

Working brain-to-brain: 'Real learning' - Teacher-directed online live lessons using a synchronous cyber classroom

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ABSTRACT

Information Communication Technologies enable the instantaneous transfer of information such that online live two-way interaction and knowledge sharing over the Internet becomes available. Thoughts can be transferred from one person to another in nano-seconds. This paper documents and investigates the phenomenon of brain-to-brain information exchange in ICT-enabled educational environments. The authors call this 'real' learning because it takes place synchronously in real time. It is proposed that new technologies such as the synchronous cyber classroom deliver superior outcomes for learners of all ages in terms of being true or real learning.

INTRODUCTION

Our paper demonstrates how ICT have been used to enhance the learning of students from early childhood to tertiary level. Essentially the study is based on a collaborative study of synchronous learning via the Internet undertaken by Ms Megan Hastie at Brisbane School of Distance Education and Professor Nian-Shing Chen of National Sun Yat-sen University (NSYSU), Taiwan. Megan Hastie's work at Brisbane School of Distance Education (BSDE) has demonstrated that students aged 5 to 8 years can successfully use ICT to enhance their learning (Hastie, M., Palmer, T., 2003). Professor Nian-Shing Chen has demonstrated that ICT are an integral tool for tertiary students (Chen N.S., et al, 2005). These findings have been replicated in previous studies with medical personnel in a small rural Australian hospital. (Hastie, M., Palmer, T., 1997)

Professor Chen developed a LMS (Learning Management System) in 1995 (Chen N.S, Zimitat, C., 2003). The NSYSU Cyber University platform built using the LMS provides many asynchronous and synchronous tools useful for conducting online classes, meetings and information exchange. It incorporates full video-conferencing facilities with interactive whiteboard capacity all using IP over the Internet. The platform allows the recording of all information for subsequent review and maintenance of records, enabling colleges and K12 schools to adopt e-Learning for teaching and learning. The paper describes one such collaboration.

THEORETICAL FRAMEWORK

A basic premise of our paper is that we live in an age in which all learners need to use Information Communication Technologies (ICT) for flexible, adaptable learning and for life-long learning.

We regard students with access to ICT such as those involved in our study as advantaged learners. Those who do not have access to ICT are becoming increasingly disadvantaged as they become casualties of what is termed 'the digital divide'. Warschauer (2006) says the term 'digital divide' has helped focus public attention on the important social issue of technology and inequality and urges us to deepen public understanding of this issue through an evaluation of access to ICT and the ends that such access serves.

Our study investigates complex factors including content, literacy and education, and community and institutional structures that impact on students' access to new technologies. As Warschauer (2002) points out 'there is not a binary division between information haves and have-nots, but rather a gradation based on different degrees of access to information technology'.

BSDE is a public school which operates under the governance of Education Queensland (EQ). Current EQ policy states that ICT is the bedrock of 21st century schools and strongly endorses the use of new technologies to create greater interaction between students, teachers, parents and guardians (Education Queensland, 2006). Our trial used ICT in the form of synchronous teacher-directed learning in a cyber classroom to augment existing programs offered by BSDE which include print, multi-media and digital technologies.

The study focused on a small group of very young learners aged 5 to 8 years enrolled in Megan Hastie's class between 2001 and 2006 at BSDE. The students and their parents live in various locations within Australia and overseas. They use ICT to communicate with their teacher and for individualised synchronous lessons in synchronous cyber classrooms.

The use of ICT as a tool for enhancing and accelerating student learning has been the subject of ongoing research both at BSDE and NSYSU. Chen et al (2005) stated that 'the synchronous cyber classroom provides a learning environment that can outperform both asynchronous online instruction and traditional face-to-face instruction'. At BSDE we have used ICT to enhance fundamental skills such as reading, writing, and arithmetic which we regard as the cornerstones of education and student learning. Our study explores the rate of acquisition of these basic skills in students aged 5 to 8 years of age when they are able to practice them in synchronous cyber classrooms created by advanced ICT technology.

We explore the impact of technological hardware on the learning outcomes of these students. We describe the development of an optimal learning environment for the students using two features of the synchronous cyber classroom: the interactive whiteboard combined with voice over the Internet (VOIP). Chan and Petrie (2006) stated that 'The significance of the learning environment cannot be underestimated. The brain learns faster in challenging, creative, accommodating, and healthy environments.'

