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Framing the integration of computers in beginning teacher professional development

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Abstract

Government education departments mandate that computers should be and must be used in classrooms. Many beginning teachers are unsure of how to implement these expectations. Peter Twining's (2002) Computer Practice Framework (CPF) provides us not only with how to conceptualise computer use in education, but with the means to practically and progressively integrate computers into classrooms. Explanation is given as to how the CPF can be used as a reference point for beginning teachers to plan and use computers in their primary classroom programmes, through drawing on a personal narrative and linking it to the framework of the CPF. As the CPF focuses on curriculum transformation, this paper discusses what it means to transform the curriculum, and how it may be possible to go beyond previous practice.

Introduction

There are explicit messages given worldwide by governmental departments about the importance of technology to student learning, citizenship, employment opportunities, and the future of society. Examples are Australian policy on implementing information and communication technologies (hereafter ICTs) in education which is geared to actualise the role of education in the strengthening of 'an equitable, imaginative and economically strong knowledge society' (Bruniges, 2003, n.p.), the Australian National Goals for Schooling in the 21st Century – especially goal 1.61 (MCEETYA, 1999), and the U.S. Department of Education's report, "Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge" (1996). In addition, the Ministry of Education (MOE) New Zealand's document, "Education Priorities for New Zealand: A Summary" (2003), mandates the increased use of ICT as a teaching and learning tool. "Interactive Education: An Information and Communication Technologies Strategy for Schools" (MOE New Zealand, 1998) directly refers to the importance of implementing computer-based technologies into schools. These directives do not say how computers are to be used, so this article focuses on practical tasks that do use computers, and the focus and purpose of such tasks. The framework employed for this task classification is Peter Twining's (2002) Computer Practice Framework (hereafter CPF). This article is structured such that a brief description of Twining's CPF and its limitations are explained. This is followed by reference to the author's personal narrative of her five years in teaching and the steps she took from the class computer not being used at all in her classroom to having a number of computers being used in her classroom almost always. As reference is made to the transformation of curriculum throughout the text, the paper points towards employing Knowledge-Producing Schools (Bigum, 2002a, 2002b, 2003) as one way of achieving this transformation that the CPF privileges.

A Brief Description of Twining's CPF

Twining's Computer Practice Framework helps us to conceptualise computer use in education. The CPF has three core dimensions, labelled Quantity, Focus and Mode. These concepts are defined as:

- Quantity: the quantity of computer use as a proportion of the available learning time;
- Focus: the (teaching) objectives supported by the computer use;
- Mode: the impact of computer use on the curriculum (see Twining, 2002, p. 101).

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[1] Note: Goal 1.6 of the Australian National Goals for Schooling is to "be confident, creative and productive users of new technologies, particularly information and communication technologies, and understand the impact of those technologies on society" (MCEETYA, 1999, n.p.).

Twining (2002) explained that these three dimensions interrelate in order to provide a "rich picture of computer use", and that "each dimension on its own is of minimal value" (p. 108).

Focus is segmented into three sub-categories:
1. Information Technology (hereafter IT): Is the computer being used to help children develop their skills, knowledge and understanding of hardware and software?
2. Learning tool: Is the computer being used to support aspects of children's learning other than IT? The Learning Tool focus is further sub-divided into three areas:

- Is the computer being used as a Curriculum learning tool (curriculum area other than IT)?
- Is the computer being used as a Mathetic learning tool (e.g. developing abilities to learn and collaborate)?
- Is the computer being used as an Affective learning tool (e.g. enhancing self-esteem, motivation)?

3. Other: Is the computer being used in a way not covered by the first two foci? Examples of this focus include 'using computers in order to respond to pressure to do so', and 'allowing children who have finished other work to "go on the computer"' (Twining, 2002, p. 103).

