ICT and Learning: The iPAinT Experience

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Introduction

Providing educational programmes appropriate to the needs of gifted and talented students has been found to be extremely challenging. One reason for this is the difficulty in determining just what the research reveals to be "best practice" for gifted and talented students. Riley et al (2004, p.3) report that

> *There is a paucity of reported national or international research which evaluates the effectiveness of provisions for gifted and talented students in relation to social, cultural, emotional, creative, and intellectual outcomes.*

Even when we do find research purporting to advise practice, meta-analyst Asher (2003), warns that the published literature in the field of gifted and talented education is inherently flawed. Sample sizes tend to be small, our experimental curriculum reform practices are not noticeably better than our current practices and narrative reviews are prone to the "subjective selection biases" of the reviewer (Asher, 2003, p7). This makes it very difficult for educators struggling to effectively meet the learning needs of gifted and talented students.

Reviewing the research reveals further uncertainty over what actually is "effective practice" when we grapple with the context in which gifted and talented students are taught. For example, pullout groups, mixed ability groups or special classes for gifted students. The difference in "degree and kind" of individual gifted and talented students (gifted students are not a homogenous group), and the diversity of individual teachers, makes defining what constitutes "effective practice" extremely difficult. These issues coupled with a lack of professional development opportunities for teachers in gifted education both at pre-service and in-service levels make it extremely difficult to contemplate the potential benefits that ICT will bring to enhance the learning of gifted and talented students.

Stratford and Brown (2002) suggest that the government focus on the definition of ICT can be described as technocentric in that it locates the technology, rather than the social practices associated with the technology, at the centre of the discussion. New technologies in and of themselves will not improve educational outcomes for gifted students or for anyone else. What is needed are educational strategies focused on improving learning and teaching and

studies that show how teachers are making effective use of ICT to support their teaching and learning goals. Brown, (1997) discusses the tripart relationship between learning specific technological knowledge and capability, learning about the relationship between this area of technology and society and learning with ICT across the curriculum. The Ministry of Education's strategy document Digital Horizons: Learning Through ICT (2002-2004, p 8.) develops these ideas further in the outline of the government's overall strategy which encompasses four areas: (1) improving learning experiences and outcomes for all students, (2) supporting educators in integrating ICT into curriculum and management practices, (3) increasing efficiency and effectiveness of educational management and administration, and, (4) developing partnerships with communities, businesses and other stakeholders".

The Ministry of Education has actively pursued a number of initiatives to ensure the optimal development of ICT in support of teaching and learning in these four areas. The common purpose of these initiatives has been to increase knowledge, skills and resources amongst schools and clusters of schools. As noted in the previous article, the Ministry of Education has also funded a number of initiatives in the area of gifted education. The development of the iPAinT ICTPD cluster has brought together a number of the goals and aims of both the gifted education and the ICT initiatives.

The iPAinT (Integrated Powerful Adventures in Thinking) cluster is a Ministry of Education funded cluster focusing on using ICT to meet the special learning needs of gifted and talented students. The iPAinT cluster schools are Dominion Rd school, Puhinui school, St Josephs school (Takapuna), Whenuapai school, Hauraki Plains College and Rutherford College. A West Auckland Education Centre initiative, the cluster is directed by Pam Hook and co facilitated by Sue West and Pam Hook. The cluster began the contract in 2003 the first task for the cluster was to examine issues in the area of gifted education. For example, areas of policy, definition, and direction. It was important to begin here as most schools in New Zealand have developed quite individually in this regard. This individual approach is supported by the Ministry of Education (2002) policy for gifted and talented students. Once concepts of gifted and talented and multicategorical identification methods were addressed, the schools in the cluster explored curriculum models and differentiation through such questions as "What do gifted and talented students need to know, do and think?" and then "What do they experience?"

In 2004 the cluster schools have been encouraged to explore the ideas that ICT is a potentially powerful tool for supporting and developing cognitive rigour and challenge, and for differentiation of content, process, product and learning environments. These practices are congruent with some of the principles of effective practice for gifted and talented students. As a cluster we are exploring how learning through ICT can: facilitate connections for students with like minded others; support qualitatively differentiated enriched and accelerated educational experiences through interactions with unrestricted "information surfaces" (Manovich, 2001); introduce cognitive challenge through explorations of new ways to manipulate information; facilitate deep thinking about the impact of ICT on society, and introduce cognitive dissonance through explorations of cyber ethics.

