Which comes first, 

technological skill or innovative teaching styles?®

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Abstract

In recent years there has been an increased trend at universities towards a more interactive and innovative style of teaching, using multi modal and different teaching approaches. Kolb and others have established that students have a preference for learning activities that reflect the learning style in which they are most comfortable. However, it cannot be assumed that they have the technological capabilities needed to fully benefit from these changes in style.

The findings from a survey of second and third year students showed that there was a relationship between students’ self assessment of their communications and technological skills and their preferred learning styles. Students with a higher self-assessment of their knowledge and skill level with respect to computers, e-mail and the Internet felt more comfortable in a more innovative teaching environment. Many of the students reported that their skill level was very low, and therefore some may not be gaining the full benefit of the content of course. However, unless teachers revert to past methods, students will need to improve their computer and technological skills. The results also indicated that there is a significant difference between international and non-international students both in their perceived technological abilities and preferred learning styles.
Introduction

In today's highly competitive environment a university and its students need to adapt to changes in technology especially those changes that have the potential to impact on teaching and learning quality. From a teaching perspective, new technologies are demanding a fundamental re-examination of educational assumptions and practice. They are forcing educators to rethink their approach to learning environments. From a student's perspective there is a need to be better equipped to take advantage of these technologies both in terms of access and their ability to use these technologies.

Additionally, the learning processes are being constrained by more limited teaching periods. This adds an extra burden of increasing knowledge demands while increasing demands for the development of practical skills (Bell & Patterson, 1998).

Today, effective teaching programs in higher education integrate a variety of teaching methods and technologies. Judging by the proliferation of texts and information available on technology based training, and the use of the web for teaching, educators are being encouraged to use e-mail and Internet technologies as part of flexible delivery. These are used to meet specific learning objectives, satisfy the diverse needs of participants and model good teaching practice. Such flexible delivery is being encouraged in higher institutions around the world (Jacobson, 1994, and evidenced by the numerous journals and conferences that are held around this topic.) These sources also include associated handbooks (ASTAM BOOKS, 1999), as well as the availability of professional development courses including those offered by Swinburne TAFE.

For the purpose of this paper, technology has been defined as use of computers, the Internet and e-mail. The Internet is used for two main purposes: as a research tool for retrieving materials; and as a non-traditional teaching space. E-mail is used for keeping in touch with students and lecturers outside class time. Some of these technologies are used for tasks that require knowledge and skill (eg. Using specific software packages), while others are more closely linked to the specific learning objectives of individual subjects (eg. The ability to retrieve information or use for self-completion tasks).

Recent research demonstrates a relationship between preferred learning styles and approaches to using technology (Yoon, 1993-4; Rasmussen & Davidson-Shivers, 1998). Current uses of knowledge of individual learning differences range from promoting awareness of various styles to improving learning outcomes and developing alternative instructional methods. A wide range of reasons for considering individual differences have been submitted including those that enhance the teaching and learning process (Conti & Wellborn, 1986) improving computer assisted instruction and adapting instruction to improve performance (Jonassen & Grabowski, 1993).

In many cases it is assumed that students are proficient in their ability to use computers, the Internet and e-mail. It is also assumed that their knowledge and their skill levels make them reasonable proficient in using these technologies (Leidner & Jarvenpaa, 1995). The study reported in this paper examined students' perceived skill and knowledge levels of various technologies and their relationship to students' preferred learning style in order to ascertain whether students have the technological capabilities to fully benefit from innovative styles of delivery.

Learning Styles

Most educators recognise that students differ in abilities, attributes and motivation, (Chickerling, 1981). Research findings support the notion that individual differences affect
learning performance among adults (Davidson, Savenye & Orr, 1992; James & Blank, 1991; Sugarman, 1985). Understanding these differences helps instructors cope with the variations in performance exhibited by their students (Jonassen & Grabowski, 1993). In addition, understanding these differences has important implications for designing and developing instruction in that a singular method of instruction is not necessarily best for all students (Cronbach & Snow, 1977).