Twining explained that the three foci always apply to some degree because:

- The teacher always has to consider management issues when planning and allocating activities (Other);
- One cannot focus on learning to use a computer (IT) in isolation from some content, which inevitably will be from part of some other curriculum area (Learning Tool);
- When using a computer to do something else (Learning Tool), learning and/or reinforcing of computing skills (IT) takes place;
- Learning to become more effective learners (Learning Tool) should be an implicit part of teaching;
- Any learning episode always entails an element relating to the affective nature of the task (Learning Tool) (Twining, 2002, p. 105).

The mode only applies to the learning tool focus, not IT or Other. The mode is also divided into three sub-categories. It asks whether the learning tool focus

- Supports: the content is the same as it would be if computers were not being used, and the process may be automated but is essentially unchanged;
- Extends: Either or both the content and the processes are different than they would be if computers were not being used; however, the changes could have been achieved without the use of a computer; and,
- Transforms the curriculum: Either or both the content and the processes are different than they would be if computers were not being used. Without a computer, the changes could not be achieved.

For example, to practise one's spelling, or multiplication tables, using readily available software that promotes these tasks, uses the computer as a curriculum learning tool (focus), where the curriculum areas are respectively English and mathematics. The computer would be considered a tool to 'support' (mode) learning because it provides an automated process of the same content that might be done using more conventional technologies.

Written self-evaluation of tasks is a common activity in New Zealand schools. This is sometimes done by handwriting and can involve the use of a blank or worksheet with guidelines. By asking a child to complete his/her evaluation on the computer, it merely automates the task. No mode would apply as the focus is IT.

Using a computer for group work focuses on the computer as a mathetic learning tool (focus), because its role is to facilitate and develop skills in group collaboration. The type of work being completed determines the mode.

Using the computer to motivate a child to write by saying for example, "How about you draft your story on the computer? Won't that be fun?!" focuses on the learning tool as affective. Some children dislike handwriting and consequently would rather type or do something different to the other children, especially if they are reticent writers.

Researching a scientific topic using the Internet would be deemed as a 'curriculum learning tool' (focus) and its mode would be extend because though the content is the same as reading reference books, the process is different.

In contrast to the above examples where the activity could conceivably be accomplished without the use of computing technology, the transform mode by definition requires a computer. Twining highlighted how a teacher's intention may to be to employ a task to transform the curriculum, yet the reality of the task is that it is simply automated:

> A painting programme may have the potential to transform the curriculum and a teacher might intend that children use it to create pictures using processes such as trial and error and exploring techniques not available without a computer (Mode = Transform), when in practice the children simply replicate work that they have already done using 'potato stamps', paints and paper without changing the content or processes that they engage in other than automating some aspects of it (Mode = Support) (Twining, 2002, p. 104).

Limitations of the CPF

During a study of classroom computing practices in two senior primary schools, I made use of the CPF to analyze how students were using computers in their classrooms (Johnson, 2004). Upon examination of the observation data collected, I found that the CPF, while useful for simplistic categorization of activities, privileged two elements of computer usage: firstly the learning tool focus (discussed in detail in Lynch, 2006) and secondly, the transform mode - which can only be applied to the learning tool focus. Twining indicates that the CPF is 'value laden in the sense of having identified key aspects of the learning situation to concentrate on' (p. 101), however, as the learning tool focus and transform mode are privileged, it could be argued that these are concentrated on more fully and the others are of less importance, therefore, they are not evenly valued. While Twining's framework is useful and provides an interesting analysis of workings within the classroom, it presupposes that the IT focus and support mode are only a starting point for effective teachers. This suggests that automation of a task, or use of technology to perform everyday tasks is merely elementary and not valuable in itself. Additionally, the use of the support category assumes that it is sensible to view the computer as a tool, which can at times be used without affecting qualitative changes in learning. The view that computers can be injected into classroom practice to produce more efficiency without affecting other changes (i.e. a value-neutral tool) is contestable (Lynch, 2003, 2006).

