of computer software. In short the avant-garde vision became materialised in a computer. All the strategies developed to awaken audiences from the dream-existence of bourgeois society…now define the basic routine of a post-industrial society. Interaction with a computer” (Manovich 2002:3).
He provides numerous examples of this materialisation; the visual art strategy of collage has re-emerged as ‘cut and paste’, the montage techniques of Russian cinema equate with the windows on your desktop (the user essentially acting as ‘editor’ as they switch from one frame to another), and Tschichold’s theories of typography are echoed in the graphic style of both Macintoshes and PCs (Manovich 2002).

His ideas are compelling and both Photoshop and Flash utilize the techniques Manovich describes. These applications may therefore be said to embody some of the most creative, radical, and enduring thought in the history of civilisation. The software interface could be described as modelling effective creative practice.

The term interaction however, can describe more than just the initial meeting place of the technology and the user (the interface). The word may also be used to portray the ongoing process by which the two work together to create something. Complexity theorists have long maintained that ‘interaction’ is actually the very essence of learning (Jorg 2004, Bloom 2004, Wells 2004). Rejecting the idea of learning as ‘discovery’ Jorg states;

“The classroom focus on reality becomes not a reality to be described as unfolding but a reality which has to be invented again and again...A reality composed of multiple simultaneous, interdependent cause-effect relationships” (Jorg 2004:123).

Within this model it is the interaction between minds that is seen as paramount. This is supported and influenced though by the ongoing active adaptation by learners to the entire learning environment (Jorg 2004, Bloom 2004). This concept of interaction as a means of creating reality was clearly visible within the context of the research project. Students interacted with the software as they made things, allowing the software to have an ongoing influence on their decisions and adapting their ideas to suit. The technology also allowed them access to a reality they would not otherwise have. Cleetis shares his personal view of this process,

**Me** “Do you get a picture in your head and then play around until it matches?”

**Cleetis** “Well I don’t know what the computer can actually do so I try to find out what it can do then I try to figure out what I can do with those...like what it is I’ve got to use”.

**Me** “Do you like using the computer?”

**Cleetis** “Yep”

**Me** “Why?”

**Cleetis** “It’s just...like, I couldn’t make that but on a computer I could. I can just do all this stuff which I usually can’t do. Yeh because I couldn’t draw that any other way but on the computer”.

The technology also provided the students with a reason for interacting with each other. Coming from different classes, it initially gave them something in common, an impetus for conversations. This is a phenomenon I discuss further in the section on ICT as Support for Learning Conversations.
Interaction may therefore be said to directly support the following specific creative behaviours;

- Produces original ideas and products
- Is not afraid to be different or wrong (in both cases the user changes their mind, tries new approaches as a result of interacting with the software and learning new things)
- Has a keen sense of humour and sees humour in the unusual (user can interact with others who also have an ‘unusual’ sense of humour by making funny products)
- Displays intellectual playfulness, imagination and fantasy (user can interact with others who also have a interest in imagination and fantasy by making imaginative and fantastic products)

Capacity and Speed are functions of the hardware the application is installed on hence I have not addressed them.

**ICT as a Support for Learning Conversations**

Within the ICT for Concept Construction discourse just discussed, the emphasis is on the relationship between the user and the technology. ICT as a Support for Learning Conversations alternately stresses the interaction of people through or around a computer. Charles Crook is one of the main proponents of this theory and he argues for,

“…a socio-cultural model of learning which stresses the primacy of the joint construction of knowledge through communication…this leads to…the use of the computer as a support and resources for the communicative processes of teaching and learning” (Wegerif 2002:22)

Eugene Gormy (2003) takes this idea further. He believes that using computers to construct social and cultural knowledge actually means using the internet and such a use has lead to the internet becoming a domain of social and individual creativity with it’s own specific knowledge, culture and symbols. He terms this phenomenon ‘cyberculture’ and believes its main value is creativity;

“Cyberculture is a creative activity in the digital media, based on intrinsic motivation and principles of interaction and sharing. It’s… aim is knowledge and the self-sufficient creative act…It is based on the idea that ICT is a means of realization and perfection of human potential –both on the individual and social levels” (Gormy 2003:7).