Although there are a number of variables that might influence performance, one difference that might affect the learning process is learning styles. Learning styles refer to how individuals learn. Dunn (1986) defines learning styles as ways in which an individual "adsorbs and retains information or skills" (p12). Kolb (1981, 1984) agrees with Dunn's definition in general, but adds an emphasis on the processing and perception of information. Gregore (1979) expands Kolb's definition by stating that learning styles are overt, observable behaviours that provide cues about how individuals process, or mediate information. Davidson (1990) supports these definitions by stating that learning styles are characteristic ways of gaining, processing and storing information.

For the most part, these definitions suggest that learning styles are concerned with how individuals process and perceive information within a learning situation. Further, these scholars agree that learning styles are relatively stable traits and suggest that learning styles tend to be consistent across different contents and situations. The dimensions of processing and perception form the basis of understanding how learning styles influence the learning process.

Learning styles are important considerations in the learning process. According to Yoder (1994), awareness of the individual differences of learning styles and their interaction with performance is essential to educators. Bostrom, Olfman and Sein (1990) also support the importance of the variables of learning styles especially in a computer environment.

Studies have demonstrated that student performance improves when their learning styles are taken into consideration. (Dunn, 1986; Fizzell, 1984; James & Galbraith, 1985; Matthews, 1991). For example, a study of the matching of learning styles and instructional method found that learning styles made a significant contribution to student performance in a computer-based lesson (Riding, Buckley, Thompson & Hagger, 1989).

How students process and Perceive Information.

For adult populations (ie. People aged 18+), Kolb's (1981) Experiential Learning Styles Theory and learning styles instrument have been widely used, especially in business and higher educational institutions. Kolb's learning styles theory is based on the idea that learning is comprised of two dimensions: (a) how information is processed (active vs reflective) and (b) and how it is perceived (abstract vs concrete) during the learning experience.

The bipolar dimensions of the Experiential Learning Styles Theory are based on the notion that there are competing abilities within each dimension of process and perception. The presence of one ability over another is the basis of learning styles preference.

One bipolar dimension refers to how individuals process information. The process dimension is composed of an active-reflective continuum. Active learners learn best when they participate in projects, homework and small-group discussions (Kolb, 1984; Smith & Kolb, 1986). Learners who tend to be reflective observe prior to making a judgment and prefer lecture-type learning situations. However it is important to remember that individual
preferences for the processing dimension of learning styles fall between the two poles on a continuous scale, providing an infinite scale for determining preferences.

The other bipolar dimension of the theory refers to how individuals perceive information. The perception dimension is composed of an abstract-concrete continuum and is most closely associated with cognitive complexity (Kolb, 1981). Learners who tend to be abstract learn best in instructor-led, impersonal situations that emphasise theory and systematic analysis and tend to be frustrated by unstructured learning experiences (Kolb, 1984; Smith & Kolb, 1986). At the other end, learners who tend to be concrete learn most effectively through specific examples. These learners benefit from interaction with others, especially learners with similar abilities (Kolb, 1984; Smith & Kolb, 1986). Once again, the continuum between these two poles allows for graduation in the levels of preferences for abstraction and concreteness.

Previous Research on the Significance of Learning Styles.

As universities move towards more interactive and innovative styles of teaching, several studies have researched the significance of learning styles in relation to individuals' performance with mixed results (Dunn, 1986; Carrier, Williams & Dalgaard, 1988; Bostrom, Olfman & Sein, 1990). Studies specifically related to the use of computers as either the content or delivery method have supported learning styles as a component of success. For example, Bostrom, Olfman, and Sein (1990) also found that learners with a converger learning style (Kolb's taxonomy) performed better than those students with other learning styles when learning how to use computers. Carlson (1991) found that in those students who were matched with delivery (although she did not deliberately match subjects to delivery), learning styles were significant when learners were matched to instructional method in a multi-media lesson (hyper-media). Similarly, Davidson, Savenye, and Orr (1992) reported that certain learning styles performed better that others. They found specifically that order (sequential-random at an abstract level) had significant effect on performance in a computer applications course.

