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Examining University Students' and Academics' Understandings of ICTs in Higher Education

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Abstract – This paper aims to identify university students' and academics' perceptions of the impact of ICT on higher education. The paper seeks to explore tertiary students' and staffs' understandings about how ICT affect their academic teaching practice and learning strategies. The significance of perceived effects of ICT on developing effective tertiary teaching and learning becomes vitally important when viewed in the context of the situation of Australian universities where millions of dollars have been allocated to provide access to various types of ICT facilities. Whether or not there is a positive relationship between student learning and teaching in the ICT context is an important pedagogical, practical and policy issue. A modified case approach was employed and data were collected from tertiary teachers and students at an Australian university in the first semester of the 2007. Participants from different academic positions at the university were invited to complete a questionnaire to present their views on the impact of ICT. This data were supplemented with a series of in-depth interviews. The findings point to a disparity between teachers' and students' understanding of ICT and their respective teaching and learning practice. Findings from the study reveal that teachers' understandings did not match with the capacity of ICTs and therefore did not align with the goals and objectives university inputs. While the most of the students' views turned out to be more positive and receptive to the use of ICT for learning than teachers, their expressions seem to be more uncertain or hesitant concerning their academic learning processes embedded with ICT. It is suggested that the findings would be valuable to promote a better understanding of tertiary students and staff of what specific issues and challenges are brought about by their engagement with ICT.

Keywords: ICT's impact, Higher education, Tertiary Teaching and Learning

Introduction

The report entitled *Learning for the Knowledge Society: An education and training action plan for the information economy*, can be seen as an important part of reforming education policy to support the embedding of ICT (Information and Communication Technology) in Australia (DCITA, 2002). The policy identifies crucial outcomes that Australia needs in order to develop its information economy with the aim of maintaining education as one of the nation's main economic drivers. Key outcomes relate to:

- 1) People,
- 2) Infrastructure,
- 3) Online Content,
- 4) Applications and services,
- 5) Policy and organisational framework,
- 6) Regulatory framework (DCITA, 2002).

All of these outcomes were supported by the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA, n.d.) for achieving the Ministers' vision of:

- 1) creating an innovative society,
- 2) ensuring that all learners achieve their potential,

- 3) improving quality and raising standards,
- 4) achieving efficiencies through sharing, and,
- 5) capitalising on the internationalisation of education.

The application of ICT in education should not replace other teaching or learning methods. The use of ICT should foster a paradigm shift for the provision of quality education within the higher education sector. It is advisable that higher education examine this paradigm shift more closely and particular attention must be paid to ensure that graduates who leave university have successfully participated in an information and communication environment. Therefore, in order to develop such capacities, it is essential that higher education institutions themselves explore ways to prepare authentically the students with the necessary skills and to ensure that the students who have graduated will be competitive, creative and critical thinkers. If this does not occur, higher education institutions would be failing to deliver teaching which is student-oriented, collaborative, critical and higher ordered in thinking.

The main objectives of this study were to identify the perceptions of ICT's impact on higher education among tertiary teachers and students, and to explore the issues that have emerged from the implementation of ICT in higher education institutions, particularly in the University of Tasmania. Research questions for guiding this study were identified as: what factors do teachers and students perceive can influence the effectiveness of ICT integration in tertiary teaching and learning practice, and how do the different perceptions of teachers and students of ICT affect their teaching practice and learning strategies. As this study investigated views about ICT usage in the University of Tasmania, participants from different academic positions at the university were invited to complete a questionnaire and participate in informal face-to-face interviews to present their views on the impact of ICT in higher education. It is important to understand factors that enable or constrain academics in the effective use of ICT in their teaching practice. Therefore, in the light of above mentioned arguments a better understanding of ICT use is of utmost significance to the both university staff and students in terms of effective tertiary teaching and learning.

A Brief Review of the Relevant Literature

Recent studies have considered the impact of ICT in higher education in terms of the benefits for tertiary learners; for example, Oliver and Goerke (2007) investigated the use of mobile learning (m-learning) at Curtin University of Technology in Western Australia. They suggested that

emerging technologies owned and used by students, and incorporated wisely into university curricula, can go some way towards enhancing high quality, face to face learning experiences, where articulated knowledge is constructed and student achievement of intellectually challenging outcomes is effected (p. 12).