This phenomenon is illustrated by the continued development of creative ‘sharing’ technologies, for example, online collaborative projects, peer to peer file sharing systems, blogs, wikis and multi-player games. Margaret Wertherheime vividly illustrates ‘cyberculture’ within the context of a multi-user domain (MUD);

“Nothing evinces cyberspace’s potential as a collective creative realm so much as the fantastic online worlds known as MUDs…Like good novels, successful MUDs evoke the sense of a rich and believable world. The difference is that while the reader of a novel encounters a world fully formed by the writer, MUDers are actually involved in an ongoing process of world-making. To name is to create and in MUD worlds the simple act of naming and describing is all it takes to
generate a new alter ego…MUDing is quintessentially a communal activity in which players become integrally woven into the fabric of a virtual society…The interlocking and imaginative social mesh of a MUD means that actions taken by one player may affect the virtual lives of hundreds of others…” (Wertherheim 1999:235).

Cyberculture as a support for learning conversations has various positive implications for teaching and learning. From accessing resources, to creating shared work, publishing, and contributing to dialogue. Jamie McKenzie thinks students will also “…attain a world view…as the global network gives them a chance to cross their local boundaries…and transcend their ethnocentric, narrow-minded nativistic bias…” (McKenzie 2004:6).

Within the context of my research I consciously worked to explore the use of ICT for Concept Construction. I did not do the same for ICT as a Support for Learning Conversations but it too was very present. While the children didn't communicate with each other through the computers, the machines did provide both a topic of conversation and a physical space for communication to occur around.

In terms of talking, the technology was initially a means of ‘breaking the ice’. This developed quickly into an ongoing dialogue involving asking each other for help, sharing techniques and interesting websites, critiquing and complimenting work.

Physically the children pointed at screens, turned monitors to show something to their neighbour, tapped each other's keyboards, and crowded around a single machine.

In both ways the ICT gave the children something in common, an excuse for making friends. The children themselves recognised this, enjoying the social aspect of the group;

“We're a very different collection of characters though I think we all work really well together and share our ideas as well and have a lot of fun”.

Sarah

“They're (the others in the group) fun and cool…we've all made friends and we all agree that it's fun and we like staying in at lunchtime because we don't feel hungry cos we want to stay in and finish our stuff”.

Andrea

“The group? Yeh, they're pretty cool. They're just cool people.
They're different and all that”

Cleetis

ICT as a Supporting for Learning Conversations is an increasingly interesting and important commentary. Perhaps this is because, as Carol Gigliotti says, “It is not my own consciousness I yearn for, but that connection with other consciousness that tell me beyond doubt I am here” (Beardon & Malmborg 2002:63).

A Combination of Both?

It seems that it may be a combination of ICT for Concept Construction and ICT as Support for Learning Conversations that creates a truly rich and creative environment.

This was true within my own study and seems to be supported by the findings of a 2003 Arts Council England nationwide review. This survey was commissioned to
look into the use of ICT within art and design education (an area of the curriculum already traditionally viewed as 'creative). It found generally that progress in the area was "…uneven, with the occasional pocket of exemplary practice…" (Arts Council England 2003:6). But then went on to highlight some of the exemplary practices it found. Here we find examples of ICT being used for concept construction;

"There is evidence of a creative approach to using digital media sometimes on its own but more often as an element within a process which includes non-digital materials and techniques…" (Arts Council England 2003:21).

And as support for learning conversations;

"…the massive strength of the arts has always been the power of collaboration…museums, galleries, artists provide sources of inspiration, materials and support that expands the scope of some projects…such collaborations allow access to technologies and skilled personnel not otherwise available. They also, crucially, open up new ways of thinking and making" (Arts Council England 2003:34).
How does the Experience of Creatively using High-end Software Impact on Students back in their Regular Classroom?

This question has been a launch pad for much thought in me and in order to communicate my ideas I need to answer it in two different ways. Firstly I will address the practical. That is the real, communicated thoughts of students and teachers as given in reply to the question. Second I will discuss the question in relation to wider educational contexts and approaches.

The period of this research project was short and I did not have any real hopes in terms of effecting long-term change for the students back in their classrooms. While the project was underway however the students reported a positive common change, they said they were generally happier to be at school and looked forward especially to Tuesdays which was when we worked together;

“I've been waiting for the Tuesdays, counting down. It’s so boring in class but this gives me something to look forward to”.  
Bobby

“I'm feeling happier going to school. I can't explain it, but I just feel happier going to school now. I've got funner things to do like this”.  
Andrea

“It frees up your Tuesdays a bit more. I like it when Tuesday comes”.  
Kirk

Post-research there were two main sets of feelings and actions that appeared. The first was an even more pronounced frustration by the students at working within a regular classroom. They expressed continued unhappiness at the lack of technology and freedom;

“It's (being in the research group) made me think we should really be working on computers rather than…it just makes you, how can I put this, annoyed”.  
Kirk

“We never get to really choose what we do...you still have to do everything that she's (the classroom teacher) put on the board. You just get to choose when you do it...it just takes up more of the day. I get less time”.  
Bobby

“I still just think some of the stuff we have to do is stupid. It just wastes my time and I’d rather be doing other stuff”.  
Cleetis

“I personally liked the independence that we got (in the research group). That we could do what we liked which was cool. In class
there are a lot more rules”.