A major focus of our study has been an exploration of the impact of teacher-directed learning on student outcomes in a synchronous cyber classroom. We define teacher-directed learning as instruction in which the teacher directs or leads the student. The teacher delivers a tightly scripted curriculum to the student, giving the student small pieces of information and immediately asks the student questions based on that information. The teacher is in control of the interaction, telling, showing and modelling, demonstrating and prompting the rapid active responding of the learner (Hastie and Palmer, 2003). We explore the notion of using ICT to work brain-to-brain, that is, for the exchange of information between the teacher to the student and the student to the teacher.

A second premise of this paper is that teacher-directed synchronous lessons enhance cognitive function. We explore the ICT enabled transfer of information between the teacher and learner. We examine the notion that cognitive function in young brains may be enhanced through strengthened neurological function. Chan and Petrie (2006) found that neurons gain strength through use because they are constantly firing with electrical and chemical energy. We explore the integration of visual, auditory and kinaesthetic senses during intensive teacher-directed synchronous lessons with 5 to 8 year old students in our cyber classrooms. We equate students' enhanced cognitive function during teacher-directed synchronous lessons with 'best practice' in early childhood education.

Finally, we describe the instructional design features of lessons conducted in our synchronous cyber classrooms and correlate these with enhanced learning outcomes across the entire spectrum of learners from early childhood to tertiary level. We focus on motivation, concentration, memorization and work-rate as essential indicators of true or 'real' learning in the brain-to-brain information exchange between the teacher and the student.

Arnone (2003) stated that 'Educators and instructional designers recognize that instilling curiosity in students encourages their disposition to learn.' Arnone described a range of instructional design strategies for developing curiosity in students including the use of curiosity itself as a primary motivator. She recommends the resolution of conceptual conflict, the creation of an atmosphere where students feel comfortable to raise questions and test hypotheses, adequate time to explore a topic, student selection of topics, and the incorporation of elements such as incongruity, contradiction, novelty, surprise, complexity and uncertainty. She suggests appropriate degrees of stimuli, exploration, reward and modelling. We now describe the instructional design strategies used in the individualized synchronous lessons conducted for students aged 5 to 8 years in our cyber classrooms. We explore this in terms of our collaboration during the past two years, and in the context of our longer-term research and studies (Chen N.S, Zimitat, C., 2003, Huang W.Y., et al, 2004).

METHODOLOGY

During 2005 and 2006, Professor Nian-Shing Chen of NSYSU and Megan Hastie of BSDE collaborated on an international trial of the adoption of e-Learning for early childhood education.

From BSDE to NSYSU to the world of early learners

From her desk at BSDE, Megan Hastie accessed students via the NSYSU Cyber School platform. The students lived within Australia and overseas. The trial involved thirteen students aged 5 to 8 years over a five year period. The collaboration between NSYSU and BSDE formed two years of the trial. Two students required remediation in reading development, one student with special needs had temporarily withdrawn from mainstream education and needed highly individualised instruction at home, two students needed extra tuition in English due to their ESL situation overseas, one gifted student required extension and enrichment and seven regular students required support to overcome their geographic and educational isolation overseas or in other locations within Australia.

Lessons were conducted one-on-one to provide intensive individualised instruction using online synchronous cyber classrooms created by the NSYSU Cyber School. Individualised lessons were deemed to be the most efficient form of live instruction over the Internet for the students and recognised the egocentric nature of very young learners. Lessons were generally of twenty to sixty minutes in duration depending on the age and concentration level of the student. Initially most students participated in lessons of twenty minutes but the majority of the students soon requested an extension to sixty minutes or more.

The lesson commenced with the teacher, logging-on to the NSYSU Cyber School platform which features integrated IP-based video-conferencing client software called JoinNet developed by HomeMeeting Incorporated (U.S.A.) The student and their home tutor, usually a parent, logged-on to the NSYSU platform at a pre-arranged time. Allowances were made for time zone differences for students living overseas to enable online live synchronous or 'real time' learning.

A student working in our synchronous cyber classroom wore a headset with built-in microphone. The student drew and wrote on the whiteboard in response to teacher direction using the mouse or a graphic tablet. The teacher also wore a headset with built-in microphone. The headsets limited extraneous noise. The student received immediate digital and auditory feedback from the teacher in the form of written and verbal comments.