Another recent study conducted at the University of Melbourne (Kennedy et al., 2006) found evidence of a significant positive association between effective use of ICT and success in tertiary studies. The researchers reported that many students endorsed the use of a number of technologies and technology-based tools in their university studies. For example, mobile phones were identified as one of the widely accessed technologies; therefore, in higher education, an important aspect of the shift in

technological processes has been to the adoption of ICT for learning and teaching. Tertiary teachers should model the operation of innovative ICTs, such as students' mobile devices, in their courses so that teachers know how to challenge and change their teaching practice. Pelliccione (2001), in a case study at Curtin University of Technology reported that university teachers had a high commitment to the adoption of ICT for teaching and learning. The data in this study also suggested that the adoption of ICT in teaching and learning would be promoted by greater support of the change at the management level of the university.

A large portion of the literature has been devoted to the issues of what factors have been shown to influence the different perceptions of effectiveness of ICT integration. It must be asked what can be learnt from these studies about the relationship between different perceptions and teaching and learning behaviour in terms of effective ICT use?

The issue of students' ICT uptake is of crucial importance, for it has been argued that use of ICT during learning practice will lead to competent and confident use in their learning, while lack of it will mean that students will make little use of ICT (Stiggins, 1999). Universities and other tertiary education institutions have indicated that ICT has a generally positive effect on the quality of teaching and learning, although few have been able to offer detailed evidence. Although many student satisfaction surveys have been conducted on the use of ICTs, it is still unclear whether or not students fully perceive their potential and use them effectively (Noss & Pachler, 1999). It should be determined whether refraining from their use is simply through ignorance or some other underlying concern, and how this may be addressed. Without investigation, it is difficult for universities to know if they are meeting the needs of students effectively (OECD, 2005). Galanouli et al., (2001) reported that students perceived three main barriers to their perceptions of ICT use during learning practice: teachers' attitudes, lack of resources and lack of time. Although lack of appropriate equipment was considered an important factor when students were unable to use ICT in their learning, it was also clear that teachers' uptake of ICTs and attitudes towards ICTs' use played the most crucial role in the success or failure of their teaching and learning. Many other researchers (Pelgrum, 2001; Preston, Cox & Cox, 2000; Snoeyink & Ertmer, 2001; Yuen & Ma, 2002) in addition to carrying out their own literature reviews undertook studies to obtain primary evidence of the barriers to teachers' perception of ICT use.

The teachers' main concern was their students' academic success, but lack of evidence and the imposition of ICT usage are putting pressure on teachers which, in turn, will lead to building-up more stress and resistance (Hope, 1996; Schrum, 2000). Teachers who are already fearful of the technology will become more reluctant when the use of the technology is imposed on them. Chere-Masopha's (2005) comments about imposing on teachers with unclear instructions and directions in implementing ICT and the lack of professional development are important findings in determining the possible issues of the teachers' resistance towards the technological implementation. Caverly and MacDonald (2004) shared similar views in that they said there is little focus given to develop positive perceptions for professional development in technology (p. 38). It is likely this will force teachers to create their own standards and understandings which may not produce a satisfactory result.

There has been some optimism amongst teachers in Tasmania that a thorough understanding of effective ICT use would enhance motivation to use ICT with their students. If this goal is to be realised, the students also will be equipped with a variety of ICT skills in order to be meaningfully and motivationally engaged in their learning.

Methodology: A Modified Case Study

Case study is a common qualitative research approach. Burns (2000) stated that “Case study is used to gain in-depth understanding replete with meaning for the subject, focusing on process rather than outcome, on discovery rather than confirmation” (Burns, 2000, p. 460). In order to get an ‘in-depth’ understanding of the situation being studied, the boundary and target population should be clearly defined. In this research study, the bounded system was limited to the University of Tasmania, Launceston campus, and the target populations were the academic staff members, and some of the domestic and international students at the University of Tasmania. This research was conducted by an individual researcher and, therefore, it was limited in time and funds. Interviews were frequently used in this case study as a method of data gathering and questionnaires were used in conjunction with interview. By implementing a modified case study such as the one that was demonstrated in this research, some insights for university teaching and learning were provided so that the objectives of this study were able to be achieved.