Sarah

These negative feelings were expressed by two of the students through their rebellious behaviour. While Cleetis’s teacher perceived this as simply a continuation of the behaviour he’d always indulged in, Sarah’s teacher attributed it more directly to her involvement in the research group;

(on Sarah) “I’ve noticed a few changes but not good ones. Her behaviour has seen her sent out of the room by other teachers for talking back and she is more reluctant to apply herself to things she isn’t interested in. She does seem to interact more with others, however is quick to attack others verbally”.

The second kind of change was more positive but seemed only to relate to three of the children. According to their teachers Kirk, Andrea and Bobby had become happier and more confident since their participation in the study;

(on Kirk) “I’m really thankful that he was with you because since he started he’s smiling. There’s some animation over his features. We used to laugh that you could tell he was coming because there was this little black cloud over his head…He has become more outgoing and smiles more”.

(on Andrea) “Andrea says she enjoys coming to school more. She challenges me about why she has to do certain work…I think those changes are a result of being in your computer group. Another thing I have noticed is how she is willing to help her peers in this area – creative work and I think this is because she is more confident about herself and what she can do”.

(on Bobby) “He is still an individual and more prepared to stand out from the crowd with confidence”.

It is interesting that all comments in this area relate to student attitude and behaviour. No one reported any change in terms of creativity or achievement. While I do not doubt that the lack of reported student evolution in these areas is in part the consequence of such a short study, it’s absence did get me thinking about contextual definitions for those terms ‘creativity’ and ‘achievement’. For the first time I realised that perhaps for others those two terms were not synonymous in the way they were for me.

With the benefit of hindsight I can see that my original plan for this research project was essentially a simple theory test. The scheme was based on my experiences in The Discovery class. My perceptions of that class were that it was a place where frustrated, sad, indifferent children had seemed to find their creativity and to experience success. Because of my own values I equated creativity with achievement and saw the Discovery class as an environment conducive to both. I also saw information and communication technologies, specifically high-end software, as a crucial part of that environment. These factors combined led me to hypothesize that high-end software provides a context for some children to display a creativity that they would not show anywhere else and I rather smugly assumed my research findings would support this notion.

This framework quickly fell apart as I realised the classroom teachers of the students involved could actually see the children’s creativity very clearly. This was evident in
the observation scales they used to initially identify students for participation in the project (Appendix A) as well as in their interview comments;

(on Bobby) “He’s a very creative boy…”

(on Cleetis) “He does really well when it comes to creative stuff…”

(on Andrea) “…her creativity…she comes up with her own wicked stuff…”

(on Kirk) “He did one-day withdrawal school last year…he was fabulous and creative…”

(on Sarah) “…doesn’t fit the standard mould of a girl her age with her creativity”.

Hearing these kinds of statements I began to understand that these children were sharing the creative parts of their personality but that they were still perceived of as ‘underachievers’. I realised that outside of my own head and classroom, creativity did not necessarily equate with achievement. This is possibly very obvious, but for me constituted a real epiphany and led me to formulate hypothesis number two, that these children display their creativity in other contexts where it is not valued. At this point I became very post-modern and excited. I began to perceive of my research group as an example of Derrida’s ‘Différance’; a schism whose very presence made visible the insidious power structures of the status quo (Derrida 1982, McLuhan & Fiore 2001). That my students were not achieving was proof we worked in an industrial-style school where obedience and productivity were prized over creativity. We were surrounded by a Newtonian-age monolith operating under irrefutable laws, absolute power structures and systems that preserved both. This concept appealed to the post-structural rebel in me and I think I truly believed it for a day or so. Incubation of the idea however revealed a few fatal flaws; Firstly the thesis was too tidy, especially for a piece of “…postmodern complexity” (Redding-Jones:4) and it’s neatness undermined its credibility. Secondly, I could not ignore that there were some areas of the curriculum children in my group enjoyed and excelled in;

“I like some kinds of writing like expressive writing and poetry sort of, I like that kind of writing”.

Cleetis

“I like to try and figure things out…that’s why I’m in the problem solving group I guess”.