The synchronous lessons were individualised and highly interactive. The exchange of information between teacher and student was intensive, concentrated, colourful and dynamic. The lesson comprised a series of teacher-prepared whiteboard frames. In the preparation of lessons, Megan Hastie incorporated both teacher-directed learning in the selection of developmentally appropriate content for individual students plus student-negotiated content. The home tutor was also engaged in the selection of content to suit the needs of their child. Due to the flexibility of the cyber classroom, teacher, students and parents came together from different locations which enabled them to sit in the same synchronous cyber classroom at the same time.

The first whiteboard frame of the lesson was used to welcome and greet the student and test data and audio exchange functions. The second frame contained a plan for the lesson, an advance organizer, which summarised the scope and sequence of the lesson. The student, home tutor and teacher agreed to proceed with the lesson as outlined in the lesson plan or modifications were made prior to the commencement of the lesson. Content for lessons varied according to the age and stage of development of individual students. Core content was drawn from Education Queensland key learning areas (Education Queensland, 2006). Students were encouraged to explore topics of interest and use 'tool' subjects such as reading, writing, drawing and number to document their learning on the interactive whiteboard within the synchronous cyber classroom.

The lesson concluded with the teacher and student planning and negotiating the content for the next lesson. The platform allowed recording of the lesson for future reference.

Working brain-to-brain with a typical student in our synchronous cyber classroom

During 2004 and 2005 Megan Hastie worked with a six year old Australian female student living with her family in California. For the purpose of this paper we will refer to her as Student T. During the

two year trial the student participated in weekly synchronous lessons in our cyber classroom. The parents of Student T supported the use of ICT to enhance their daughter's learning and embraced the opportunity to have direct instruction and interaction with their teacher at BSDE. The parents provided the necessary hardware including a computer with internet connection. They provided technical support and feedback on their daughter's conceptual development during and after lessons. NSYSU provided free access to the Cyber School platform and JoinNet software with technical support from Professor Chen and his colleague Mr Laurence Quinlivan. Technical support at BSDE was provided by Mr Bruce Cifuentes, Head of Department ICT.

Student T had prior experience with computers and was familiar with Microsoft Paint software. At the beginning of the trial Student T was shy and reluctant to speak as she had not met her teacher Megan Hastie face-to-face. A positive working relationship was developed through written and verbal praise for Student T's efforts. For instance, Student T displayed a talent for graphic art and responded positively to praise for her computer generated art. Student T also displayed a strong curiosity about natural Science and this became a focus of lessons. Student T was encouraged to select a topic, usually an animal, to research in preparation for the following week's lesson. She would email her teacher during the week to confirm her selection. This enabled the teacher to undertake research on the chosen topic and prepare whiteboard frames using basic skills such as reading, writing and number to augment the work of the student.

The student chose, on one occasion, to research chameleons. She drew a vivid green chameleon and then used the computer mouse to write in a variety of colours, 'Chameleons can change colours' as shown in Figure 1. In so doing she demonstrated factual scientific thinking, appropriate literacy skills and impressive mouse control.



Figure 1. Chameleons can change colours

The student demonstrated a preference for factual writing. For many months she researched factual content and wrote factual notes about her topic. The teacher modelled various writing genre, encouraging Student T to try fictional writing. The interactive whiteboard and VOIP enabled teacher-directed learning and provided the tools to get the job done.

At the beginning of the trial it was found that Student T needed extra support with reading development. Traditional print materials were adapted for online delivery and Student T made rapid progress in reading with a gain of approximately seven reading levels within six months. Reading instructions and messages typed by her teacher on the interactive whiteboard provided extra reading

practice. The features of the NSYSU platform provided the teacher and Student T with the hardware, software and artistic licence to explore a wide range of developmentally appropriate learning.

FINDINGS

Our findings are based on the premise that all 21st Century learners need to use Information Communication Technologies for learning. The collaboration between NSYSU and BSDE enabled a small group of very young learners at BSDE to bridge the digital divide. In particular, the use of the synchronous cyber classroom created greater interaction between students, the teacher, parents and guardians.

The synchronous cyber classroom became a significant communication and instructional tool for the learners in the study. This mode of communication and instruction was found to be time and cost efficient. Lessons were scheduled to allow for time zone differences. We have found the relatively low costs of delivery via the Internet present a serious challenge to the more costly print and telephone modes of delivery. The synchronous cyber classroom enabled the teacher to provide individualised and personalised support for the student and their home tutor. We successfully trialled this approach with a range of learners including two students requiring remediation in reading development, one student with special needs who had temporarily withdrawn from mainstream education, two students needing extra tuition in English (ESL), one gifted student who required extension and enrichment and seven regular students (Hastie, M., and Palmer, T., 2003).

