WHITEPAPER

Team learning systems as a collaborative technology for rapid knowledge creation

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Abstract

This whitepaper outlines the development and use of the Zing team learning system (TLS) and suggests this tool represents a new breed of collaborative tool for the development of useable knowledge arising from group learning and problem solving. A key feature of this tool is that it scaffolds the learner's use of the thinking and decision making processes and encourages them to develop facilitation skills. With these skills

they are able to self-facilitate workshops to create their own new knowledge. In this process they are given the opportunity to experience and re-invent the world of mathematicians, writers, artists and scientists through real-time public experimentation, dialogue, critique and debate. Groups that work and learn this way quickly develop a sense of community, engagement and self-worth they deem preferable to the boredom, anxiety and alienation they often experience in the conventional classroom. Most importantly these new forms of tools provide users with new contexts for thinking: contexts that have the potential to increase individual and community capacity.

Introduction

This paper reports on a new breed of tool that supports both higher level thinking and, more importantly, human-human interaction in the form of team learning (Elliot *et al*, 2004; Fitzgerald & Findlay, 2004). We argue that developing tools that support team learning is no longer merely desirable but now essential if humans are to productively engage with the increasing complexity and uncertainty that arises from accelerating technological and social change. The paper begins by developing a case for the development of technological tools that support the collaborative creation of new knowledge. It then overviews the Zing team learning systems and reports on its development and use over the last 14 years. It concludes by identifying some key features of collaborative knowledge creation processes.

Mind tools

It is generally accepted that when used well, information and communication technologies (ICT) can function as powerful mind tools that mediate thinking and promote higher order learning (Salomon, 1990; Underwood & Underwood, 1990;

Jonassen, 1998). Embedding these tools in authentic teaching and learning contexts that foster a dialogue between learners and teachers can further enhance learning and conceptual change (Laurillard, 2002). However, it is our contention that many uses of ICT are still too focused on individual and reproductive learning and are not of the scale and dimension required to prepare the next generation of learners for a more complex and rapidly changing world. The first reason is that they do not promote sufficiently what Charles Crook described as mediational collaboration to "….create communities of shared understanding" (Crook, 1994, p.193). The second reason is that they are not focused enough on knowledge creation or what is becoming known as the process of knowledge enabling (Von Krogh *et al*, 2000). Lessons from business are showing the importance of collaborative or team learning (Senge, 1990) to help transform inert organisational knowledge into meaningful actions (Von Krogh et al, 2000). These shortcomings in the current educational uses of ICT are even more pronounced for today's youth because many of the ICT activities they engage in outside of formal education (eg computer games) are highly collaborative and involve significant learning (Gee, 2003). In these activities they are not only *users* of technology but they are establishing themselves as *producers* of knowledge as well. Recent research has shown that 57% of American teenagers who use the Internet can be considered active content-creators (Fallows, 2005). They are writing blogs, developing webpages, re-mixing and sharing media. They are effectively shaping and re-shaping their (and their peers) internet experience.

Cultural gaps between school and home

Many young people find school less than rewarding and they are frequently anxious, poorly motivated or simply bored (Leone & Richards, 1989). One source of the problem is the cultural 'distance' between the teachers and their learners (Findlay, 2003). Another is that while many educators advocate constructivist approaches the reality is that the practice does not match the rhetoric (Windschitl, 1999). The majority of teachers today continue to practice a 'knowledge telling' model of teaching and learning. Most are unable to compete for student interest and focus against such readily accessible cultural tools as the television, movies, mobile phone, computer, internet chat rooms, blogging and online games. At home children's lives are technologically rich. At school they are technologically bereft (Downes, 2002) with many teachers preventing rather than encouraging access to familiar tools. The interactive, socially constructivist model of learning that occurs as a natural aspect of students' private lives through jointly discussed and interpreted experiences of music, television programs and movies as well as social exchanges via the mobile phone, Internet and sport is so much more interesting and enjoyable. There is a view that bridging the world of school and home can offer a rich resource for productive learning. It might also be argued that school has an even more proactive role to play by providing tools and experiences that support the wise application of knowledge so that citizens of tomorrow can respond to rapid social change. We argue that the tools and knowledge for dealing with the problems that arise from social change are available but not wisely used (Findlay *et al*, 2002) .