Bobby

“We have fun activities like Inquiry. We’re doing our own inquiry and we can choose whatever we like…I’m studying mythical beasts right now because I really like them”.

Andrea

“I quite like writing stories. I have a folder at home and it’s full of stories I haven’t finished yet”.

Kirk
“I like writing and Inquiry where I can basically use my own ideas”.

Sarah

Their classroom teachers were also happy to give them credit in this way;

(on Sarah) “(she) kinda likes the freedom of the Inquiry model where you get to develop your own questions. She really enjoys that whole concept of being able to come up with her own question and her own research”.

(on Kirk) “He has the most amazing vocabulary, the best speller I have ever seen, but he truly know how to use the words. He crafts his writing beautifully…He loves to sketch, detailed sketching although he wouldn’t consider himself an artist…quite a beautiful sketcher”.

(on Andrea) “She’s really good at expressing her ideas in her poetry (and) through her art and she does these wicked drawings in class”.

(on Bobby) “He is in my Maths problem solving group and has an amazing Maths strategy that he uses. He’s able to do things in his head that just about anyone else can’t do…he’s really really good mentally”.

(on Cleetis) “…he really stands out when we do inquiry because he’s the type of kid that finds it very easy to ask the higher and the lower order questions…he’s a strange kind of child because…most kids only have one type of thing that they’re really good at but this kid’s sporting, he’s artistic…great writer…”

I concluded that there was some room in the regular classroom for creative activities. That indeed some parts of our school curriculum, such as Inquiry and Creative Writing actively promoted it. Things were getting more paradoxical; my students were sometimes excelling but were still labelled ‘underachiever’.

I decided to think about the educational context that the group was in and I began to view our school in terms of a paradigm shift. Our Intermediate is an organisation with many of the modernist trappings still (uniforms, bells, curriculum areas, an emphasis on the written etc) but in recent years we have consciously undertaken a re-culturing of the environment; As a staff we have developed a school vision, backed up with school values and learning attributes. We have developed an inquiry model, shifting the emphasis from traditional science and social studies content knowledge to transferable concepts like questioning, researching and communicating understandings. Initiatives that promote and value creativity and allow those children in my group to shine. As an organisation we are in transit and unfortunately despite these ‘moments’ still I think the industrial-age model reigns supreme. Hence creative behaviours like an unusual sense of humour, an interest in fantasy, and an indifference to being different or wrong are ultimately seen as inappropriate or unimportant. It is only in this context that children who are acknowledged as creative and who do well in creative endeavours could still be described as ‘underachievers’.

In summary, participating in the research group and creatively using high-end software does seem to have some small ongoing impact on the students in terms of attitude and behaviour. It does not however appear to influence their status as
'underachiever' within a regular classroom. This may be because the creative behaviours they display, although valued within specific curriculum activities, are not valued by the school culture at large. Indeed it may be these very behaviours that provoke the 'underachievement' label.
Conclusion

The superficial answer to my research question is that for gifted underachievers the use of high-end software can impact positively in regards to creativity. This is because applications like Photoshop and Flash have the subsequent features inherent in their design;

- Provisionality
- Interactivity
- Range
- Accuracy
- Quality
- Automation
- Multi-modal
- Neutrality

These qualities in turn provoke and support the following creative behaviours in gifted underachievers, both in terms of the creative work process and the finished creative product;

- Produces original ideas and products
- Displays intellectual playfulness, imagination and fantasy
- Creates original stories, plays, poetry etc, or invents things
- Has a keen sense of humour and sees humour in the unusual
- Generates unusual insights
- Demonstrates awareness of aesthetic qualities
- Is not afraid to be different or wrong
- Enjoys speculation and thinking about the future

This conclusion however has brought along with it some deeper understandings of the problematic place of creativity in education and therefore the position of creative students like those in my study. It seems to me that creativity is about more than just the creative process and/or the creative product. People who are skilled at this process and/or making products earn the right to be described as ‘creative’. They become ‘creative people’; creativity becomes, at least in part, who and what they are. Creativity can therefore be said to be about identity.

And if information and communication technology, explicitly high-end software, can promote and facilitate creativity in the ways this project details then does it not follow that ICT can promote and facilitate identity? Specifically creative identity? I believe so and confidently state that high-end software can help you to be the best creative person you can be.

In a traditional school setting however this does not equate with achievement. Even the most cursory postmodern analysis reveals that industrial age schools (even progressive ones like ours) do not privilege for example, an unusual sense of humour (it disrupts the class!) or originality (the children wear uniforms) or an aesthetic awareness (when the bell goes you stop work, even if your page isn’t ‘right’). There is a mismatch in values so extreme you could say that in this school context being the best creative person you can be is actually synonymous with being an underachiever.