Sample

In this study, 90 participants were recruited from current students who were studying at the University of Tasmania (Launceston). Another 30 participants were selected from academic staff members at the University of Tasmania (Launceston). The number of selected participants from the sample is organised as shown in the Table 1-1 below.

Table 1-1: *Number of Respondents (staff and students) Chosen from Different Faculties*

Faculty/School	Academic staff		Students	
	<i>Q1</i>	<i>Interview</i>	<i>Q2</i>	<i>Interview</i>
ELC	5	2	10	2
Education				
<i>Domestic</i>	15	2	20	2
<i>International</i>		2	20	2
Computing				
<i>Domestic</i>	10	2	20	2
<i>International</i>		2	20	2

Note: *Q1- Questionnaire for Academic Staff; Q2- Questionnaire for Students; ELC- English Language Centre*

In this study, data were generated using a questionnaire survey. Burns (2000) stated that questionnaire survey, “... is the most commonly used descriptive method in educational research, and gathers data at a particular point in time” (p. 566). This study used a questionnaire survey as a means to generate descriptive data (Burns, 2000, p. 566). This study employed a cross-sectional survey, to ensure that the required data could be collected within the allocated time and budget. In order for the results of the study to be presented at the highest level of confidence, the data needed to be gathered effectively. This led to the decision to use multi-method, multi-person

and multi-site approaches in order to triangulate the data (Burns, 2000, p. 419).

Data Gathering, Analysis and Results

As part of the study, 90 students and 30 staff members were asked to complete a questionnaire to explore their perceptions of ICTs' impacts on learning and teaching and the experiences of the ICT use they have in the university. This sample ($n = 120$) is not representative of the overall population of students and staff members who studied and worked in one university in Australia, but it is broad enough to give valuable insights into a range of user perceptions.

The data which were gathered via the questionnaire to address the Research Questions concerning the perceptions of ICTs' impact are presented in Table 1-2. These data describe the participants' perceptions of ICT use, and detail respondents' views about whether or not ICTs' impact on enabling or constraining their teaching and learning. A 5 point Likert scale was utilised to determine the respondents' rankings.

The following nine items shown in Table 1-2 are of utmost significance to this research study, in that they present the highest differences between students' and staffs' views and are related to the major issues inherent in the research questions

Table 1-2: *Students' and Teachers' Perceptions of ICTs' Impacts*

Perceptions of ICTs' impacts	Mean Score		
	Students ($n = 90$)	Staff ($n = 30$)	All ($n = 120$)
Improve the quality of education	4.67	3.36	3.71
Transform the learning environment into one that is learner-centred	3.25	3.91	3.95
Increases students' motivation and engagement	3.70	4.09	3.90
Increases collaboration and cooperation among students	3.92	3.45	3.67
Increases positive effects on interaction	3.33	3.09	3.29
Changes the nature of student-teacher relationship	3.33	3.45	3.43
Improves higher-order thinking	3.10	2.36	2.67
Improves critical thinking/learning	3.17	2.55	2.76
Improves problem-based learning	3.00	2.81	2.90

The data in Table 1-2 indicated that the vast majority of students had a positive view about ICTs' ability to enable or enhance the delivery of quality education. However, staff respondents had the lower level of agreement on this item. All respondents agreed that ICT-based learning was more learner-centred than the traditional approach. All respondents reported that ICTs use greatly contributed to student motivation for learning and promoting engagement in their learning. Staff members' responses were even stronger in their support of this item.

All respondents strongly believed that ICTs facilitates collaboration and cooperation between students. There was extensive acceptance among the respondents that ICTs can encourage effective interaction between teachers and students. Both staff members and students commonly accepted that the traditional relationship between students and teachers were altered by the use of ICTs in teaching and learning practice.

There were substantial differences of opinion about whether using ICTs was likely to lead to higher-order thinking. Staff expressed the view that when students studied with the use of ICTs, they were limited to the extent they could develop higher-order skills; whereas, student respondents commonly agreed with this statement. Moreover, staff members did not accept that the use of ICTs was an effective way of enhancing students' critical thinking skills. The responses to the last item in the Table 1-2 indicate that all respondents disagreed about a rich ICT environment that can effectively support distributed Problem-based learning students. The Staff Mean Score signified the lowest level of agreement; whereas, students were neutral about this proposition.