For the thin layer of the ‘knowledge haves’ the current Knowledge Age paradigm (1990 onwards) is overseeing the widespread invention and adoption of technologies that automate the work of experts – teachers, doctors, lawyers and others (Findlay, 2003). In many cases control is being transferred to the customer or the learner. In many ways professionals are facing the same fate as farmers did at the end of the Agricultural Age factory workers at the end of the Industrial Age and armies of clerks and secretaries at the end of the Information Age. During each major wave of cultural change new tools emerge which incorporate the core knowledge acquired in the previous period and automate the prior dominant type of work, the cultural equivalent of Leontiev’s (1978) automatic operations. Leontiev explains these shifts/transformations at a personal level with reference to the process by which actions become automated and form operations freeing the person to embark on new the development of new actions-new learning and at a collective level, whereby individual actions may contribute to co-ordinated group activity. An important consequence of this cultural shift is the declining role of parents and teachers in the socialisation of children into the adult world. According to the social constructivist school (Vygotsky, 1978), learning and development is mediated by tools. A new capability first appears externally and is then internalized. The capability then tends to become automatic. The role of the teacher/parent is to scaffold or provide a bridge through the zone of proximal development (ZPD) from what the learner currently knows to what they could know, and in this way develop independence. However, we now know that the tools themselves can also provide the scaffolds in the ZPD (Salomon *et al*, 1989) through pre-structured content and in-built cognitive supports that sequence or guide the flow of the activity, focus attention on a general area of interest,

but also direct attention to related concepts in rich ways. It is becoming very clear that the world of young people is evolving differently to that of adults through their separate engagement with the tools. The result is their culture is racing away from the adult world. For many adults socialized into human society at the end of the Industrial Age or the start of the Information Age the world of their children and students is difficult to comprehend. If adults are to play a more useful and relevant role in the education of young people, the focus must shift from the transmission of knowledge to the process of knowledge creation. Taking this step is a prerequisite to preparing them for a world in which 'work, knowledge and communities are being radically and constantly transformed' (Downes *et al*, 2001, p.16).

The Zing Team Learning System

The Zing Team Learning System (TLS) has evolved from a family of tools known as Group Decision Support Systems (GDSS) developed for the management and information sciences (DeSanctis & Dickson, 1996; DeSanctis & Gallupe, 1985) however it differs in three important ways. First the TLS provides a shared conceptual space in which all participants are able to simultaneously view and contribute all the participant's ideas as they are created. Group decision support systems usually only allow participants to separately develop then post an idea without seeing what others are writing. Second, the TLS facilitator is able to easily take participants ideas such as suggestions for questions and/or ways of solving the problem and integrate them into the session. These ideas can function as thinking processes that direct the course of a session. It makes it possible for these ideas to become psychological and cultural tools

to be incorporated into the Zing system and then used within the same flow of activity. Third, the manner in which the TLS is used is determined by an etiquette that facilitates the formation of effective groups or teams, even when the skills of the facilitator are not well developed. The combined effect of the thinking process and the etiquette makes it possible for novices to use the tool with considerable skill, almost as well as the originator of the learning or decision method.

The TLS is comprised of a computer with 12 keyboards attached via a USB hub and connected to multiple monitors or a video projector to display a common image to all participants. The internet version uses a network of computers connected to a server to conduct online meetings. Users have a keyboard and access to a shared display that shows a both team and individual contributions. A person is designated the facilitator and takes responsibility for managing the meeting which could involve creating the meeting process, selecting agenda items or summarizing the main ideas raised during a session. A feature of the system is that all participants are able to contribute and view each others ideas dynamically in the area referred to as the team “playspace”. They respond synchronously to a sequence of questions that act as a guide or scaffold for thinking. All sessions follow a similar format so that when each question is presented, participants talk in small groups for a few minutes, type their ideas, read the ideas aloud, and then with the help of the facilitator, identify common themes. We refer to this process as the Talk-Type-Read-Review etiquette. The etiquette has a similar function to the Think-Pair-Share structure (Kagan, 1992) where the learner first thinks alone before next discussing it with a neighbour followed by the whole class. The etiquette shapes

the way participants behave towards each other (Findlay, 2004) by encouraging discussion and reflection before the sharing/writing process.