As recognised by Twining, frameworks like the CPF are limited in that they do not easily accommodate the analysis of tasks that serve multiple purposes. Some tasks are so rich in skill and learning potential that it is difficult to classify the focus of tasks as either IT or as a Learning Tool. Some tasks could be considered both, for example, an activity observed in School A involved two boys creating a web page about gardening on the school's network. For such an activity, the focus could be considered all, or either of the foci (IT, Learning Tool, or Other). Many classroom activities involving computers can fit into more than one category. Even in examples where the categorisation of learning activities seems more straightforward, the complexities of relations between skill development and curriculum learning (Lynch, 2006) may

be overlooked when analysis is driven by a framework such as the CPF. I question whether it is indeed possible, or even desirable, to code computer activities within one category, as education and learning and computers are multifaceted. In addition, incidental learning (outcomes or skills) often occurs in teachable moments (Alibali, Flevares & Goldin-Meadow, 1997; Hyun & Marshall, 2003), which may not match to the intended focus or objective (Goos, Galbraith, Renshaw & Geiger, 2000). While the CPF is a useful starting point for planning, as Twining himself advocates, it does not allow for the complexities of computer use and various purposes and outcomes a computer-based task may have. It has been shown that activities can be attributed to more than one mode. As the CPF stands, it may help teachers to think about the type of use they are asking children to do when using computers, allow them the possibility to explore further options, and address areas that may be being ignored. The IT focus is given little profile, and yet is a valid and often important part of students' progress in their computer education. IT as a focus can be viewed as something that beginning teachers can aim for when they first introduce computer use into their classroom. Arguably, one who starts to integrate the use of computers in his/her classroom would use the IT focus as a fundamental part of a classroom programme. Therefore, the CPF can be productively used for teacher professional development, especially to work towards employing the learning tool focus. It also encourages teachers to think about the qualitatively different ways a computer can be used and the different outcomes that might be achieved. Therefore, the CPF can also be used as a tool for reflection.

Notwithstanding, the transform mode provides an almost impossible height for teachers to reach. How many tasks can only be completed on a computer, not using pen and paper, viewing the computer as a learning tool? Perhaps in the future, we will be a point where less time will be spent on IT foci, and more time will be focused on transformation. However, this is neither a realistic goal for planning, nor an achievable one for classroom practice. It is difficult to think of an activity that can only be completed on a computer. One possible example is using a computer to simulate population growth and decline. Lynch (2006) gave the example of using a multimedia authoring programme to create and explore dynamic systems graphically. Twining himself only gave one example of the transform mode in action, where 'a teacher might intend that children use it [the computer] to create pictures using processes such as trial and error and exploring techniques not available without a computer' (p. 104). However, in respect to that example, Twining added, 'when in practice the children simply replicate work that they have already done' (p. 104), conceding that this activity may become unintentionally an automated version of a practice (e.g. mode = support). It seems this singular example is not particularly relevant and demonstrative of the 'transform' mode in action. Activities that fit and fulfil the transform mode are not only difficult to create or explain, but in practice we argue they are difficult to achieve, especially in an arguably typical 1:25 teacher to child ratio (regardless of the number of available computers).

Because the nature of this critique is complex, I wondered whether the CPF could be more simply used as a reference point for beginning teachers. I now include the personal narrative in order to demonstrate positive aspects and use of the CPF.

Personal Narrative

This next section reflects on my professional development as a teacher, specifically in relation to the integration of computers. It also reflects a typical phenomenon whereby beginning teachers have the tendency to move from a behaviourist approach to more of a constructivist approach in their teaching pedagogy (see Levin, 2003; Loughran, 2006; McInerney & McInerney, 2006). I was a classroom teacher of 10 – 13-year-olds over five years in a New Zealand intermediate school. I share this in order to describe the steps I took to integrate computers in the classroom, to help conceptualise the gradual and successful implementation of computers, and to make future reference to the possible classifications of the CPF.