The qualitative data collected from the open-ended questions, detailing respondents' personal views on perspectives, were sorted, coded, interpreted, then presented and described in Table 1-3. Most students and staff respondents stated that if ICTs are difficult to access, or some hardware/software problems are encountered, or web access is slow, it was not practical for them to integrate ICT use into their teaching/learning practice; or, the effort they must expend to ensure ICT implementation was not reasonable. The second highest-ranking item for respondents was professional development in ICT use. All students and staff members believed that using ICTs should be based on insights into aspects of professional development rather than the ability of perform basic functions. The staff commented that they would not benefit without particular ICT training, such as for lesson preparation. Students stated that lack of training was a barrier to their use of ICT in learning. Students reasoned that specific ICT training would be helpful for their learning.

Table 1-3: *Responses to the open-ended questions: improvement for current ICT implementation in teaching and learning*

Categories (in rank order)	Students (n = 90)	Staff (n = 30)	All (n = 120)
Improving ICTs' infrastructure	47	10	57
Providing Professional Development	14	24	38
Ensuring Technical assistance and support	12	13	25
Raising credibility of the ICTs' impacts	3	7	10

The responses to the open-ended questions also indicated that students and staff respondents thought that technical assistance and support was of great importance to the promotion of their teaching and learning with the use of ICTs. For example, staff members reported that they lacked confidence that technical assistance and support would be available when they needed it. One student even wrote, "Every time I have gone to the help desk, no one is ever there". Therefore, respondents considered these to be obstacles, and, in turn, impacted on their motivation, as well as reducing their confidence when using ICT.

Discussion

The discussion is based on the questionnaire surveys and subsequent interviews with staff members and students in this study. For the participants, the issues to emerge in relation to factors that enable or constrain students/teachers integrating ICTs into their teaching/learning practice revolve around the literature focusing on the significance of ICTs in teaching/learning, factors that relate to the effectiveness of ICTs' integration,

as well as an understanding of different perceptions affecting teaching/learning practice.

- *Different perceptions of ICTs' impact on teaching and learning*

It is interesting to note that staff respondents agreed less than students on the impacts of ICTs. Of particular note are the last three items (higher-order thinking, critical thinking and problem-based learning), where the total Mean Score for students were significant higher than staff.

- *Different Perceptions of Self-directed Learning*

Table 1-2 indicated that staff respondents had a higher Mean Score on the item 'Transform the learning environment into one that is learner-centred.' However, staff members above the age of 35, who reported the highest agreement of ICTs' impacts on improving the quality of education, showed the lowest adherence to the traditional teaching paradigm. The opposite case was true for the students (mainly from ELC) of age 17-23 years, who showed the lowest agreement for the suggestion that it moved learner-centred in an ICT learning environment.

This means that those students just entering the tertiary institution had a more negative view towards a more learner-centred environment with the use of ICT for higher academic learning than students who are a few years older and have already experienced some years of academic learning at the university. While in line with results in Table 1-2, students in the Schools of Education and Computing have greater preference for learning with the aid of ICTs and have greater agreement for the proposition that 'ICT can transform the learning environment into one that is learner-centred' than students in ELC.

In support of strong relationships between tertiary learning experiences and ICTs' impact on student-centred learning, Oliver (2002) stressed that ICTs have impacted on educational practice in higher education, and have the capacity to promote and encourage the transformation of education from a very teacher directed enterprise to one which supports more student-centred models, but that the impact will grow considerably in years to come. He also argued that the use of ICT in higher education settings can act to support various aspects of knowledge construction and as more and more students employ ICTs in their learning processes the more pronounced the impact of this will become.

The large majority of the staff interviewed described their teaching as being student-centred with the use of ICTs; that is, they provided opportunities for their students actively to search for the ways of learning, make choices about their own learning methods, and self-evaluate learning progress. A staff respondent also suggested that, "*I hope to be more of a problem solver, someone there in case I am needed, and my students are more self-directed learners*" (M4, STA, 5, 04/5).

