Online Students: Relationships between Participation, Demographics and Academic Performance

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Abstract: Using information technology to support teaching and learning is becoming ubiquitous in tertiary education. However, how students participate and perform when a major component of the learning experience is conducted via an online learning environment is still an open question. The objective of this study was to investigate any relationships between the participation, demographics and academic performance of students in an information technology course that was taught wholly online. Through a detailed analysis of tracking data of student participation, which was automatically collected by the online learning environment, it was found that a relationship existed between students' participation in the online learning environment and their performance, as measured by final results in the course. Relationships also existed between gender, nationality, participation and performance. However, there was no relationship between age and performance and participation. These findings suggest that when designing online learning for a diverse population, student demographics should be taken into account to maximise the benefits of the learning experience.

Keywords: culture, diversity, online learning, participation

1. Introduction

1.1 e-Learning and online learning

The term e-Learning is interpreted differently by different researchers, describing a variety of situations including distance learning, online learning and networked learning. Definitions and explanations abound. Terms such as computer based education, computer based instruction, computer supported learning, distance education, ICT based learning, online learning and web based learning seem to be used interchangeably by different authors; all are claimed to describe e-Learning (McFarlane *et al.*, 2003). For the purposes of this research we will focus on online learning. Garrison and Anderson's (2003) definition of e-Learning, 'learning facilitated online through network technologies', best defines online learning as it is delivered via the Internet and how it is currently implemented at Deakin University. In the context of this research, e-Learning refers to the broader category of which online learning is a subset. Online learning can be defined as 'any class that offers its entire curriculum in the online course delivery mode via the Internet, thereby allowing students to participate regardless of geographic location, independent of time and place' (Harasim et al.,1995).

Online learning environments (OLEs) facilitate learning by utilising software that enables the design, delivery and management of online teaching and learning. The notion of providing courses wholly online is relatively new and allows students of diverse backgrounds and in geographically dispersed locations to have access to, and participate in, the same courses. In the past, students have been able to study 'off campus', or from a distance, relying on study guides, detailed notes and text books, but with few or no opportunities for interaction or collaboration. OLEs provide these resources but additionally they enable regular interaction and collaboration between students and instructors through the use of discussion boards, chat rooms and other interactive functionality, bringing all students into a 'virtual classroom'. The key difference between traditional off campus and online is the ability for students to communicate and collaborate with each other via the OLE, reducing the effects and limitations of isolation.

A wholly online course can be defined as a course that has no face-to-face interaction; all communication and interactions between instructors and students, educational content, learning activities, assessments and support services are integrated and delivered online via an OLE (Deakin University 2004). In order to assist students to maximise their outcomes, a better understanding of student activity in OLEs and the effect it may have on academic achievement is required (Young and McSporran 2001, Alstete and Beutell 2004).

1.2 Student tracking tools

Some OLEs have inbuilt tracking tools that allow them to record the participation levels of each student and to show patterns of access in this type of environment. The use of tracking data in OLEs is still a relatively new and under-explored area of research. Student tracking data captures every movement of students as they navigate through the OLE. For example, this data can provide instructors with information about when

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students log in, how much time they spend in the OLE, the number of messages they have read and posted, which tools and resources they have used, and the number and types of files that they have accessed. Tracking student online activity can provide early warning indicators of student performance (Wang and Newlin 2002) which is particularly important as the visual and aural cues present in a face-to-face situation are missing. For example, research has shown that the total number of home page visits during the first week of study can be predictive of eventual academic outcomes in the course. This same research found that discussion forum activity had a direct relationship with students' final grades (Wang and Newlin, 2002).