I strongly believe however that creative children should not change themselves to fit in with an outdated school model. I do not think being good at school automatically equates with being good at life and I admire the approach of the ‘nonproducer’. This
does seem to be a sensible and honourable way of dealing with inappropriate curricular. I think instead that schools should change to incorporate and celebrate the creative and I am gratified and proud that my school is attempting to do this. Providing creative children with access to high-end software is one strategy all schools could use to achieve this.
<table>
<thead>
<tr>
<th>Reference</th>
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<tr>
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<tr>
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**Gifted Underachievers**


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### How are Students Creative when Using High-end Software?


### How does High-End Software Facilitate Creativity among Gifted Underachievers?


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How does the Experience of Creatively using High-end Software Impact on Students back in their Regular Classrooms?


Appendix a: Teacher observation scale for identifying creatively gifted underachievers

Teacher Observation Scales for Identifying Gifted Underachievers with Creative Abilities

<table>
<thead>
<tr>
<th>Teacher’s Name:</th>
<th>Student’s Name:</th>
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<tbody>
<tr>
<td>Class:</td>
<td>Year:</td>
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<tr>
<td>Gender:</td>
<td>Date:</td>
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</table>

These scales are designed to help teachers identify underachieving children with special abilities in the area of creative thinking. In this scale there are four headings; Learning Characteristics, Motivational Characteristics, Self-determination Characteristics and Creative Thinking Characteristics. Under each heading are a series of statements. The degree to which you have observed the presence or absence of each characteristic is rated by placing a tick in the appropriate box using the following scale values:

1. The characteristic has SELDOM or NEVER been observed.
2. The characteristic has been observed OCCASIONALLY.
3. The characteristic has been observed OFTEN.
4. The characteristic has been observed ALMOST ALWAYS or ALWAYS.

With a gifted underachiever there is likely to be a gap between the first two sections and the last two sections; that is lots of ‘Seldoms’ and ‘Occasionallys’ under the headings Learning Characteristics and Motivational Characteristics and lots of ‘Oftens’ and ‘Always’ under the headings Self-determination Characteristics and Creative Thinking Characteristics.

1. Learning Characteristics:

<table>
<thead>
<tr>
<th>Displays logical and analytical thinking</th>
<th>Seldom</th>
<th>Occasionally</th>
<th>Often</th>
<th>Always</th>
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</thead>
<tbody>
<tr>
<td>Is quick to see patterns and relationships</td>
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<tr>
<td>Achieves quick mastery of information</td>
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<tr>
<td>Strives for accurate and valid solutions to problems</td>
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<tr>
<td>Easily grasps underlying principles</td>
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<tr>
<td>Likes intellectual challenge</td>
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<tr>
<td>Jumps stages in learning</td>
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<tr>
<td>Seeks to redefine problems, pose ideas and formulate hypotheses</td>
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<tr>
<td>Problem-finds as well as problem-solves</td>
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<tr>
<td>Reasons things out for themselves</td>
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<tr>
<td>Supports ideas with evidence</td>
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<tr>
<td>Can recall a wide range of knowledge</td>
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<tr>
<td>Independently seeks to discover the why and how of things</td>
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</table>
### 2. Motivational Characteristics:

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Seldom</th>
<th>Occasionally</th>
<th>Often</th>
<th>Always</th>
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<tbody>
<tr>
<td>Strives for high standards and personal achievement</td>
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<tr>
<td>Is self directed</td>
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<tr>
<td>Is highly self-motivated and sets personal goals</td>
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<tr>
<td>Is persistent in seeing tasks to completion</td>
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<tr>
<td>Becomes committed to and absorbed in tasks</td>
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<tr>
<td>Tends to be self-critical and evaluative</td>
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<td></td>
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<tr>
<td>Is reliable</td>
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<td></td>
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<tr>
<td>Prefers to work independently</td>
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</tbody>
</table>

*Based on The NZ Council for Educational Research Teacher Observation Scales 1996*