The TLS has been developed by Zing Technologies (www.anyzing.com) to help businesses and organizations work more effectively in teams. It is widely used in Australia for strategizing, problem solving, process re-design, team building and project management and has more recently found success in the United Kingdom, Singapore, Hong Kong, the United States of America, Germany, Denmark and New Zealand. Recent work has shown that the TLS is also effective in supporting various qualitative process management techniques such as those found in qualitative research and action research/learning (Willcox & Zuber-Skerritt, 2003). Our experience with this system shows that it is able to provide 'trainer wheels' that help people facilitate complex learning and meeting activities. In education settings, the tool helps students perform the role of the facilitator, teacher and tutor. In the world of work, the tool helps ordinary workers successfully conduct meetings that were once the exclusive domain of consultants and senior managers.

Early work with the TLS

The TLS was first developed in 1991 for use in community development activities in the City of Ryde a suburb of Sydney, Australia. It was designed to help leaders of community groups facilitate complex strategy planning sessions, collect ideas and quickly publish reports. The principal of a local school in the Ryde district offered to undertake a two week trial of the tool in an educational setting. The teachers were

reluctant to undertake training with the system. They said they knew how to use computers in the classroom and this was no different to other software. At the end of the trial the teachers said they could see little value in using the tool for classroom work. They did however invite one of the original developers, John Findlay, to facilitate a session with a group of six students aged 11 who had participated in the failed trial to show how the TLS could be used. At the start of the session, the students asked if they were allowed to express their opinion. They were told this was not only possible, but necessary for the development of effective teams. The students responded with enthusiasm and said they enjoyed working this way. Despite evidence of successful use, the teachers said they felt this mode of learning still did not fit with their classroom, and they would not be interested in using such a tool.

It was not until 1994 that the tool was next used in education, this time for a professional development activity. Dr. Peter Ellyard, an Australian futurist and education consultant, was asked to work with school principals to create a vision for the future of school education in the State of Victoria, Australia's second largest state, Australia's second largest educational system with 2.3 million students. The project involved collecting thousands of ideas from over 400 secondary school principals in a series of 10 workshops in both metropolitan and regional centres. The report (Ellyard, 1995) influenced the direction of education in Victoria for the next decade, with many of its key recommendations being adopted by policy makers. One of the school principals who had used the technology in the original vision-building workshops purchased a system for his school. The results of the trial showed that although the 12 teachers involved in

the initial training program were generally enthusiastic, very little classroom use followed. A team of students from the school were trained to facilitate their own workshops and they demonstrated their skills at a multimedia conference in an activity called ‘Think Tank Theatre’. This activity involved the facilitator leading the students in a collaborative thinking activity would ask a member of the audience to give the group a problem to solve or a proposal to evaluate. Then, using the TLS and De Bono’s Six Thinking Hats method, the students would work through what they knew about the problem, the pros and cons, creative ideas, their feelings and finally what they could or should do.

In 1996, the De Bono Institute was established in Melbourne, Australia as a centre for ‘new thinking’ with the involvement of Dr. Edward De Bono, best known for his work on thinking and problem solving. The Institute adopted the TLS as its main learning mechanism. According to Max Dumais, the Institute’s first CEO, the TLS provided a different metaphorical space that was able to support De Bono’s idea of ‘parallel’ or ‘design thinking’. This space stood in contrast to the traditional ‘adversarial’ approach most often a feature of group problem thinking and problem solving. The Institute began using the tool in its outreach programs with schools, and over a period of three years, some 25 systems were purchased for school districts to facilitate professional development activities.