Teachers have carried throughout the ICTPD contract an awareness that learning through ICT has potential, however it may also bring with it disappointment, frustration and even limit opportunities for gifted and talented student learning. ICT in and of itself cannot make learning more engaging and meaningful. The role of the teacher in designing learning environments to meet the needs of gifted and talented students has been pivotal to the value of any learning through ICT that has occurred. As noted in the research as long ago as 1990, the teacher's role is to plan for and manage the computer learning environment and to facilitate and guide the learning that goes on within it (Ryba & Anderson, 1990). Given the developments in new educational technologies and the complexities surrounding the capability of new systems and software, it means that the role of the teacher in planning and managing the learning environment is more critical than ever before.

The pedagogical model for professional development delivery for the iPAinT cluster was initially framed around the Centres of Pedagogy model for mentoring (Goodlad, 1983). The iPAinT cluster's centres of pedagogy were created to develop long term sustainable change within the cluster schools. It has involved establishing a system of mentors (Fogarty 2001), that include formal mentors (e.g. principals, teaching and learning experts in ICT and gifted education whose role it was to bring expertise and encouragement) practical mentors (e.g. experienced ICT teachers whose role it was to bring experience, excitement and skills teaching) and finally collegial mentors (e.g. novice and beginning ICT teachers whose role it was to teach peers, dialogue with partners, develop collaborative efforts and model learning behaviours for each other).

Using this system of mentoring, teachers have experienced opportunities for learning through their classroom practice, engaging in opportunities for reflective practice, engaging in collaborative planning, exploring new directions, taking part in professional writing, presenting at conferences and taking part in Talk2Learn online discussions. It should be noted that membership in any iPAinT centre of pedagogy is flexible. iPAinT principals regularly join practical mentor sessions, and iPAinT teachers might attend and learn within formal mentoring sessions.

This approach to professional development for teachers was also influenced by Joyce and Showers (2002) whose research shows that teachers who received training in theory combined with demonstration, practice, and participation in peer coaching study teams showed an 80% transfer and application of new learning to the classroom. The dramatic impact on transfer and application of new learning in the classroom that occurred when iPAinT schools encouraged participation in peer coaching/learning teams has encouraged us to build professional capacity with iPAinT cluster teacher facilitation in 2004. The second year of the cluster finds us moving from an entirely external ICTPD facilitator delivery to one where within cluster schools, facilitators are playing an increasingly significant role. We anticipate by the end of the contract in 2005 that we will have developed sufficient capacity and expertise within the cluster to sustain the goals and aims of the project into 2006 and beyond.

Powerful Tools

To what extent can we use learning through ICT to bridge the gap between what happens in classrooms and what gifted students need to know, do and think? Can the interactivity that the technology offers be used to uniquely assist in the development of cognitive skills and enhance the learning of gifted students? The iPAinT cluster schools experiences in 2003 and 2004 would suggest that this is the case.

Students can be gifted and talented in many different domains. For example students can be **gifted in using ICT.** The UK Qualifications and Curriculum Authority guidelines on identifying students who are gifted in using ICT, http://www.nc.uk.net/gt/ict/index.htm, suggest we should look for students who: demonstrate ICT capability significantly above that expected for their age; learn and apply new ICT techniques quickly; use initiative to exploit the potential of more advanced features of ICT tools; transfer and apply ICT skills

and techniques confidently in new contexts; explore independently beyond the given breadth of an ICT topic; initiate ideas and solve problems, use ICT effectively and creatively, develop systems that meet personal needs and interests. Babaeva and Voiskounsky (2002) have explored identification of students gifted in using ICT through the intelligence, social skills and personality traits of expert software engineers.

Too often in schools these students are taught **about** ICT, for example, how to make a PowerPoint™ presentation, when in reality at home they are learning **through** ICT, playing MMORPG'S, tweaking their personal websites, creating Macromedia Flash™ movies, beta testing games and creating mods for Battlefield 1942 ™, (Brown, 2003). Students use the bluetooth technology of cell phones, pagers and personal digital assistant to enhance their understanding of the world in ways educationalists have not yet imagined. Babaeva and Voiskounsky (2002 p.156), note that "although almost every school teacher can name students who are exceptionally good in computers, only rarely do these students get competent tutorship." Furthermore even when guidance and challenge has been provided for students gifted in using ICT, we too often neglect guidance in explorations of cyber ethics.