In a more recent study, learning styles of American college students were found to be a significant factor which influenced learning in a hyper-text environment (Ellis, Ford, & Wood, 1993). More successful learners were serialists who can be described as preferring information that is given step-by-step, in a patterned sequence. They found, however that after the third instructional session, significant differences were no longer found. This finding led these authors to suggest that as learners become more familiar with the instructional method, they adapt to the new way of learning through the use of various learning strategies. Yoon (1993-4) in his examination of learning styles and prior knowledge when using computer assisted instruction reported significant effects for learning styles and level of prior knowledge of the technology.

These results are supported by a more recent study conducted by Rasmussen and Davidson-Shivers (1998), who found that learning styles did appear to influence performance in a computer (hypermedia) learning environment. Learning styles appeared to affect the learning process by influencing the how new information is processed.

Technology and its use in the classroom

This paper focuses on the knowledge and skill associated with using computers, the Internet and e-mail in the classroom, as a tool to enhance learning. These technologies and their uses as part of the learning process are described below.

- Computers
The basic technology referred to in this study is the computer. Apart from its usefulness as a word processor and for other software programs such as Excel and various statistical packages, the computer is the tool with which students access the Internet, e-mail and e-commerce, etc. For its most effective use, students require both knowledge of what packages are available and the skill to use them.

- **The Internet**

There is no argument that the Internet is an important information resource and retrieval tool that is part of learning at tertiary level. Less extensively used is the Internet as an alternative teaching space. The subject home page can be used both as a site for information retrieval, for student-to-student or lecturer-to-student contact as well as providing links to other sites of interest to the subjects. The Internet can also provide a site for the presentation of student materials or the submission of student assignments and as an access point for e-mail, discussion lists and chat sessions. More recently, using a multi-modal approach, it has been used for self-directed learning and distance education.

- **E-mail**

E-mail allows students and lecturers to communicate outside the classroom to review class material, ask questions or transfer information. It is not constrained by time (e-mails can be sent and answered any time or day), and allows the sender and reply to be 'considered'. It may also assist shy and language limited students to ask questions in a less 'threatening' environment. The e-mail can facilitate information exchange in an otherwise crowded and often limited class contact time.

**Flexible Delivery Benefits Lecturers and Students**

A benefit of encouraging regular Internet and e-mail usage by students is that it enables remote access. Students can use the Internet to access the library (catalogues and CD ROMs) and information that might otherwise take time to access via traditional means. Teaching time becomes more flexible, both for staff and students, with the ability of presenting teaching materials and conducting student-to-student and staff-to-student interaction outside normal class times.

**The Survey**

At Swinburne University of Technology, as at other Universities, there is a strong move towards developing subjects that incorporate flexible teaching programs. A recent call for expression of interest to develop such programs resulted in 65 proposals across Swinburne University of Technology.

In doing so, it seems that educators take for granted that, students, who have graduated from Australian high schools, come to university with certain knowledge and skill level in using computers, the Internet and e-mail. Is this the case? And what of the significant percentage of international students who may have completed high school in another country?
Therefore, it would seem important for educators to understand tertiary students' self-assessment of their knowledge and skill level with computers, the Internet and e-mail before starting to develop flexible delivery programs. So too is of interest students' preferred learning styles, as this will affect their ready acceptance of the use of technology in teaching. These research needs formed the basis for the study in this paper.

Within this context, the following hypothesis were developed:

\[ H_0: \] All 2\textsuperscript{nd} and 3\textsuperscript{rd} year students have the knowledge and skill to use computers, the Internet and e-mail.

\[ H_0: \] International students are not disadvantaged compared to non-international students in terms of their perceived abilities to use the technologies.

\[ H_0: \] All students adapt to flexible learning in the classroom.

\[ H_0: \] There is no difference between 2\textsuperscript{nd} and 3\textsuperscript{rd} year students in their preferred learning styles.