In regard to what I taught and implemented in the classroom, the first step I took was to teach basic computer skills to the class. This was usually done in opportune moments where I would show a child who was using the computer what to do. Examples included teaching individuals how to highlight text they had typed in and change the font, size, and colour. Individuals would ask me for help throughout the teaching periods. In the first two years of my teaching, students would usually ask to go on the computer to publish their work, especially if they had poor or untidy handwriting or presentation skills.

Next, I began to assign specific activities to complete. I provided a series of worksheets and tried to get students to make documents to replicate a document I had made, so that they were modifying text in font, size, and colour. That was not successful. I had no timetable of work to be completed, and no programme for which children had to be accountable to complete the task. Also, the work was tedious and did not generate enthusiasm.

In order to address these issues, certain tasks were made as computer tasks, i.e. they had to be completed on a computer, whether at home or at school. For instance, writing a thank you letter to a parent for helping with a field trip, had to be compulsorily published (printed out) using a computer. Another example was typing up (publishing) a finished copy of a story they had handwritten. This was a good way for children to have to use the computer and have to develop skills. Towards the end of my time teaching young adolescents, I still used this method. This does bring up issues of disadvantage for those who do not have computers, but I found that the children with home computers preferred using their home computers, rather than school ones. Therefore, students without home computers used the school computers regularly.

Next, I found specific software programmes to assist learning, for instance, spelling programmes, word games, and mathematics games that children who struggled with these areas could use, as a reward, and as a motivation.

The next significant step was to use a classroom timetable where children would book themselves in to use the computer for 15 – 20 minutes during a day (only once per day) to do certain activities including research. This worked well except that some of the more organized children dominated the computer because they would always book in early before everyone else, while many children simply forgot. Another problem was that there were not enough spaces during the week for each child to have a turn once a week. This was improved by the addition of more computers into the classroom and into the school.

The Information and Computer Technology (ICT) Specialist teacher made some pedagogical and practical improvements to the overall school programme by providing incomplete HyperStudio™ template stacks of work for which children had to complete. He designed these stacks for a unit in Social Studies and a unit in Science, which supported the objectives of the curriculum and the units. Work was completed in the ICT suite (a room with about 20 networked computers), where almost each child had complete access to one computer. By that stage, the school also had 15 laptops that could be booked out at a time and used in the classroom for a period of 1.5 hrs, so I took advantage of that, and had a computer shared between two people. Some of the work was completed in pairs or in groups of three. Other units that were completed in my classroom included doing a PowerPoint™ slideshow of work for a unit, and researching information only using Internet sites that were previously book marked by the ICT Specialist teacher.

Opinion of usefulness of computers increases

Children's Computer Use	Personal interest and use	Teach basic skills	Assign activities to develop skills in unrelated tasks	'Publish' drafts. Present work on computer	Use software to assist learning (spelling, word games, math games)	Use software as part of classroom programme. Mathetic and affective benefits

Teacher confidence and skill grows

Figure I - Continuum of Classroom Integration

During these stages, shown in Figure 1, my confidence and skill in using computers grew, and my opinion of the usefulness of computers increased. I was encouraged to use computers through professional development workshops, and through speaking with and learning from more experienced teachers. I wanted to use computers effectively in my classroom, and I did receive technical and professional support to help me do so. Had I stayed teaching, where would I have gone next? This question is explored later in this text.

As I was one of those teachers who provided a behaviourist programme that was both structured and teacher directed in my early years, it took some time before I felt comfortable enough to allow one or some students to do something different to what the rest of the class was doing. Phenomena such as this have been documented as typical in teacher professional development (see McInerney & McInerney, 2006), and demonstrate a move from the safety of behaviourist learning theories (e.g. Skinner, Mager, Gagne, Merrill) towards the more recently advocated constructivist learning theories (e.g. Dewey, Piaget, Vygotsky, Bruner).