The idea of establishing an ICTPD cluster that has as its mandate the integration of ICT and the teaching and learning of gifted students certainly has merit. Often these students are so used to learning in highly interactive, relevant and motivating environments with built in challenge and cycles of expertise that our traditional pedagogy and curriculum fail to capture them. Their real learning often starts when they leave school each day. As (Moore, 1997, cited in Prensky, 2001) notes "For adults, computer skills are a tool, but for teenagers using computers has become a second language" (p 46). In the iPAinT cluster we have looked more broadly at how ICT might enhance the learning of gifted and talented students regardless of domain. Students who are gifted and talented learn at a faster rate, acquiring knowledge of content, process and procedures with less need for repetition and reinforcement. They think more abstractly; manipulate ideas and make more connections across disciplines, times, locations, cultures and circumstances at an earlier age than other learners. They are more able to problem find, to problem solve, and to think critically, creatively and metacognitively. They can do all this more quickly than others as noted by (Maker, 1982; Van Tassel-Baska, 1993). To meet these unique learning characteristics, meaningful learning for gifted students needs facilitation to ensure it has challenge, rigour, and allows for differentiation. Teachers must understand the learning characteristics of

gifted and talented students and then determine how learning through ICT might better meet these needs rather than the reverse when the availability of the technology is used as a driver for the learning experience.

Within the iPAinT cluster ICT has certainly enhanced the ability of teachers to access a wider range of activity structures, games, learning objects and collaborative projects. ICT has provided mechanisms to assist in thinking through the use of visual thinking organizers (e.g. Inspiration™ and Reasonable™ software). Opportunities to reflect upon, to remake and to recreate the work (audio/visual and text) of others have been facilitated through ICT.

To build knowledge and meaning for gifted and talented students through ICT, it is important to provide learning environments that widen the range of activity structures, and present opportunities for collaborative projects. It is important to encourage the individual to develop potential whilst interacting with intellectual peers and to afford the social conditions that can promote learning dialogues and discussion with intellectual peers, whether it be through discussion or text (Trewern, personal communication, 2004). These environments should be created by the teacher and they should provide an opportunity for students to demonstrate their ability, provide opportunities for decision making, extend their creativity, and assist in the development of higher order thinking skills.

The following section of this article presents some examples of areas explored by the students and teachers in the iPAinT cluster.

1. Communication: like minds, blogs and I seek you.

One educative practice considered particularly appropriate for gifted and talented students is the bringing together of 'like minds'. The communication aspect of ICT facilitates this as noted below:

> "ICT has benefits for all students, including gifted and talented students who are geographically isolated. It has the potential to bring together students with like interests and minds." (Ministry of Education, 2002a, p.5)

> "ICT networks can be used to give gifted and talented children a broader base of communication. Email or conferencing systems can be used to link these children, so that they can exchange ideas and feel less isolated." (BECTa Information Sheet on Gifted and Talented Children and ICT, 2001).
> http://www.becta.org.k/technology/infosheets/pdf/g&tchild.pdf

Many educators have designed opportunities for their gifted and talented students to meet 'like minds' through computer mediated newsgroups, mailing lists, email, text based chat, bulletin boards, Internet Relay Chat (IRC), I seek you (ICQ), computer mediated conferencing (CMC), BLOGS (http://modbog.com) and graffiti boards. Initiatives specifically appropriate for gifted and talented students include the National Foundation for Gifted and Creative Children Pen Pal and E-mailing lists at http://nfgcc.org/gkids.htm and the graffiti board at the Virtual School for the Gifted at http://www.vsg.edu.au Academic mentoring support and career advice is available through corporate sponsored and volunteer programmes at IBM Mentorplace http://www.mentorplace.org/ and the International Telementor Program at http://www.telementor.org/

2. Critical thinking – Morin's battle for lucidity (Morin, 2001)

Developing ability in critical thinking is a challenging task. The "skilled and active interpretation and evaluation of observations and communications, information, and argumentation", (Fisher & Scriven 1997, p21), is considered good practice for gifted and talented students. However, developing an ability in critical thinking requires more than simply providing students with opportunities to problem solve or make decisions. Students need to be explicitly taught the constituent skills of critical thinking. These include context, audience reading, clarifying the meaning of terms and analysis of arguments. For example if students cannot clearly differentiate between define and describe, understand what is required to compare and contrast, or determine cause and effect then it is unlikely that they will ever produce well reasoned argument

Students can learn the constituent skills of, and develop a real facility in, critical thinking through visual thinking software. Enabling gifted and talented students to become strategic users of critical argument mapping software, e.g. Reason!Able™ http://goreason.com and

Athena™ http://www.athenasoft.org/ , visual critical thinking tools, e.g. Designs for Thinking, Thinking Maps™ http://www.designsforthinking.com/ , and known/unknown question mapping through concept mapping software, e.g. Inspiration™ http://www.inspiration.com , will give gifted and talented students the tools to analyse, evaluate, and create in any context. This may not prevent the ICT maverick from making decisions on the basis of Googlefight http://www.googlefight.com/, but it will enable students to think critically about the results gained!