The pedagogical aspects of the tool were boosted by a collaborative relationship between the developer, and second author, when the company relocated to the

Australian Technology Park in central Sydney. A small specialised high school for music students relocated temporarily to the park while their school buildings were rebuilt. The collaboration involved the developer and five mathematics and science teachers trialing the tool for classroom activities. They met each week to plan the next week's activities and review the previous week's successes and failures. Over a two year period, the teachers and the developer amassed a large number of science and mathematics workshops that used the methods. The workshops drew heavily on concepts from Edwards Deming and encouraged learners to be detectors and correctors of their own errors. Deming's approach was widely adopted in Japan after World War II to develop quality products. In one example this method was applied to a remedial multiplication activity. Each year the high school tested all students to determine if they required additional assistance with their mental multiplication skills. From this group, twelve year 7, 8, 9 and 10 students were selected to work with the TLS. These students participated in a prototype mathematics game over four sessions to see if the students could work out strategies for themselves to improve their recall of multiplication tables (of up to the 12 times table). The technique used was borrowed from the business world. It is a process improvement technique used by quality consults to achieve zero errors in a production process. It is also widely used to help people identify and correct errors made in a workplace and learn from each other without apportioning blame. In the first session, the students were presented with 100 multiplication tables problems. Students submitted their ideas for reducing errors and completed the entire sequence of questions before reviewing the results. At the end of the session, the students reviewed all their responses and made a note of their errors. It was observed that they had more

problems with 7x, 8x, 9x and 12x tables, and generally with the higher numbers. They then brainstormed a list of ideas for reducing their error rate. One of the strategies they generated involved making ascending and descending series of numbers such as 96, 88, 80, 72, 64 for all numbers from 1 to 12. They then used these as a basis for exploring patterns and sequences. Through this collaborative process they developed an understanding that multiplication tables were related and that a difficult to remember multiplication table could often be inferred from a lower (or higher) table that was easier to remember. Results showed that the average error rate at the start of the trial was 37.5%. At the end of the trial, the students were re-tested and their error rate had dropped to 7.5%. While this is trial only involved a small number of participants the results were very encouraging.

Arising from the trials at the music high school a professional development was developed to help teachers view collaborative knowledge creation as an integral and essential tool in their day to day teaching. The program was called “Learning as a Game” and it consisted of 10, two hour workshops that helped teachers re-evaluate their teaching strategies so that the learner, rather than the teacher, becomes the key constructor of knowledge in the classroom. This allowed teachers to adopt a more facilitative role – scaffolding students’ thinking, designing new learning opportunities, mentoring and coaching. The origin of the name was derived from the observation that teachers are easily able to organise and supervise school sporting activities, which are collaborative, competitive and highly engaging for learners, but less able to organise the school classroom in the same way. Thus learning as a game became a metaphor for re-

inventing the pedagogy giving teachers clear directions for skills transfer to another context. The program has been expanded and integrated with the TLS to deliver 10, 20 and 30 weeks of mentoring for teachers who wish to shift responsibility to their learners for the creation and facilitation of their own learning activities. The anecdotal evidence again is encouraging and the research base is being developed in two key ways. The second author is finalising his doctoral studies (University of Wollongong) that reports on the use this technology in Australia and the United Kingdom. The first author has instigated a professional learning project that will begin in 2006. The major objective of this pilot project is to build stronger links between the University of Canberra's pre-service teacher education program and the continuing professional development of secondary teachers. Using a combination of interviews, focus groups and written reflections, teacher education students, teachers and academics will investigate the application of the Zing team learning system.

One of the most recent academic developments has been a series of workshops called, 'Working Wisely'. These were created as a series of 10 interactive sessions designed to enhance the interactions between staff, children and families in an early childhood centre in Penrith, Australia. In multicultural Australia, educators and care centre workers frequently find themselves ill-equipped to deal with dilemmas that occur when people and their children from diverse cultural, racial and religious backgrounds interact. The thinking methods are drawn from the previous work of the lead researcher, Dr. Linda Newman, of the University of Western Sydney, known as the Ethical Response Cycle (Newman & Pollnitz, 2002). This process guides people through the thinking that needs