Framing Integration and Teacher Professional Development

The CPF is possibly not as useful for experienced teachers who have already implemented computer use in their classroom programme nor is it particularly helpful in analyzing the focus and mode of multifaceted activities. The previous discussion can be summarized by the following statements:

- ICT tasks are not usually mono-purposeful.
- Education, learning, and computer use are typically multifaceted.
- Incidental learning and outcomes are not always linked to objectives.
- Sometimes when teachers plan activities, their intentions and the resulting outcomes are incongruous.

Figure 1 showed the continuum of computer integration in my class programme based solely on my personal experience as a classroom teacher. As stated previously, as my confidence and personal computer skills grew, my opinion of the usefulness of computers also increased, as did my skill as a teacher. In contrast, Figure 2 shows how I could have used the CPF to plan, rather than stumble and experiment my way to what I deemed was a satisfactory level of the integration of computers in my classroom programme.

Using this outline (in Figure 2), I propose that the CPF can be used to assist the incremental planning of computer use in the classroom for beginning teachers.

Children's Computer Use	Personal interest and use	Teach basic skills	Assign activities to develop skills in unrelated tasks	'Publish' drafts. Present work on computer.	Use software to assist learning (spelling, word games, math games)	Use software as part of classroom programme	Transform the classroom programme by using Knowledge Producing Schools or similar
CPF mode and focus	Other focus (e.g. computer use as a reward or distraction)	IT focus	IT focus	IT focus	IT focus or Other focus	Learning tool focus (curriculum, mathetic, or affective). Support or extend mode.	Learning tool focus (curriculum, mathetic, or affective). Transform mode.

Figure II - Comparing Experience and the CPF

As can be seen from Figure 2, the IT focus is a dominant part of the incremental steps towards integrating computers in the curriculum, and towards the ultimate goal of transforming the curriculum. This progression could also be a reflection of the increasing skill level found in the population more generally, which leads me to wonder whether we will get to a point when we will not need to teach basic IT skills to students. However, because the CPF privileges the learning tool focus, and does not allow for the IT focus to be accompanied by the support mode, a beginning teacher may feel discouraged at the lack of progress s/he is making, or consider that only employing the computer to be used as an IT focus is of limited value. It is with this in mind that I state a teacher needs to be comfortable with using the computer as a tool before a teacher can think about how to transform his/her classroom programme to provide invigorating and challenging activities throughout the classroom programme (or to transform the curriculum). Arguably, the computer as 'tool' is an important step in the process of integrating computers into a classroom programme.

Beginning teachers, or pre-service teachers are not necessarily taught or shown how to use computers in their classroom programme. It is arguable that a beginning teacher's first priority is to establish a basic programme that includes all subject areas they are required to teach. Another concern is to be seen by others to be using the technology provided – because it is there and because it 'should' be used, i.e. for political purposes. (This is similar to Twining's 'Other' focus where teachers are pressured to have children use computers). A typical response to this may be to ensure children are 'busy' using the computer/s, though attention may not necessarily be given to what is being done. However, by encouraging the use of computers in any form may well establish a teacher's trajectory towards using computers in an effective way. By outlining steps one can take to move from one stage to the next, towards the idea of transforming the curriculum, a beginning teacher can view his/her progress and also appreciate that it takes time to establish programmes or new initiatives in one's classroom. When one begins teaching, the countless concerns are overwhelming, and admittedly, one probably does not want to concern oneself with transforming curriculum when one has not even started to teach a basic programme. It is my opinion that having computers used is better than not using them at all, even it is 'only' as an IT focus. Computers are a technology that arguably has constructed and continues to construct the identity of children and adolescents in developed countries nowadays, due to the everyday use of and association with screens, media, and technology (Goodson, Knobel, Lankshear & Mangan, 2002; Hagood, Stevens & Reinking, 2002; Rushkoff, 1997).

All of this leads me to ask what can be used to transform the curriculum, if transformation is the end goal of implementing information and communication technologies into classrooms?