3. Playing with "information surfaces" - acquiring, manipulating, storing, creating, and distributing (Manovich, 2001)

Some gifted and talented students adopt new ICT techniques quickly. They are able to transfer the ICT skills gained in one learning domain to another with ease, and can integrate applications where useful. Students can collaborate over a network to acquire, to record, to manipulate, to store, to create, and to distribute "information surfaces". These include texts, still images, moving images, sound (including MP3) and spatial constructions. Students can use ICT to mediate the Internet and web sites, computer games, hypertext and hypermedia, CD-ROMS and DVD-ROMS. This mediation can be communal or individual; for example it can be single user or simultaneous communal explorations of effectively unrestricted "information surfaces" through the use of directories (e.g.Yahoo), search engines (e.g. Google), hyperlinks, HTML tables, pull down menus and dynamic windows.

Providing opportunities for gifted and talented students to organize, access, analyse and manipulate "information surfaces" through software has never been so easy. Word processors, spreadsheets, databases, search engines, data mining, image processing, animation, digital audio, digital video, 3-D computer graphics, visualisation, and hypermedia authoring software represent a "real, rich and relevant" second language for students looking to produce, distribute and communicate complex and abstract ideas.

4. Learning through ICT that differentiates content, process and product

Ability grouping, acceleration of content, process and product, and opportunities for creative thinking can all be explored when hypertext stories are collaboratively written, illustrated

and peer critiqued via email or team blog www.modblog.com by a circle of academically gifted and talented students under mentoring by expert writers and or illustrators.

Acceleration can be facilitated through ICT programmes for gifted and talented students that allow intellectual challenge, rapid pace and individual feedback. Stanford University's Education Programme for Gifted Youth (EPGY) http://www-epgy.stanford.edu/ is a good example. Study of other languages can be effective differentiation for verbally gifted students. For example, Kidlink http://www.kidlink.org/ provides opportunities for students around the ages of ten to fourteen to socialize in other languages. The TKI Learning Languages page http://www.tki.org.nz/e/community/language/ resource has links to French, German, Italian and Spanish through the BBC Languages site http://www.bbc.co.uk/languages/ and Lingua@web http://www.linguaweb.ndirect.co.uk/ sites. Online tikanga and te reo Maori resources can be accessed through WickEd and bilingual interactives like Wharenui http://www.tki.org.nz/r/wick_ed/say/wharenui.php. Connecting with e -Pals from other countries to learn about schooling, fads, social life and music gives these initiatives meaning.

5. Online enrichment programmes

Online enrichment programmes for gifted and talented students with individual feedback are available through initiatives such as The Virtual School for the Gifted at http://www.vsg.edu.au/ and the University of New England TalentEd Enrichment Program (TEEP) http://scs.une.edu.au/tedvep/default.html, a computer mediated collaborative learning environment that encourages investigation and problem solving. Project eSchool a fully online, integrated curriculum for students in schools provides study opportunities around Level 3-5 and it is hosted by The Correspondence School and online programmes such as Learnz http://www.learnz.org.nz/index.php. These can easily be modified to link to curriculum aims and objectives and provide a rich learning resource for gifted and talented students.

6. Opportunities for problem solving

These are available through the undervalued field of computer gaming. Papert (1998 cited in Prensky 2001) observes that

> "Game designers have a better take on the nature of learning than curriculum designers." (p131)

Indeed Scriven (1988), argues that

> "Computer games, including arcade-type games, represent the most important educational software resource available today. If one includes reasonable extrapolations from the present examples, they could become the most important educational resource (for the schools) of all kinds, not excluding books. Even the most-condemned commercial games are strongly focused on educationally significant skills and attitudes and offer unique opportunities to teach them." (p82)

When the learning principles behind good game design, (Gee 2003), are compared with the learning needs of gifted and talented students they are very similar. It is hardly surprising that gifted and talented 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 involve in depth investigations and are highly motivating they seem highly appropriate learning experiences for gifted and talented students.