**Methodology**

**Participants**

The sample consisted of 169 second and third year business students at Swinburne University of Technology. Having at least completed the first year of their B.Bus course, it was assumed that these students would have developed a certain knowledge and skill level with using computers, the Internet and e-mail. The self-completion questionnaire was distributed in the first lecture of the semester in marketing research (2\textsuperscript{nd} year, day and night classes), business strategy (3\textsuperscript{rd} year), and communications strategy (3\textsuperscript{rd} year). Students were given instructions on how to complete the questionnaire. The questionnaires were completed and collected during the lecture and results were analysed using SPSS Version 8.0.

**Major Variables.**

The dependent variables in this study were (a) students' access to a variety of commonly used technological equipment, (b) students' perceived knowledge and skill levels of these technologies, (c) frequency of using each of the technologies, and (d) students' preferred learning styles. The independent variables were student's status (full-time or part-time), their age, gender, year of study, and country of birth.

**Limitations**

The main limitation of the survey was that the method of selecting students and administering the survey meant that the sample was a non-probability technique. As the survey was conducted at the start of the semester, it was expected that the usage of the various technologies would have been higher if the survey had been administered during the semester. However, the findings give an interesting insight into the current situation and raise some interesting issues for further consideration.
SUMMARY OF THE MAIN FINDINGS

STUDENTS’ ASSESSMENT OF THEIR LEVEL OF REGULAR ACCESS TO COMPUTERS, INTERNET AND E-MAIL

Most universities including SUT, provide computing and technological resources that are available to their students so it was expected that most students would at least claim to have access to a personal computer. This was confirmed with 82% of students reporting that they had 'regular access when needed' to a personal computer and 27% saying they had regular access when needed to a laptop. However, it was of concern that in today’s 'computer age’ that there are 12% of students who claimed not to have 'regular access when needed’ to either of the above. Of greater concern was that while only 8% of non-international students reported that they did not have regular access when needed to either a personal computer or a laptop, this figure was 25% for International students studying at this University.

Over three-quarters of the students said they had regular access to the Internet when they needed it, either at school or at work or at home. The following table summarises the reported percentage of students that said they had regular access to the Internet. It shows that more males than females said they had access to the Internet at University (school), and that a significantly lower percentage of International students reported having access to the Internet at work.

Table 1: Summary of Internet access by gender and International students

<table>
<thead>
<tr>
<th>Internet Access at</th>
<th>Total</th>
<th>Male - female differences</th>
<th>International students</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>75%</td>
<td>82% male</td>
<td>63% international</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70% female</td>
<td>78% non Intl.</td>
</tr>
<tr>
<td>Work</td>
<td>19%</td>
<td>Only small differences</td>
<td>3% international+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>23% non Intl.</td>
</tr>
<tr>
<td>Home</td>
<td>52%</td>
<td>Only small differences</td>
<td>60% international</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50% non Intl.</td>
</tr>
</tbody>
</table>

*Multiple response question

+significant difference at 95%

The main two reasons given for using the Internet were for university study, and for browsing. A much higher proportion of local students (55%) was using the Internet for university study than were international students (37%).
About three-quarters of the students surveyed said they had access to the e-mail. There was little difference between males and females, International students and non-International students.

The students who were using a personal computer they were doing so on average about 3 times a week and lap top users were using their laptop less than once a week. Student users of the Internet were using it on average about once a week, and e-mail users were using it about 3 times a week. It is expected that these figures were on the low side as the survey was conducted at the start of the semester, and at the start of the year.