Student tracking has its limitations, however. It can only record positive action and it cannot record what it does not see. Students may choose to mark discussion postings as read rather than actually read them; they may have accessed resources by mistake; pages may have been accessed but never used. The tracking tool has no way of judging the significance of a recordable action. Further, it cannot record when actions do not take place. However, McKnight and Demers' (2003) research has shown that some elements of student behaviour online can be predicted and that student tracking can be used to achieve both teaching and learning goals, informing ongoing revision and evaluation of the course, highlighting student needs and suggesting which types of students struggle or excel in such environments. An insight into how different categories of students use and perform in online learning environments is needed to ensure that these environments are suitable for, and accommodate, every type of student using them. This study used data from a wholly online course to determine whether or not a relationship existed between student participation in the OLE and their outcomes as represented by their academic results. The impact of gender, age and nationality on participation and results was also investigated.

1.3 Student participation and performance

Many researchers support the idea that student-to-student and student-to-instructor interactions are important elements in the design and successful implementation of online learning courses. However, as Picciano (2002) notes: 'web-based learning requires adjustments on the part of students and teachers for successful interaction and participation to occur'. Picciano continues by stating that most online courses provide the ability for student and instructor interaction via discussion boards. Picciano's study looked for links between student interaction and participation, and online course performance but did not find a statistically significant relationship. An investigation into the reasons for student non-participation was conducted by Fung (2004). This study found that students had no problems accessing computers or the OLE but non-participation was due to lack of time, which was influenced by students' preferring to spend more time reading course materials rather than contributing to online discussions. Another finding revealed that a lack of interesting questions and lack of active participation from others deterred some students from being active participants (Fung 2004). Lack of time, not being comfortable with the medium and learning style preferences were also noted by Beaudoin (2003) as key reasons for student 'invisibility', or non-participation in an online learning environment. McKnight and Demers (2003) also commented that lack of participation could be due to students printing content from the OLE at the beginning of the semester, to refer to at later stages.

Student performance can be measured by a number of indicators including: successful completion of a course, course withdrawals, grades, added knowledge, and skill building. For the purposes of this study performance is measured and defined by the overall grade students are awarded at the end of completing the online course. Student performance is well understood to be a multivariable phenomenon affected by study habits, prior knowledge, communication skills, time available for study and teacher effectiveness (Picciano 2002). According to Picciano (2002) uncertainty still exists about the effects of the nature and extent of student interaction in online learning environments on student performance.

Although little is known about what factors influence student outcomes in an online learning environment, Beaudoin (2003) suggests that a high level of interaction and participation is desirable in distance education courses. Beaudoin's study found that performance cannot easily be correlated with participation. Although it found that highly participatory students achieved higher results, it also revealed that minimal online participation does not necessarily compromise student results. However a study undertaken by Alstete and Beutell (2004) found that the strongest indicator of student performance in online classes was discussion board usage. This finding was supported by the fact that the number of student sessions was positively and significantly related to overall course performance.

There is a notion that an OLE offers students an improved learning experience when compared to a more traditional classroom learning environment. Holley (2002) found that university students participating in a wholly online course using techniques such as virtual lectures and discussion boards, achieved better

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grades than students who studied in traditional learning settings. Whether achieving better grades equates to an improved learning experience is debatable however.

1.4 Impact of student demographics

The connections between student performance and attributes such as gender, age and nationality have been studied by researchers in the past in traditional classroom settings. Research on student participation in online tasks and outcomes have also been investigated, such as that reported by Graff (2006). However, there is a lack of research into whether, and how, demographic factors affect students' participation and performance in an online learning environment.