Anecdotal conversations with gifted and talented students affirm claims of the challenge and learning made by researchers exploring digital game based learning, such as http://www.gamestudies.org/ and Scriven (1988), Prensky (2001), Gee (2003). Providing opportunities for students to explore game design and develop their own games http://www.gamemaker.nl/index.html enhances the cognitive challenge in a way that we would find difficult to achieve without ICT.

7. Problem finding and problem solving, acceleration, opportunities for critical and creative thinking

These can be explored through interschool online collaborative projects, such as Trewern and Fry's The New Zealand Learning Network's Classroom Project Sniff, Swing and Swipe 1and 2 at: www.aucklandzoo.co.nz/sss/home.html (which won the DEANZ 2002 Award for excellence in distance, open, flexible e-learning and first place in the Educational projects section in the prestigious Stockholm Challenge Awards 2004), and international competitions such as ThinkQuest www.thinkquest.org/. The Web Tools for Learning Newsletter (Daniel and Cox 2004) is a great place to start thinking about online collaborative

projects. See http://webtools.cityu.edu.hk/news/newslett/interschool.htm, and MontageNZ online http://www.montage.org.nz/about/AboutUs.htm is a New Zealand resource listing moderated online collaborative projects with students from all over the world.

8. Supporting students with specific curriculum strengths.

For example The New Zealand Institute of Physics http://nzip.rsnz.org/es/index.html has Y12 and Y13 simulations and applets that will fascinate the able science student. Highly able young mathematicians have enjoyed PLUS, http://plus.maths.org/ an internet magazine looking at maths in a wider context through practical applications, maths careers and puzzles, NRICH http://www.nrich.maths.org.uk/public/index.php an online maths club, and WickED maths stuff http://www.tki.org.nz/r/wick_ed/maths/index.php.

9. Ethical decision making and caring thinking

Opportunities to take action in ethical decision making and caring thinking can be exercised when gifted and talented students take part in TakingITGobal™ an online community providing young people with inspiration to make a difference, information on issues, opportunities to take action, and a bridge to getting involved locally, nationally and internationally." http://www.takingitglobal.org/ ePALs is a monitored e-learning community where students can explore cross cultural collaborative projects on ethical issues and communicate through chatrooms, instant language translation, discussion board, and email and web mail http://www.epals.com/. Intercultural E-Mail Classroom Connections (IECC) http://www.iecc.org/ helps teachers find teachers in other cultures and countries for e-mail classroom pen-pal and other project exchanges. Significant opportunities exist for authentic explorations of ethical use of ICT through articles in daily newspapers, for example, http://www.nzherald.co.nz/ and sites such as Cybercitizen Awareness http://www.cybercitizenship.org/ .

To offer a "paint by numbers" prescriptive gifted and talented ICT menu, outlining where to play and how to do it when you get there would undermine and trivialize the unrestricted "information surfaces" available. We would also misrepresent the nature of gifted and talented students to represent them as a homogenous group. (Ministry of Education. 2000 p.17). The purpose of this section is to provide a starting point for teachers who want to

know how to get started in some of these areas. Refer also to Riley (2003) for a comprehensive listing of web-based resources for teachers of gifted and talented students.

Conclusion

It is apparent that a teacher charged with meeting the special learning needs of individual gifted and talented students will find much to value in the flexibility, interconnectivity, adaptability of pace of access, and the breadth and depth of "information surfaces", available through ICT. More qualitative than quantitative, ICT differentiation provides real choice for the learner, providing multiple ways for students to acquire content, to process ideas, and to develop products. With ICT students can explore multiple options for taking in information, choose different paths for making sense of ideas, and express what they learn in many alternative ways. With appropriate teacher leadership, learning through ICT can certainly provide opportunities for appropriate rigour and challenge for gifted and talented students. Would all students want to be involved in learning through ICT activity? Could all students participate? Should all students be expected to succeed? An affirmative answer to any of these questions indicates that the proposed ICT facilitated experience is not uniquely appropriate for gifted and talented, (Passow 1988, as cited in Gross, Macleod and Pretorius 2001, p. 26), and should be offered to all.

The flexibility, interactivity and active nature of ICT mediated learning holds enormous potential for teachers wanting to differentiate learning experiences for gifted and talented students. However, these "learning through ICT" experiences need to be facilitated by educators alert to the special learning needs of gifted and talented students and teachers who can facilitate appropriate changes in pedagogy and curriculum. There are complex and exciting adventures ahead for both the educator and the gifted and talented student.

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