OVERALL SELF ASSESSMENT OF KNOWLEDGE AND SKILL LEVELS OF COMPUTERS, THE E-MAIL AND THE INTERNET

Students were asked both about the perceived level of knowledge and skill in using computers, the Internet and e-mail. The Concise Oxford Dictionary (1996) defines knowledge as "familiarity gained by experience", and skill as "expertness, the ability to do something well that comes from knowledge". It was felt that a gap might exist between perceived knowledge about a particular technology and one's skill level in using it.

However, the analysis of students' self-reporting of their knowledge and skill levels showed a strong relationship between the variables of knowledge and skill. It also showed that the majority of students in second and third year do not have a high self-assessment of their computer or Internet or e-mail knowledge and skill levels.

There was not one demographic variable that clearly segmented computer knowledge. Students aged 18 to 20 years had a slightly lower self-assessment of their computer knowledge and skill than older students did, and students who were studying part time and International students had a slightly higher self-assessment than others. However none of these differences were statistically significant. Students who had a laptop had the highest self-assessment of their computer knowledge and skills.

The majority of students said their knowledge and skill level with the Internet was low (ie. They knew very little or only something about the Internet). Not surprisingly the students who used the Internet at home or at work had a slightly higher self-assessment of their knowledge of the Internet. Only 4% of the students surveyed said they knew a great deal about the Internet. There was no significant difference between students' knowledge of the Internet by any of the demographic variables. Males did rate their knowledge higher than females, but the difference was not significant at the 95% level (It was significant at the 90% level).

The following graph shows that overall the majority of students said they knew very little or only 'something' about computers, e-mail or the Internet. Analysis of those who said they knew a 'great deal' showed that a higher number of students had a great deal of knowledge of the e-mail than for computers or the Internet.
Graph 1: Summary of knowledge of computers, the Internet and e-mail

Self-reporting of skill levels showed similar patterns to self-reporting of knowledge levels. The majority of students said their skill level was none, very little or they had only some level of skill with computers, e-mail or the Internet.

Therefore, the research indicated that educators could not assume that regular access to a personal computer means that a student has a high self-assessment of their perceived knowledge or skill level in using that computer (or the Internet or the e-mail).

RELATIONSHIP BETWEEN ACCESS TO TECHNOLOGY AND STUDENT CONFIDENCE IN USING THAT TECHNOLOGY

Having regular access when needed to computers seems to increase a student's confidence in their ability to use all forms of technology. The findings showed that a higher percentage of students who said they knew a great deal or a lot about computers, also said they had regular access when needed to a computer, and/or the e-mail, and/or the Internet.

Overall, the students rated their computer and e-mail knowledge slightly higher than their knowledge of the Internet. Males rated their computer and Internet knowledge slightly higher than females, and females rated their e-mail knowledge slightly higher than males, but the differences were not significant.
Table 2: Mean scores for self-assessment of knowledge of computers, the Internet and E-mail

<table>
<thead>
<tr>
<th>Variable</th>
<th>Computer knowledge (Mean scores)</th>
<th>Internet knowledge</th>
<th>e-mail knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>3.41</td>
<td>3.32</td>
<td>3.30</td>
</tr>
<tr>
<td>Females</td>
<td>3.28</td>
<td>3.08</td>
<td>3.41</td>
</tr>
<tr>
<td>Great deal/lot knowl.</td>
<td>3.91</td>
<td>3.59</td>
<td>3.93</td>
</tr>
<tr>
<td>Some/no knowledge</td>
<td>2.89</td>
<td>2.86</td>
<td>2.94</td>
</tr>
<tr>
<td>International</td>
<td>3.09</td>
<td>3.14</td>
<td>3.22</td>
</tr>
<tr>
<td>Not international</td>
<td>3.40</td>
<td>3.19</td>
<td>3.43</td>
</tr>
<tr>
<td>Total</td>
<td>3.33</td>
<td>3.18</td>
<td>3.37</td>
</tr>
</tbody>
</table>

Note that the data shown in the above table is based on the rating scale where 5=great deal of knowledge, 4=know a lot about them, 3=know something about them, 2=know very little about them, and 1=have no knowledge of them. Missing and can’t say answers have been excluded.