Our study found that teacher-directed learning in a synchronous cyber classroom accelerated the acquisition of basic skills. This was because teacher-directed learning facilitated individualized self-paced learning in an ICT-enabled learning environment. Simply put, the students used ICT to practice basic skills and received immediate feedback from their teacher. It allowed the teacher to monitor and evaluate the students' learning with the NSYSU platform providing data collection facilities.

We described the accelerated learning of Student T. Her accelerated reading development, in particular, was exemplified. When the teacher discussed this phenomenon with Student T's home tutor, the home tutor wrote:

'Yes I have noticed an improvement in her reading since we started the synchronous cyber classroom sessions. I think it is a combination of things. (including normal development) but beyond that too: thinking on her feet that the live sessions requires, speaking and reading out loud, to you her teacher, has built self-confidence because she wants to show you how clever she is!! And reading along with you as you type is also a great visual learning tool. So we are in agreement!!'

The accelerated development demonstrated by Student T was indicative of the outcomes observed by the writers across the entire spectrum of learners from early childhood to tertiary level. Student T and all other students in our trial demonstrated higher levels of motivation, concentration, memorization and work-rate. We believe this is because teacher and student were working brain-to-brain in an optimal ICT-enabled learning environment.

We acknowledge the role of technological hardware and its impact on learning outcomes for young learners. We attribute enhanced learning outcomes to two features of the synchronous cyber classroom: the interactive whiteboard combined with Voice over Internet Protocol (VoIP). We note that the interactive whiteboard is a highly engaging and stimulating work space for both student and teacher. During synchronous lessons we have observed that both student and teacher appear to be compelled to encode graphic information on the whiteboard either by drawing or typing text. This has been found to be a major stimulus to writing development in young learners. The majority of students demonstrated significant gains in keyboarding skills. Several students became prolific writers. They developed word processing skills and recorded complex and detailed information on the interactive whiteboard. We make the observation that the interactive whiteboard may have become the 'face' of learning in the cyber learning environment.

As we have stated, technological hardware impacted on learning outcomes. However, a more significant finding was that the instructional design features of lessons conducted in our synchronous cyber classroom enhanced the cognitive development of young learners. We believe the lessons provided opportunities for young learners to develop their cognitive skills. It was as simple and as

complex as actively involving the student in learning through the integration of visual, auditory and kinaesthetic senses. A self-perpetuating cycle was established resulting in higher motivation, concentration, memorization, and increased work-rate. A longitudinal study incorporating brain research would be needed to quantify stronger neurological function in the brains of our young learners. However, we believe we helped them develop enhanced cognitive skills.

Finally, when Student T proclaimed 'Chameleons can change colours' she issued a challenge to us as educators to ensure that all young students can change and grow to fulfil their true potential as 21st Century ICT-enabled learners. We believe this can be achieved through the use of teacher-directed lessons in our synchronous cyber classrooms.

CONCLUSION

The collaboration reported in this paper between Prof. Nian-shing Chen of NSYSU and Ms Megan Hastie of BSDE has resulted in enhanced and accelerated learning in the trial group of learners aged 5 to 8 years. Technological hardware such as the interactive whiteboard together with Voice over Internet Protocol (VoIP) has provided the teacher with powerful technological and instructional tools. Specific instructional design strategies were identified that resulted in higher levels of motivation, concentration, memorization and work rate for lessons undertaken in the synchronous cyber classroom. However, teacher-directed learning in the synchronous cyber classroom has been identified as the most significant strategy in accelerating the acquisition of basic skills. The quality of the interaction between the teacher and the student is the determining factor in ICT-enabled lessons in the synchronous cyber classroom.

The major finding of this paper, therefore, is that the synchronous cyber classroom provides a multi-dimensional learning environment that can outperform both asynchronous online instruction and traditional face-to-face instruction. As such it represents a model for 'best practice' in early childhood education. The potential for this mode of educational instruction is unlimited. The challenge ahead is to make the synchronous cyber classroom available to all young learners. How to provide e-training programs for school teachers to help them develop skills for conducting effective lessons in synchronous cyber classrooms is another challenge worthy of urgent consideration.

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