to occur to resolve conflict between decisions derived from equally valid but culturally diverse decision making processes. Participants in the program have experimented with dilemmas to develop skills for dealing with complex clashes between people with different traditions, practices and beliefs. The parental views may differ markedly from the mainstream culture in which the institution is situated, or the belief system in which the early childhood practitioner was acculturated. The differences may concern food and how it is prepared and eaten, how young people of different gender are permitted to interact or the conduct or celebration of religious events such as Christmas as a focus of the centre's activities, when such an activity may be contrary to the beliefs or practices of some parents. The TLS provides a safe environment in which to present the dilemmas and explore them in a formal way, following a thinking guide path. Participants are not only able to acquire the thinking skills through participating in the process, but also are able to see the widespread views as each person reveals their choices and reasoning for dealing with both the practice dilemmas, and the real dilemmas encountered in the centre.

New directions: Learners as collaborative designers

The experience of using the TLS suggests that students and teachers are able to create their own learning events using a variety of collaborative models. The system allows them to work in whole-of-class and small teams within a classroom under the control of a teacher, but also independently in small teams within a class, at a learning centre or from home. This effect of this means that students need no longer to be tied to a teacher or facilitator opening up the possibility of them engaging with people outside

school including members of the community and peers elsewhere in the world. The most successful implementations of TLS have occurred where students have been given responsibility for creating their own learning activities and facilitating their own sessions in small groups. Although student facilitators faced many of the class control issues experienced by teachers this problem has been overcome by ensuring the learners became adept at crafting entertaining and novel question sequences linked to interesting web sites through exploration and trial and error. School students of all ages said their TLS activities were more interesting, fun and worth doing that normal classroom activities. The conventional classroom activities often involved note taking, working alone in exercise books and listening to teachers. The students frequently describe their mainstream learning activities as boring and irrelevant to their lives. When using the TLS, students are often surprised they remained on task for an entire two-hour long session. They discovered that other students contributed information that helped resolve their own understanding of concepts or techniques. The experience of creating their own knowledge in a collaborative way also gives students more ownership of their learning and a greater sense of their own self worth. Students also said they were disappointed that although they frequently asked their teachers if they could use the technology, few teachers were prepared to do so on a regular basis.

Collaborative knowledge creation

While our work continues with this technology we are beginning to see some characteristics emerging that appear to be integral to the collaborative knowledge creation process. These characteristics include:

- Support for a vernacular approach to knowledge creation in which ordinary people are scaffolded to use their local knowledge and skills to build new knowledge of both local and global significance.
- Making explicit different kinds of behaviour in the forms of an automated etiquette tool to build knowledge about the consequences of certain kinds of human interactions as well as develop a portfolio of facilitation techniques.
- Encouragement of productive thinking focussed on practical outcomes – that is build and share knowledge about a specific topic or issue that can be used by others. In terms of the TLS the most powerful aspect of a group's thinking is the question sets they build to facilitate other learners thinking on the topic.
- An emphasis on imagination and creativity (ie actions) built on a solid foundation of routine knowledge and processes (ie operations)
- The importance of developing appealing metaphors for the problem solving and knowledge creation process (ie Learning as a game, Working Wisely)

Conclusion

The next generation of tools for learning will be qualitatively different from their predecessors. We have argued in this paper that many of the new tools will place high level cognitive expertise in the hands of ordinary people while also allowing them to co-create new knowledge. The knowledge will then be incorporated into the tool itself thereby transforming the tool. We believe that out of this transformation will emerge a new evolutionary form of tool. Such tools will afford knowledge creation and application

and be capable of surfing across both knowledge and behaviour paradigms. Because tools such as the TLS can also be used to shape behaviour through the application of the etiquette in a group interaction context, we can also begin to identify, model, explore and acquire a portfolio of identifiably useful skill sets and behavioural paradigms. This of course involves a fundamental shift in self-interest from the 'guru' who wants to control everyone on a local scale to being able to have a distributed followership of co-creators of a new culture on a global scale. By revealing and democratising their knowledge about knowledge formation and behaviour, teachers and other experts can ensure their own survival, not as the guardians of the 'old knowledge' but as the facilitators of new 'emergent knowledge' relevant to the context that we all need to co-create.

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