PREFERRED LEARNING STYLES

To assess whether they were reflective or active learners, and whether they were concrete or abstract learners (Kolb, 1981), the students were then asked to indicate which learning style they would prefer. The options were presented as scenarios, using non gender specific fictional student names, and the students were asked to say whether they were more like Terry (the first option) or Leslie (the second option). These options are described below.

1. The teacher directs the activity most of the time; or a class in which the students participate more actively.
   o teacher directs vs. students participate

1. The teacher gives a formal lecture; or a class in which the students and teacher discuss issues in a more informal style.
   o formal lecture vs. more informal style

1. Small groups of students give presentations and may organise the class; or the teacher directs the class.
   o Small groups vs. teacher directs
1. Students learn by using different media like video, newspaper articles, library searches, journal articles, the Internet and various texts; or, prefers the teacher to hand out all the necessary material for the subject.

   - Different media vs. teacher hands out

While the majority preferred that the teacher directs the class rather than small groups giving presentations, over half of the students said they preferred a more informal style of teaching rather than the traditional style of lecturing to the students. A majority still preferred that the teacher hand out the necessary material for the subject.

**DO COMPUTER KNOWLEDGE AND SKILLS RELATE TO LEARNING STYLES?**

It was of interest to determine if students' preferred learning style was related to their perceived knowledge and skill level with computers. In the following analysis students with a 'low' knowledge or skill level were students whose self-assessment was 'know nothing', 'know very little', or 'know something' about computers. Students with a 'high' knowledge or skill level were those whose self-assessment was that they have a 'great deal' of knowledge and 'know a lot' about computers.

The results also showed that the higher that students rated their computer skills the more likely they were to prefer a less traditional style, ie. a greater student participation in the subject, and an informal style of lecture. Further, the higher that they rated both their computer skill and their Internet skill the more likely they were to prefer using different media to assist in their learning of the subject.

Table 3 shows that active and concrete learners, who prefer to learn through the use of smaller groups and increased student participation, were students with the highest self-reporting of their computer knowledge and skills. They were also keen to use different media such as videos and journals to learn.

On the other hand, reflective and abstract learners had a much lower self-reporting of their computer knowledge and skills. These students were more reliant on the teacher directing the class, and they preferred that the teacher hand out the necessary material to help their studies.

**Table 3: Summary of the preferred learning styles**

<table>
<thead>
<tr>
<th></th>
<th>Computer Knowledge (%)</th>
<th>Computer Skill (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% prefer</td>
<td>High</td>
</tr>
<tr>
<td>Teacher directs</td>
<td>54</td>
<td>45</td>
</tr>
<tr>
<td>Students participate</td>
<td>46</td>
<td>55</td>
</tr>
</tbody>
</table>
Further analysis of the preferred teaching styles revealed that:

- Males were more likely than females to prefer more student participation in class, and an informal style of lecture;
- International students were more likely to prefer teacher directed classes, and teachers handing out the material for the subject. Like their non-international counterparts, however, they preferred a more informal style of discussion to formal lectures.
- More students in second year preferred the teacher hands out material, while third year students were more prepared to use different media to obtain information and prefer small groups of students giving presentations and organising the class, rather than the teacher directing the class.

However, the differences were not significant (95%).

Some of these results are summarised in Table 4.

**Table 4: Preferred learning styles analysed by origin and study year of students**
CONCLUSIONS

In today’s tertiary classroom, teachers are changing their teaching styles, partly in response to technological advances as well as the changing profile and offerings of Universities. It is therefore important to understand students' knowledge and skill levels and their preferred learning styles to ensure that students are not being inconvenienced by these changes.

The survey reported in this paper was based on the work of done by Bostrom, Olfam and Sein (1990) and Yoder (1994) which investigated the premise that a relationship exists between preferred learning styles and students' interaction with technology. It also made use of the work done by Kolb (1981) which established that students have a preference for learning activities that reflect the learning style with which they are most comfortable.