The data also showed that teacher beliefs about how using ICTs will impact on teaching and learning will vary greatly according to students' learning outcomes. Some staff members felt comfortable in moving away from a traditional teacher-centred teaching method to a more integrated approach using ICT. For example, one staff respondent noted that, "*The students respond to ICT, they are more motivated than [with just] teacher-centred teaching, which is really good*" (M2, STA, 3, 02/5).

Staff recognised that ICTs enabled them to achieve educational goals that focused on learning. A few staff took this a step further to emphasise not specific content goals but students' attainment of independent learning skills. Although some staff members mentioned they enjoyed using ICTs in their teaching practice, the majority of them suggested that the primary reason for using ICTs related to how student learning was enhanced. A staff respondent, however, was particularly concerned for his lower achieving students: *"I feel that the ICT is designed to fit in with the intermediate or advanced ICT level students and still disadvantages a number of beginner students"* (M4, STA, 5, 04/5). He also believed that the use of ICTs made teaching and learning more effective, motivating students to engage actively in the learning process. As another staff commented, *"ICTs provide evidence of students' learning to engage with the task in a more active thinker of knowledge than passive role"* (M2, STA, 3, 02/5).

These data are consistent with the work of a number of researchers in different contexts (see, for example, Cox, Preston & Cox, 1999; Pelgrum, 2001). The analysis of previous literature about motivation and attitudes has shown that a range of factors can contribute to teachers' motivation to use ICT. These include their attitudes to ICT, their beliefs in the value of ICT for teaching and learning and most importantly, their perceptions of whether or not they can use it themselves and use it effectively in their teaching. Motivational factors include making classroom teaching more interesting and more fun and contributing to students' learning (Cox, Preston & Cox, 1999).

▪ *Different Perceptions of Collaboration and Cooperation*

Collaboration and good relationships also were related to a positive perception of using ICT and it had an impact on how effectively staff and students used ICT in their teaching and learning practice. According to the literature (for example, Eklund & Kwan, 2000), teachers should consider using information technology in collaborative ways in their classroom with increased confidence in its ability to facilitate the attainment of educational outcomes. In other words, productive relationships among teachers and students engaged in sharing of ideas and practices enhanced their confidence in and attitude towards the ICT.

The survey data (Table 1-2) indicated that all respondents agreed that ICT facilitated collaboration and cooperation between students. Students who held a view that ICT could 'transform the learning environment into one that is learner-centred' also held the view that ICT would 'increase collaboration and cooperation among them'. This suggests that students perceived learning with ICT as a collaborative learning activity and had a positive attitude towards learning using ICT.

It was noted in the literature there has been a strong trend towards community-based learning, and these are the principles situated at the value of 'community of practice' (Markel, 2001; Wenger, 1996). The data showed that students feel that when they practise using ICT with their colleagues they are associated with their community members as partners in a common endeavour, and they have the opportunity to share their knowledge and develop relationships with community members. One student respondent stated, *"...sometimes I learned though self-teaching, but sometimes I like to practise on computers with my colleagues ..."* (M1, STU, 1, 07/5). Staff also reported that they relied on E-mail to interact with their colleagues and even some staff also required tools for synchronous collaboration; for example, *"We use the network to interact with other colleagues in Hobart and Burnie via video*

conferencing” (M3, STA, 4, 02/5). The data indicated that learning using ICT encouraged and facilitated students' relationship of their 'community' members. This fits with Wenger's (1996) assertion that learners are brought together through their mutual engagement in situated activities. This finding also is consistent with the belief that the development of a sense of community has become increasingly important in the context of the higher education system (Bickford & Wright, 2003). The higher education system is generally decentralised as individual faculty often played a leading role in responsibility for their own teaching and delivering curriculum to students. The awareness of the contribution to ICTs' impacts is therefore significant as adoption of ICTs may imply that it leads to more collaborative ways of teaching and learning. Students and staff members would in many cases have to collaborate with a whole range of new students and staff, such as, course developers, consulting managers, and so on.