### 3. Self-determination Characteristics:

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Seldom</th>
<th>Occasionally</th>
<th>Often</th>
<th>Always</th>
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<tbody>
<tr>
<td>Is sceptical of authoritarian pronouncements</td>
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<tr>
<td>Questions arbitrary decisions</td>
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<tr>
<td>Pushes teachers and adults for explanations</td>
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<tr>
<td>Is reluctant to practice skills already mastered</td>
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<tr>
<td>Is easily bored with routine tasks</td>
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<tr>
<td>Expresses ideas, preferences and opinions forthrightly</td>
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<tr>
<td>Asks searching questions</td>
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<tr>
<td>Relates well to older children and adults and often prefers their company</td>
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<td></td>
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<tr>
<td>Seeks to redefine problems, pose ideas and formulate hypotheses</td>
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### 4. Creative Thinking Characteristics:

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Seldom</th>
<th>Occasionally</th>
<th>Often</th>
<th>Always</th>
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<tbody>
<tr>
<td>Produces original ideas</td>
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<td></td>
</tr>
<tr>
<td>Displays intellectual playfulness, imagination and fantasy</td>
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<tr>
<td>Creates original stories, plays, poetry etc, or invents things</td>
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<tr>
<td>Has a keen sense of humour and sees humour in the unusual</td>
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<tr>
<td>Generates unusual insights</td>
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</tr>
<tr>
<td>Demonstrates awareness of aesthetic qualities</td>
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<tr>
<td>Is not afraid to be different</td>
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<tr>
<td>Is prepared to experiment with novel ideas and risk being wrong</td>
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<tr>
<td>Seeks unusual rather than conventional relationships</td>
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<tr>
<td>Enjoys speculation and thinking about the future</td>
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Appendix b: Teacher Observation Scale for Identifying Children with Special Abilities - Original

Teacher Observation Scales
For Identifying Children With Special Abilities

Name: ____________________________ (First) ____________________________ (Last)
Age: ______ yrs ______ months Gender: ____________________________
School: ____________________________ Class/Year: ____________________________
Teacher: ____________________________ Date: ____________________________

The Teacher Observation Scales have been developed to assist teachers identify children with special abilities in the areas of learning, social leadership, motivation, creative thinking and self-determination.

Directions For Use:
Each statement in the five scales should be considered separately. The degree to which you have observed the presence or absence of each behavioral characteristic is rated by placing a tick in the appropriate box using the following scale values:
1. The characteristic has SELDOM or NEVER been observed.
2. The characteristic has been observed OCCASIONALLY.
3. The characteristic has been observed OFTEN.
4. The characteristic has been observed ALMOST ALWAYS or ALWAYS.

Scale Score Profile:
To provide a profile of the student's characteristics enter the total weighted score for each scale in the boxes below:
I Learning Characteristics
II Social Leadership Characteristics
III Creative Thinking Characteristics
IV Self-Determination Characteristics
V Motivational Characteristics

1 LEARNING CHARACTERISTICS

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<tr>
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<th>4</th>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
<td></td>
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</tbody>
</table>

Scoring:
1. Sum the number of ticks in column 3 and record here
2. Sum the number of ticks in column 4 and record here
3. Add the weighted scores for columns 3 and 4 (Total Weighted Score)

Teacher Comment:

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II SOCIAL LEADERSHIP CHARACTERISTICS

1. Takes the initiative in social situations.
2. Is popular with peers.
3. Communicates well with others.
4. Actively seeks leadership in social situations.
5. Shows ability to inspire group to meet goals.
6. Persuades group to adopt ideas or methods.
8. Is adaptable and flexible in new situations.
9. Actively seeks leadership in sporting activities.
10. Is socially mature.
11. Is willing to take responsibility.
12. Synthesizes ideas from group members to formulate a plan of action.

Scoring:
1. Sum the number of ticks in column 3 and record here \[ \times 3 = \]
2. Sum the number of ticks in column 4 and record here \[ \times 4 = \]
3. Add the weighted scores for columns 3 and 4 (Total Weighted Score) \[ \]

Teacher Comment:

III CREATIVE THINKING CHARACTERISTICS

1. Produces original ideas.
2. Displays intellectual playfulness, imagination and fantasy.
3. Creates original stories, plays, poetry, etc., or invents things.
4. Has a keen sense of humour and sees humour in the unusual.
5. Generates unusual insights.
7. Demonstrates awareness of aesthetic qualities.
8. Is not afraid to be different.
9. Generates a large number of ideas.
10. Is prepared to experiment with novel ideas and risk being wrong.
11. Seeks unusual rather than conventional relationships.