Most educators assume that students have the knowledge and skill to use computers, the Internet and e-mail. However, the findings from the survey of second and third year business students at Swinburne University of Technology showed while the majority of students were aware they had 'regular access to these tools when needed', many were not confident in their ability to use them. Computer knowledge seems to be the most important skill for these students, but over half of the students said that their current computer knowledge was either 'very little/none' or that they only 'know something' about computers. The survey demonstrated that there was a statistically significant relationship between students' confidence in their knowledge of computers, and their knowledge of the e-mail and the Internet. This means that the students who are most comfortable with computers are more likely to feel comfortable with using the e-mail and the Internet. It follows that these students will benefit more from the teaching process.
Matched with a low confidence in using computers and with the emergence of self-directed learning and distance education that relies on using the Internet and e-mail, lecturers can no longer assume that all students have both the knowledge and skill to use the Internet. Of the total sample, about two thirds said their Internet skill was low (ie. They had 'no' or 'only some' level of Internet skill).

The students interviewed expressed a clear preference for the teacher directing the class rather than small groups of students giving presentations and organising the class. They also expressed a preference for the teacher handing out all the necessary material for the subject rather than students being more responsible for collecting their own information from different media. Some preference was expressed for a less formal style of teaching rather than the traditional style of lecturing, and a greater level of student participation in class.

There was a significant relationship between students' preferred learning styles and their computer knowledge and skill levels. There was clear evidence that active learners and concrete learners are students with the highest self-reporting of their computer knowledge and skill. This supports the theory that these students prefer to learn through the use of smaller groups, and increased student participation. They are also keen to use different media such as videos and journals to learn. On the other hand, reflective learners and abstract learners have a much lower self-reporting of their computer knowledge and skills. These students are more reliant on the teacher directing the class, and they prefer that the teacher hand out the necessary material to help their studies.

Overall, the survey findings showed that:

- Not all second and third year students have the knowledge and skill to use computers, the Internet and e-mail
- International students are somewhat disadvantaged in terms of their perceived abilities to use the technologies
- Not all students adapt to flexible learning in the classroom
- There is little difference between second and third year students in their preferred learning styles.

**IMPLICATIONS OF THE SURVEY FINDINGS**

The study has implications for all tertiary educators wishing to include technology in their learning programs. Educators need to understand their students' knowledge and skill level with technology (and computers in particular), to assist in the development of more effective and flexible learning programs. All students need to be given ready access to these technologies, and many will need help to develop their confidence in using them. This learning should commence in their first year at university.

Previous research has indicated that student performance improves when their learning styles are taken into consideration (Dunn, 1996; Fizzell, 1984; James and Galbraith, 1985; Matthews, 1991). Ellis, Ford and Wood (1993) showed that although students may prefer different learning styles, it could take up to three sessions using a new teaching style for a student to adapt their learning strategy to this new style. In a condensed learning environment students who take more time to adapt to this new style may be disadvantaged. Therefore, the students who are more confident with computers, Internet and e-mail will benefit more from class activities that require these skills.
All this supports the argument that educators need to understand students' perceived technological knowledge and skill in order to develop programs to ensure that all students are sufficiently prepared to maximise their learning. Additionally to assist in the development of flexible and innovative learning programs, educators will need to develop teaching programs that will benefit all students in a class.

FUTURE RESEARCH

Based on the research reported in this paper, it would seem necessary to conduct further research into the specific knowledge and skills that students need to maximise their confidence in using computers, Internet and e-mail. This study should be conducted at the start of a student's first year at university, and repeated in subsequent years. This would help in the design and implementation of innovative teaching programs.

Even though some students are showing a preference for more innovative styles of learning some methods may not be applicable to all students, depending on how they process or perceive information. This matter should be investigated further.
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