1.4.1 Student gender and age

The world of computing has been described as a male domain where women are under-represented, both in IT education and the IT industry (Craig et al., 2005). Some research has suggested that women have had fewer opportunities and access to computers (Gunn et al., 2003). However, other studies have suggested that online courses tend to favour women, as they are generally more motivated, and better at communicating online and at scheduling their time (Young and McSporran 2001). Gender-based differences in performance and interaction in OLEs are recognized as important foci for research but there are conflicting views about the nature and impact of these differences. The American Association of University Women notes that 'girls are under-represented and lower achievers in math, science and technology subjects' (cited in Gunn et al., 2003, p. 15). However Alstete and Beutell (2004) argue that gender is related to students' performance and that women generally outperform men in online classes. Meyers et al. (2004) argue that there are specific gender-related issues in the use of discussions within the OLEs which have implications for the design and moderation of such discussions. The concept of lifelong learning refers to the 'activities people perform throughout their life to improve their knowledge, skills and competence in a particular field, given some personal, societal or employment related motives' (Koper and Tattersall 2004, p. 689). This means that education no longer has to stop once a person becomes a certain age. Lifelong learning means that mature-aged students can be found participating in courses, usually through distance/online education so they can juggle their studies, work and families. Little is known about how traditional university entrants (students directly from high school) and non-traditional entrants (mature-aged students) differ in their use of online learning environments (Hoskins and Hooff, 2005). However, existing research has demonstrated that age is a powerful predictor of achievement, with mature-aged students performing better than younger students. Hoskins and Hooff further reported that the number of home page visits increased with students' age; the amount of time students' spent online increased with age; the number of discussion messages read and posted also increased with age. A study carried out by Alstete and Beutell (2004) also found student age to be a significant variable, with older students more likely to use discussion boards and tending to achieve better grades in online courses. This suggests that younger students may not be ready for the self-directed and self-disciplined nature of online courses and may need more support from instructors when it comes to the online format.

1.4.2 Student nationality and culture

Bentley et al. (2005) state that 'culture is so much an integral part of our life that it is often difficult to realise that there are different, but equally valid, ways of thinking, perceiving, and behaving.'The concept of culture largely stems from anthropology, where there is little consensus on a definition (Choi 1995). The first known description of culture dates back to the 18th century when Sir Edward Tylor defined culture as 'that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society' (Tylor 1871, p. 1). Kroeber and Kluckhohn (1952) suggest that culture can be seen as a product of behaviour. They identify culture as patterns of ideas and values that shape one's behaviour. In more recent times, culture has been described as 'the collective programming of the mind which distinguishes the members of one human group from another' (Hofstede 1980, p. 25). People belong to many different 'human groups' at the same time. For example, a person may belong to a nation, a generation, a gender and an organization all at the same time. Hofstede (1991 p. 5) further suggests that culture is not inherited but learned, as it is derived from 'one's social environment'.

The term 'culture' has many definitions and Williams (1983 p. 87) goes so far as to suggest that culture 'is one of the two or three most complicated words in the English language'. The Oxford Online Reference Premium (2007) produces some 504 definitions of the term culture and these definitions include 'production of organisms', 'intellectual development and tastes', 'form or type of civilization' and 'the way of life of a people'. Culture also comes in many different forms such as functional culture, organizational culture and

national culture (Dubé and Paré, 2001). Choi (1995) suggests that since there are various definitions of culture and there is no clear consensus on its meaning, it is critical to define the use of the term in any given research area. Throughout this study, the term culture is used to represent national culture. In recent years not only has there been an increase in the use of the Internet as an educational platform in Australian tertiary education, but at the same time there has been an increase in cross-cultural classrooms due to the growing enrolment of international students. The advent of wholly online courses has meant that the student base has increasingly changed from a majority of local students to a combination of both local and international students (Lanham and Zhou, 2003). Differences exist between different cultures in the way that students learn as well as their preferences and approaches to learning. Conlan (1996) suggests that the approach to learning that is adopted by students of Asian cultures generally involves memorising study materials and content for the purposes of reproducing them when required. Conversely, many Australian students and those of Western culture, have 'been encouraged to learn through the questioning of facts and understanding of concepts' (Conlan 1996). Although each person has a cultural background informed by their educational experiences, it must be acknowledged that people within a culture are different – they may be shaped by the culture, but they are still unique individuals. Chin et al. (2000) report that in their study students from a Western culture seem more confident in using web-based materials, while Asian students recorded fewer accesses to the web-based materials. This study also found that Western students showed fewer difficulties in navigating through the on-line materials than Asian students. These findings corroborate Hofstede's views (as cited in Chin et al., 2000) that Western students are more accustomed to student-centred situations whereas Asian students prefer a teacher-centred approach.