Scoring:
1. Sum the number of ticks in column 3 and record here \[ \times 3 = \]
2. Sum the number of ticks in column 4 and record here \[ \times 4 = \]
3. Add the weighted scores for columns 3 and 4 (Total Weighted Score) \[ \]

Teacher Comment:
### IV. Self-Determination Characteristics

<table>
<thead>
<tr>
<th>Kinds of</th>
<th>Seldom</th>
<th>Occasionally</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is sceptical of authoritarian pronouncements.</td>
<td>[ ]</td>
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<tr>
<td>2. Questions arbitrary decisions.</td>
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<tr>
<td>3. Pushes teachers and adults for explanations.</td>
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<tr>
<td>4. Displays a precocious interest in 'adult' problems.</td>
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<tr>
<td>5. Is reluctant to practise skills already mastered.</td>
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<tr>
<td>6. Is easily bored with routine tasks.</td>
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<tr>
<td>7. Expresses ideas, preferences and opinions forthrightly.</td>
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<tr>
<td>8. Relates well to older children and adults and often prefers their company.</td>
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<tr>
<td>9. Asks searching questions.</td>
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</tbody>
</table>

**Scoring:**

1. Sum the number of ticks in column 3 and record here: [ ] \times 3 = [ ]
2. Sum the number of ticks in column 4 and record here: [ ] \times 4 = [ ]
3. Add the weighted scores for columns 3 and 4 (= Total Weighted Score): [ ]

**Teacher Comment:**

### V. Motivational Characteristics

<table>
<thead>
<tr>
<th>Kinds of</th>
<th>Seldom</th>
<th>Occasionally</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strives for high standards of personal achievement.</td>
<td>[ ]</td>
<td>[ ]</td>
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<tr>
<td>2. Is self-directed.</td>
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<tr>
<td>3. Is highly self-motivated; sets personal goals.</td>
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<td>4. Is persistent in seeing tasks to completion.</td>
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<td>5. Becomes committed to and absorbed in tasks.</td>
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<td>6. Tends to be self-critical and evaluative.</td>
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<td>7. Is reliable.</td>
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<tr>
<td>8. Prefers to work independently.</td>
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</tbody>
</table>

**Scoring:**

1. Sum the number of ticks in column 3 and record here: [ ] \times 3 = [ ]
2. Sum the number of ticks in column 4 and record here: [ ] \times 4 = [ ]
3. Add the weighted scores for columns 3 and 4 (= Total Weighted Score): [ ]

**Teacher Comment:**
# Observations of Creative Thinking Characteristics: Process

<table>
<thead>
<tr>
<th>Date &amp; Task:</th>
<th>Kirk</th>
<th>Cleetis</th>
<th>Bobby</th>
<th>Andrea</th>
<th>Sarah</th>
</tr>
</thead>
<tbody>
<tr>
<td>23/06 – Last Flash session, students finishing off work, choosing own things to do etc.</td>
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<tr>
<td><strong>Individual Work:</strong></td>
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</tr>
<tr>
<td>Produces original ideas &amp; products</td>
<td>Says “I like to do abstract stuff – random squares racing around the screen”</td>
<td>X-ray idea unique within the group. Always keen to try something new, masters and moves on very quickly (eg: dragging, masking)</td>
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</tr>
<tr>
<td>Displays intellectual playfulness, imagination &amp; fantasy</td>
<td>Wants the ball to look like it’s bouncing off the edges of the monitor (trompe loile)</td>
<td>Adds lots of things to unmask including fantastic creatures etc.</td>
<td></td>
<td></td>
<td>Andrea says to Sarah “You should go AAARRRGGHH” very loudly. They both crack up.</td>
</tr>
<tr>
<td>Has a keen sense of humour &amp; sees humour in the unusual</td>
<td>Show not just bones in x-ray but heart and kidneys pumping.</td>
<td>Says about Bobby “His are all violent – mine is the loving story of a vicious hawk killing a baby bird” (very sarcastic, self deprecating) Talks about her pet Cockateal and imitates it singing ‘Pop goes the Weasel’ Cleetis and Bobby laugh.</td>
<td></td>
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<tr>
<td>Generates unusual insights</td>
<td>Have a big discussion about you have all these ideas for things during the week but then you get here and your mind goes blank. Discussed that this might be because of the computers sucking your brain out.</td>
<td>Makes a red dragonfly and comments “Now it looks sunburnt”.</td>
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<tr>
<td>Demonstrates awareness of aesthetic qualities</td>
<td>Asks Bobby how to make text bigger.</td>
<td>Movement of internal organs –not just still images.</td>
<td>Continues work on a previous piece. Uses scanner to achieve greater control over image. States that the hair of her character is “too bright”. Says to herself “If I rush it I’ll ruin it…”</td>
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<tr>
<td>Is not afraid to be different or wrong</td>
<td>Wants to reverse frames for smooth effect.</td>
<td></td>
<td>Continues work on a previous piece. Spends a long time getting the music to the right length.</td>
<td></td>
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</tr>
<tr>
<td>Enjoys speculation &amp; thinking about the future</td>
<td>Micah says “I hate typing”.</td>
<td>Singing ‘Funky Town’. States about her work “I like mine” Talks to herself as she works. Talks about her bird hatching movie “I only did that cos everyone else was doing violent ones and I wanted to be different”</td>
<td>Thinks out loud “Do I have to do a new layer for everything…oh yes cos I might need to change it later…say TV rings me up and wants my cartoon…”</td>
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<tr>
<td>Behavior</td>
<td>Details</td>
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<td>----------------------------------------------</td>
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<tr>
<td>Is curious and keen to explore ideas further</td>
<td>Discovers and plays a lot with the software’s built in effects (eg explosion)</td>
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<tr>
<td></td>
<td>Notices Kirk’s experiments and starts to play a lot with the software’s built in effects (eg explosion)</td>
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<tr>
<td></td>
<td>Wants to learn to do Masking – had an idea last week to show the insides of a person (x-ray). Asks for help in this area. Adds animation beneath mask layer. Asks lots of questions about Actionscript. Has been making stuff between sessions with another friend. Shows me his work. Searches for Actionscript tutorials on the web.</td>
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<td></td>
<td>Is very excited about Bobby making cursors and asks him to show her how.</td>
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<tr>
<td></td>
<td>Wants to do something really ambitious involving buttons (beyond me right now, say I will research and get back to her)</td>
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</tbody>
</table>
### Observations of Creative Thinking Characteristics: Product