▪ *Different Perceptions of Higher-order Thinking and Critical Thinking*

Higher-order thinking and critical thinking are the essence of tertiary learning, especially at a time when ICTs are working as a new route to approach information and a significant tool in the process of tertiary education. The literature review argued that 'higher-order thinking' and 'critical thinking' were important aspect of ICTs' impacts on tertiary education. For example, De la Harpe & Radloff (2000) stated that "university students, to be effective learners, need to have a well developed set of cognitive learning strategies. The cognitive approach is recognised as playing an important part in effective university study" (p. 170). The cognitive approach is used to study the output of people's concept formation processes. This approach provided a means for analysing concepts and procedures of learning and gave rise to new approaches to pedagogy. Recently, the main cognitive approaches to learning have been focused on constructivism and higher-order thinking, in which understanding is gained through an active process of creating hypotheses and building new forms of understanding through activity. Newman (2004) pointed out that recent developments in cognitive research suggested that learning is most effective when there is (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connections to real-world contexts (Newman, 2004, p. 2). Therefore, in order for the students to learn constructively, Merriam and Caffarella (1999) argued that the teaching must provide:

... experiences that induce cognitive conflict and hence encourage learners to develop new knowledge schemes that are better adapted to experience. Practical activities supported by group discussions form the core of such pedagogical practices (p. 262).

An analysis of the survey results in Table 1-2 revealed respondents' perceptions about the impacts of ICTs on the improvement of cognitive higher-order thinking and critical thinking competency, indicating that there were substantial differences in the opinions about whether using ICTs is likely to stimulate higher-order thinking. The Mean Score from the students was in the neutral range, which means they were ambivalent about this item. However, it was above 3.00, indicating that they were inclined to accept more easily the proposition that the impact of ICTs on the improvement of higher-order thinking. The Mean Score from the staff was in the range of disagreement, which means the staff were more pessimistic about the likely impact of ICTs on improving students' higher-order thinking. The main reason the interviewed staff held for their attitude was that they believed that the use of ICTs

would limit the extent to which higher-order thinking was developed. When asked if they thought the ICT helped improve their students' understanding of various subjects, one staff member responded that: "*Not really. It depends on the person not the computers*" (F1, STA, 1, 01/5). Another staff member stated:

The information and materials found on line might help the students 'too much' in the process of learning and approaching answers, and were very likely to reduce—not increase—the chances for them to achieve even low-level thinking for themselves, let alone higher-order thinking (M3, STA, 4, 02/5).

A student respondent reported:

I've had that difficulty of finding information online, you know sometimes the information I found are not appropriate and even not correct, and I found it not useful (M4, STU, 4, 08/5).

Comments from the student and staff respondents indicated that the seemingly useful information and materials online were sometimes incorrect, which would inevitably mislead the students in their understanding and lead to confusion in drawing a sound and reasonable opinion or conclusion. Compared with the views of the staff, the student respondents seemed less negative about the impact of ICTs, though the research data are not strong either way. The students' Mean Score was 0.74 points higher than that of the staff, indicating that the students had slightly less hesitation in accepting the proposition. The specific nuances in Mean Score implies that students do not appear to have more positive comments on what impacts of ICT had on their cognitive outcomes of learning though they had slightly more positive inclinations. Interview responses indicated that one possible reason was that the students were not guided well in using ICTs to learn and understand, leaving them unaware of the potential impacts and effects of the tool. For example, a student commented on the lack of clear guidance on using WebCT.

I found out from another student...I was scared about using it at first but I got hooked by the fact that you could set up a discussion board inviting comments on the lecture...We were left to find out about it by ourselves. We weren't given sessions on it (M3, STU, 3, 08/5).

A similar conclusion can be drawn from the data relating to critical thinking. Here, the staff has a less positive view on the impact of ICTs on the realization of critical thinking, while the students were more positive.

Comparing the Mean Score data of the higher-order thinking and critical thinking, we can find that the Mean Scores of critical thinking from the students and staff were 0.07 and 0.19 points higher than those of higher-order thinking respectively. This suggests that both the students and staff were more agreed about the positive impacts of ICTs on improving critical thinking than on higher-order thinking.