What would transformation of the curriculum look like?

Bigum (2002a, 2002b, 2003) introduced the idea of Knowledge-Producing Schools (hereafter KPS) regarding the implementation of ICTs and new practices that employ ICTs usefully. Bigum advocates using KPS to help go beyond traditional concepts of curricula and subjects, and to go beyond being satisfied with putting children's work on the fridge door, only to be duly replaced by the next piece of finished work. He argues that this type of production is indicative of formal education that is aligned with a behaviourist notion of reproducing what is in the teacher's head, and perhaps is not of any real value beyond decorating the fridge door.

Bigum (2002a) defined KPS as

> A design sensibility that does not accept CCTs simply as an educational good. It reads the external world as much changed because of the deployment of CCTs. It sees these changes in terms of changed relationships which flow from additional modes of communication. It acknowledges that schools need to examine new kinds of relationships with the world outside (p. 137).

Examples Bigum cited include counting vehicles on roads, surveys of community attitudes on environmental issues, monitoring local environmental indicators, and contributing to national mappings of local famous identities. Bigum explained that activities such as these are deemed useful, and are practically helpful to the community by providing valuable information leading to community improvements. He gives examples of schools that have produced interactive compact discs and the like (e.g. videos), which not only directly focus on improving a situation or solving a problem, but also have been marketed to other schools and districts. Activities that are valued by those in the local community and/or school are preferable to "doing pretend activities in a safe environment as is the case with current curricula" (Bigum & Rowan, 2005, p. 60).

Bigum suggested that while positioning students as knowledge producers is not a new idea (e.g. see Kimber & Wyatt-Smith, 2006), having students produce products that are directed at non-school audiences is a small step to go beyond the curriculum and employ ICTs as useful media for current school students.

Programmes such as this have the power to transform curriculum. While Twining's framework allows for the identification of computer usage that transforms curriculum, it also allows us to see what does not currently happen in schools, and therefore prompts us to pursue ideas such as KPS.

Conclusion

The CPF functions well as a framework for enhancing the planning process and reflective process using computers within beginning teacher's classrooms. It is useful for beginning teachers to plan the step-by-step integration of computers, and for reflecting on how computers have been used in classroom programmes. However, Twining's CPF does not allow for the complexities of obvious and not so obvious learning performed with classroom use of computers.

The integration of computers into one's classroom programme is not necessarily an easy path, as I experienced firsthand. Teachers learn how to improve their teaching from everyday lessons, but employing a helpful framework could bring additional clarity to an unclear path. It is both practical and possible for beginning teachers to use the CPF framework to make the integration of computers into one's classroom programme a less difficult and shorter process than it was for

me as a beginning teacher. The notion that beginning teachers may have little idea of how to integrate computers in the classroom suggests that perhaps some New Zealand teacher education institutions need to examine the effectiveness of their pre-service technology and computer programmes and incorporate practical solutions to government mandates regarding computers in classrooms. In a recent study, I suggested that curriculum and the structures of schooling in general should be rethought to address the needs of children who enter the classroom having been completely saturated with information and communication technologies in their everyday lives since birth (Johnson, 2007).

The potential of KPS to transform curriculum arguably provides direction for where to go next, though does not prescribe what must be covered, when, and why. KPS provides opportunities to produce knowledge and new findings, but teachers have to 'let go' (Johnson & Lynch, 2004), as they are no longer directing the learning as such. The CPF will help a teacher to get to a point where s/he can consider transforming the curriculum and catering for the digitally familiar students in his/her classroom, rather than delivering a classroom programme suitable for children before the introduction of microcomputers (Bigum & Rowan, 2005). The classroom programme can be transformed but not through the transform mode of the CPF – KPS or something similar is needed. The transforming nature of activities will come should teachers desire to create learning experiences that go beyond producing fridge door decorations, and fully embrace a constructivist philosophy that goes beyond the classroom walls and structures of traditional curricula.

Author Biography

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