2. Context of the study

This research investigated student tracking data and student demographic data that was collected through the normal operations of the university. A wholly online subject with approximately 500 enrolled students was selected for this study. The subject was a compulsory unit in the final year for students undertaking the Bachelor of Information Technology and was run in the second semester (mid-July to early November in Australia). This subject was specifically selected as it could be assumed that the students were highly IT literate thus minimising lack of technology skills as a potential variable in the study and, for the majority of students, this was their third year of tertiary study. The data was collected by the unit chair on a weekly basis over 16 weeks and was stored in a series of comma delimited files. The data required preparation and cleansing before data analysis could proceed. For example, before the data was passed onto the researcher, the data was made anonymous by the unit chair to ensure that student confidentiality was maintained. The data relating to students who withdrew early from the course (in the first few weeks of semester) was removed, resulting in 457 valid cases. This was then followed by detailed analysis involving both descriptive and inferential statistical techniques. The student cohort was a diverse mix of males (77.5%) and females (22.5%). This breakdown is consistent with enrolments in IT related courses Australia wide; 75.6% males and 24.4% females (DEST, 2006). Students in the 18-24 year range made up 75.5%. The remainder were older. To avoid potentially identifying any one individual no further breakdown of the age category was undertaken.

Students also came from varying nationalities and cultures. An aim of this study was to see whether a student's culture had any correlation with their participation and/or performance. However, as discussed earlier, culture cannot easily be defined. It was difficult to determine a student's culture based on the data set obtained from the University's student information system (SIS). Student nationality was the closest variable to culture in this context, so this was initially considered a suitable measure. However, the difference in nationalities of students was vast with 42 nationalities represented in the data set. Consequently, the best available measure of nationality was determined to be a student's citizenship. Student citizenship was record in the SIS using four categories: Australian citizens (41.6%); permanent residents (3.1%); temporary residents, which was the second largest cohort (35%); and finally international students, which made up the remaining 20.3% of overall students. Nationality was determined through an inspection of their country of birth. Through a combination of the two categories, nationality and citizenship, a broad measure of culture was determined, facilitating a comparative analysis of the results (see Table 1).

Table 1: Culture of students

Citizenship	Nationality	Frequency	%
Australian Citizen	Predominantly Western	190	41.6%
Permanent Resident	Asian adapting to Western	14	3.1%
Temporary Resident	Predominantly Asian	160	35.0%
International Student	Predominantly Asian	93	20.3%
Total		457	100.0%

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All communication and collaboration related to any learning activities between staff and students in the course were facilitated through the OLE, which had a built-in student tracking tool that recorded all online activity. The student tracking report provided an overview of activities in the course displaying both general session information and more detailed tool usage statistics for each student. Data was collected for each individual student on a weekly basis and although it included an extensive list of data, this study is limited to the total time students spent online, the number of discussion messages read and posted, and the number of content files viewed. (A content file is any internally linked file that can be in any format including .doc, .pdf, .html, .wav. etc and is most often a course-related file provided by academic staff.) The statistics provided by the tracking reports were used to determine the components, tools, and pages that were of most interest to students. Course instructors could also use the statistics to determine each student's level of participation in various activities.

Tracking data does have limitations. The data that is recorded may not always be an accurate representation of what really occurred. For example, if a student omits to log out of the OLE, the automatic logout is activated after 60 minutes. As suggested earlier, the system cannot record what it does not see. For example, a student could have been active for only two minutes in the OLE during a session in which they were logged in for sixty minutes, doing unrelated "stuff" in the outstanding fifty-eight minutes. The student tracking report records all messages that students have seen in the discussions section of the OLE. The OLE has a 'Mark as Read' option so if the student selects all messages and then 'Marks as Read' it would be recorded as "read all messages" in that discussion. Equally, there is no guarantee that the student has actually read the message – only that the message has been displayed on a student's computer screen.