<table>
<thead>
<tr>
<th>Date &amp; Task:</th>
<th>Kirk</th>
<th>Cleetis</th>
<th>Bobby</th>
<th>Andrea</th>
<th>Sarah</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/5 - Introduction to animation: Simple flipbook animation in Flash – first session</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Individual Work:</th>
<th>Kirk</th>
<th>Cleetis</th>
<th>Bobby</th>
<th>Andrea</th>
<th>Sarah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produces original ideas &amp; products</td>
<td>Abstract Swirl</td>
<td>Tap Dripping</td>
<td>Man Eats Fly</td>
<td>Man turns into Bird</td>
<td>Man Falls in Hole</td>
</tr>
<tr>
<td></td>
<td>Very different to everyone else's Work; an abstract piece rather than figurative. Different to my example animation (head)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Displays intellectual playfulness, imagination &amp; fantasy</th>
<th>Kirk</th>
<th>Cleetis</th>
<th>Bobby</th>
<th>Andrea</th>
<th>Sarah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract animation = intellectual playfulness? Ability to think beyond the literal.</td>
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</tbody>
</table>

- All students did their own thing, no interest or concern about other’s work. All original in comparison to work of their peers.
- Both pieces incorporate fantasy elements; humans with animal features (Bobby: Frog tongue and Andrea: Wings, beak etc.)
<table>
<thead>
<tr>
<th>Has a keen sense of humour &amp; sees humour in the unusual</th>
<th>Kind of ‘gross-out’ humour; man with gigantic tongue eating a fly. Laughter as a reaction from others.</th>
<th>Use of physical humour, slapstick. Laughter as a reaction from others.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generates unusual insights</td>
<td>Abstract piece indicates recognition of animation as being about movement/form rather than narrative. Thought of something very small, intimate, domestic to make animation about. Different to the others. Connection and juxtaposition of unrelated elements; human head and frog tongue. Connection of unrelated elements; man and bird.</td>
<td></td>
</tr>
<tr>
<td>Demonstrates awareness of aesthetic qualities</td>
<td>Use or swirls moving in different directions, also composition very balanced. Was told by another student his piece was “very artistic”. Very complex drawing including a background. Animation has much less frames than anyone elses but images are more ‘finished’ (coloured etc). Addition of colour. Addition of colour; limited palette.</td>
<td></td>
</tr>
<tr>
<td>Is not afraid to be different or wrong</td>
<td>All happy to be ‘different’ in terms of individual animation content.</td>
<td>A little nervous of the software, worried about getting things ‘wrong’ and wrecking his work.</td>
</tr>
<tr>
<td>--------------------------------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Happy to explore software, try things without fear of consequence.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enjoys speculation &amp; thinking about the future</td>
<td>Speculative animation “What if humans could eat flies?”</td>
<td>Speculative animation “What if humans could turn into birds?”</td>
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</tbody>
</table>