As mentioned previously, there were some shared information and experiences based on the 'community of practice' concept within the context of ICT learning (e.g., WebCT), and interaction, collaboration and cooperation have been reported by respondents in their learning, however, there was no criticism. Teaching and learning based on higher-order thinking and critical thinking were rare. Laurillard (2000) noted that the use of ICT goes beyond her original conversational framework model

(Laurillard, 1993) and the straightforward narrative discourse of traditional lectures and books. In traditional teaching approaches, the formalization and questioning of concepts is often deferred to seminars or tutorials by lecturers. Lecturers are supposed to raise some questions or bring out some issues that are not simply those non-meaningful 'rote' examples, but some heuristic and inspirational ones which can help the students achieve the status of higher-order thinking and critical thinking. Tertiary education requires students to acquire competence in academic discourse in order to express their understanding as learning outcomes.

With the rapid development of IT technology, ICTs have become indispensable ingredients in the process of teaching and learning in tertiary education (Oliver, 2002). ICT allows students not only to question ideas and to reflect and adapt in the light of theory, but it also allows the students to question amongst themselves and to offer support and criticism to each other outside the influence of the lecturer.

However, the survey data seems to show that students have stepped, mostly unconsciously and unexpectedly, into a somewhat confused area where they conflate the two concepts in using ICTs: first, 'tool to reorganize' and second, 'tool to improve'. The data indicated that for most of the time students were using ICT as the tool to just finish their tasks by reorganizing the various materials and information searched and found through the IT platform; rather than distilling and extracting the information on the Net and then forming their own opinions and conclusions. It is in this latter process that higher-order thinking and critical thinking are achieved and the thinking skills and levels of the students are improved.

The data suggested students did not enter strongly into higher-order thinking and critical thinking processes, but continued to direct a large part of their communication to the lecturing staff, largely ignoring the opportunity to be motivated to develop their own thinking and knowledge. This is in direct contradiction to the suggestion in the literature where the ICTs are successful in the move to a personal construct of knowledge (Newhouse, Trinidad & Clarkson, 2002). This inconsistency of the results in some instances is most likely due to the sample size, differences in sample selection and/or group of participants.

Therefore, to sum up this discussion, the data from the two groups indicated that ICTs, as a tool in the process of learning and teaching, can be both useful, and useless. It can do good, or rather no harm, to the students' tertiary education. The point is that whether students can realize and acknowledge the importance and optimistic impacts in the first place, and then use them to support the higher order skills within subjects and to support critical learning, improving their own and the school's performance.

Conclusions

Australian tertiary education currently through more widespread adoption of ICT is in the process of providing the means for students and staff to support their teaching and learning. However, based on the data from this study, some of the students and staff perceptions do not correspond with the existing literature. Whilst a variety of positive ICTs' effects can be found, there is a gap in understanding the potential role of ICT's impacts on tertiary education settings. This study concluded that all participants in university education need to be alerted to the wide range of ICT features and the

considerable potential of ICT technologies for tertiary teaching and learning. Therefore, better understanding of the changes that might be implemented to achieve the goal of ICT maximisation has the capacity to benefit academic staff in tertiary institutions as well as their students. In such an environment both will develop their learning and gain effective support from the institution.