3. Results

The main aim of this study was to determine, in the first instance, whether or not there is a relationship between student participation in an OLE and their academic results. For the wholly online subject that was used for this study, grades were awarded to students based on the schema shown in Table 2. The results from this study are presented in the following three sections, the first being a comparison of participation and academic achievement, followed by an exploration of the impact of demographics on participation and finally, demographics on academic achievement.

Table 2: Allocation of grades

Result	Grade
80% or above	*HD (High Distinction)*
70% to 79%	*D (Distinction)*
60% to 69%	*C (Credit)*
50% to59%	*P (Pass)*
below 50%	*N (Fail)*

3.1 Participation and academic achievement

3.1.1 Does a relationship exist between participation and academic achievement in an OLE?

It was anticipated that those students with greater participation in the OLE would (on average) achieve better grades than those who participated to a lesser extent. To test this assertion, we measured four aspects of participation: time spent in the OLE, number of messages read and posted, and number of content files viewed. The sample results were quite consistent across all of the measures. In each case, those students who achieved higher grades (HD, D or C) participated substantially more in the OLE than those who achieved a minimal pass (P) or failed (N).

A summary of the results are given in Table 3 below. Note that the median has been used throughout as the data were positively skewed. In testing for differences between high and low achieving students the Wilcoxon Rank Sum test was used. Across all four measures of participation, the high achieving cohort participated statistically significantly more, on average, than the lower achieving students (Table 3). These results suggest that, on average, the highly participatory students do achieve higher academic results. It appears that a positive relationship exists between student academic performance in an OLE and their academic achievement.

Wang and Newlin's research suggested that students who have a high participation level in the first week of an online course will achieve a higher result (Wang and Newlin 2002). To determine if this finding was

consistent in this study we divided the cohort of students into two groups based around the median number of messages posted in the first week. Any student who posted less than the median number of messages was considered to have a *low* participation level while those that posted the median or more messages were considered to have a *high* participation level (see Table 4).

Table 3: Average student participation according to academic performance

	High achievers			Low achievers		Wilcoxon Rank Sum
Result	HD	D	C	P	N	z-stat/p-value
Number of students	*61*	*119*	*129*	*88*	*60*	
Median time (in hours) spent in the OLE	25.4	23.7	24.3	18.6	12.8	z=-6.7, p<0.001
Median number of messages read	536	501	503	335	270	z=-6.7, p<0.001
Median number of messages posted	28	24	21	17	7	z=-8.3, p<0.001
Median number of content files viewed	178	189	167	147	114	z=-5.9, p<0.001

Table 4: Participation in the first week

Participation	n	Median Mark
Low	228	62%
High	229	68%

The finding was indeed confirmed in this study. The average mark for the 229 high participating students was 68% compared to 62% for the 228 students who were low participators in the first week. The difference between the two is statistically significant (Wilcoxon z=-4.99, p-value<0.0001). Although the difference identified is small, it is significant so we may conclude that students who participated more in the first week of semester did achieve a higher academic result.

3.2 Participation and demographics

3.2.1 Does a relationship exist between student gender and participation in an OLE?

Some studies in the literature have shown that females are likely to participate more in an OLE than males. Gunn et al (2003) analysed student participation in online activities and found that lower course web page views and lower discussion board participation were characteristics of male behaviour in an OLE. In addition, Arbaugh's (2000) study investigated the effects gender had on participation and found that women had consistently higher participation patterns than men. The analysis carried out in this research supports these findings. On average, female students in the sample spent 24.47 hours in the OLE, with males spending an average of 20.61 hours (see Table 5). Similarly, females in the sample also read and posted more messages and viewed more content files than did their male counterparts. The differences between males and females found in the sample are statistically significant across all measures of participation except for the number of content files viewed (Table 5). Previous research has suggested possible reasons for these results including that women are more network-oriented and collaborative and therefore participation through discussion boards is more favourable to them, whereas men tend to communicate on the basis of social hierarchy and competition, but these social cues are absent in an OLE (Arbaugh, 2000). Content files, on the other hand, are not necessarily directly related to communication or collaboration and, because of their static nature, we would not expect any significant difference between the genders.