References

- Bickford, D. J., & Wright, D. J. (2003). *The Importance of Physical Space in Creating Supportive Learning Environments*. Retrieved June 14, 2007, from <http://www.educause.edu/learningspacesch04>
- Burns, R. B. (2000). *Introduction to research methods*. French's Forest, NSW, Australia: Longman.
- Caverly, D. C. & MacDonald, L. (2004). Techtalk: Keeping up with technology. *Journal of Developmental Education*, 28(2), 38-39.
- Chere-Masopha, J. (2005). *When teachers refuse to learn: Teaching teachers computer literacy*. Retrieved July 15, 2006, from http://105.cgpublisher.com/proposals/4/index_html
- Cox, M., Preston, C. & Cox, K. (1999). *What factors support or prevent teachers from using ICT in their classrooms?* Paper presented at the British Educational Research Association Annual Conference, University of Sussex at Brighton, September 2-5.
- DCITA. (2002). *Learning for the knowledge society*, Retrieved April 22, 2006, from <http://www.dest.gov.au/archive/schools/publications/2000/learning.pdf>.
- De la Harpe, B. & Radloff, A. (2000). Informed teachers and learners: The importance of assessing the characteristics needed for lifelong learning. *Studies in Continuing Education*, 22(2), 169-182.
- Eklund, J., & Kwan, V. (2000). *Enhancing Collaborative Learning in Primary Education through the Australian Schools Web Challenge*. Paper presented at the Proceedings of AUSWEB2K, The Sixth Australian World Wide Web Conference, Lismore, NSW.
- Galanouli, D., Murphy, C. & Gardner, J. (2001). Students' Perceptions of ICT-related Support in Teaching Placements. *Journal of Computer Assisted Learning*, 17(4), 396-408.
- Hope, W. C. (1996). Factors facilitating teachers' use of computer technology. *The Clearing House*, 70(2), 106-107.
- Kennedy, G., Krause, K., Churchward, A., Judd, T. & Gray, K. (2006). *First Year Students' Experiences with Technology: Are they really Digital Natives?* Retrieved October 6, 2007, from http://www.bmu.unimelb.edu.au/research/munatives/natives_report2006.pdf.
- Laurillard, D. (1993). *Rethinking university teaching: A framework for the effective use of educational technology*. London: Routledge.
- Markel, S. L. (2001). *Technology and education online discussion forums: It's in the response*. Retrieved December 15, 2006, from <http://www.westga.edu/~distance/ojdla/summer42/markel42.html>
- MCEETYA. (2005). *Building a Knowledge Culture 2005-2007*, Retrieved May 8, 2006, from http://www.mceetya.edu.au/verve/_resources/Building_a_Knowledge_Culture.pdf.
- Merriam, S. B., & Caffarella, R. S. (1999). *Learning in adulthood: a comprehensive*

- guide* (2nd ed.). San Francisco, California: Jossey-Bass Publishers.
- Newhouse, C. P., Trinidad, S. & Clarkson, B. (2002). *Quality pedagogy and effective learning with information and communications technologies (ICT): A review of the literature*. Retrieved October 18, 2006, from www.eddept.wa.edu.au/cmisis/eval/downloads/pd/litreview.pdf.
- Newman, W. (2004). ICT: Does IT matter? *Access*, 18(3), 5-8.
- Noss, R. & Pachler, N. (1999). The challenge of new technologies: Doing old things in a new way or doing new things? In P. Mortimore (Ed.). *Understanding Pedagogy and its Impact on Learning*. London: PCP.
- OECD (2005). E-learning in tertiary education: where do we stand?. *Education & Skills*, 4(1), 1-293.
- Oliver, B. & Goerke, V. (2007). Australian undergraduates' use and ownership of emerging technologies: Implications and opportunities for creating engaging learning experiences for the Net Generation. *Australasian Journal of Educational Technology*, 23(2), 171-186.
- Oliver, R. (2002). The role of ICT in higher education for the 21st century: ICT as a change agent for education. *Proceedings of the Higher Education for the 21st Century Conference*. Miri, Sarawak: Curtin University.
- Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & Education*, 37(2), 163-178.
- Pelliccione, L. (2001) *Implementing innovative technology: Towards the transformation of a university*, Unpublished PhD thesis, Curtin University of Technology, Perth, Western Australia, Australia.
- Preston, C., M, C., & K., C. (2000). *Teachers as Innovators in learning: what motivates teachers to use ICT*. London: TTA/MirandaNet/Oracle/Compaq.
- Schrump, L. (2000a). *Let's put the pedagogy first: Technology as a tool to support instruction*. Retrieved October 22, 2005, from http://www.education-world.com/a_tech/tech004.shtml
- Snoeyink, R. & Ertmer, P. A. (2002). Thrust into Technology: How Veteran Teachers Respond. *Journal of Educational Technology Systems*, 30(1), 85-111.
- Stiggins, R. J. (1999). Assessment, student confidence, and school success. *Phi Delta Kappan*, 81(3), 191-198.
- Wenger, E. (1996). Communities of practice: The social fabric of a learning organization. *Healthcare Forum Journal*, 39(4), 20-26.
- Yuen, A. & Ma, W. (2002). Gender differences in teacher computer acceptance. *Journal of Technology and Teacher Education*, 10(3), 365-382.