Table 5: Average student participation according to gender

Results	Female	Male	Wilcoxon z-stat/p-value
Number of students	*103*	*354*	
Median time (in hours) spent in the OLE	24.5	20.6	z=2.7, p=0.006
Median number of messages read	509	416	z=2.9, p=0.004
Median number of messages posted	25	20	z=3.1, p=0.002
Median number of content files viewed	166	158	z=0.3, p=0.377

3.2.2 Does a relationship exist between student age and participation in an OLE?

Hoskins and Hooff (2005) report that there is little knowledge of how traditional university entrants and mature-aged students differ in their use of OLEs. However their study found that age can predict a student's participation with total time spent in OLE and number of discussion messages read and posted increasing as age did (Hoskins and Hooff 2005). This implies that mature-age students will participate more than the younger students in a wholly online course. The findings of this research neither support nor contradict this earlier work by Hoskins and Hooff (2005). The participation level of the 112 mature aged students in the sample was approximately the same (or slightly higher) compared to younger students. Mature-age students spent an average approximately three hours in the OLE for the semester more than younger students. Mature-aged students read and posted slightly more messages on average, but there was no difference in files viewed (see Table 6). None of the variations between the age groups were substantial and applying Wilcoxon rank sum tests for differences between the medians confirmed the results were not statistically significant.

Table 6: Student participation according to age

Age	18-24	25+	Wilcoxon z-stat/p-value
Number of students	*345*	*112*	
Median time (in hours) spent in the OLE	20.9	23.7	z=1.3, p=0.09
Median number of messages read	423	476	z=1.5, p=0.063
Median number of messages posted	21	22	z=0.8, p=0.214
Median number of content files viewed	160	160	

3.2.3 Does a relationship exist between student nationality and participation in an OLE?

The literature cited earlier indicates that there are different approaches to learning by students from different cultures and this may effect their participation in an OLE. Students of Western cultures are encouraged to question the facts and understand concepts (Conlan, 1996), encouraged to take an active role within their education and are thought to be more accepting of online learning than students of Asian cultures (Lanham and Zhou, 2003). Although students of Western cultures may be more accepting of online learning, it does not necessarily mean that they will participate more than Asian students. As Table 7 shows, of those students in the sample, Australian students participated the least in almost all aspects of the OLE. The permanent residents, those who are Asian adapting to Western culture, participated the most.

Multiple significance tests were performed to determine if the differences between the student cohorts were statistically significant. For simplicity we will not detail all of the tests here (there were 24 of them in total). However, the main theme coming through from all of the tests was the students who were Australian citizens participated significantly less than the other cohorts. In terms of time spent in the OLE and messages read and posted the Australian Citizens median participation was significantly less than all the other cohorts. In terms of content files viewed the differences were not significant. These results are contrary to other studies in the literature. One possible contributory factor may be related to language difficulties experienced by Asian students who may have had to re-read messages and ask more questions. A study by Smith *et al.*, (2005) identified that Asian students tend to seek clarity of the tasks set for them, therefore the high participation levels of the Asian students may relate to clarification of the tasks at hand. Further study is required to shed light on this point.

Table 7: Average student participation according to nationality/culture

	Australian Citizens	Permanent Residents	Temporary Residents	International Students
Number of students	190	14	160	93
Median time (in hours) spent in the OLE	18.18	36.78	22.97	25.33
Median number of messages read	369	774	477	472
Median number of messages posted	19	29	21	25
Median number of content files viewed	156	245	178	123

3.3 Academic achievement and demographics

3.3.1 Does a relationship exist between student gender and academic achievement in an OLE?

The literature suggests that in general women tend to perform academically better than men (Alstete and Beutell 2004). It is suggest that this may be the result of female students' greater tendency to put extra effort and time into their studies. The current study found that a relationship did exist between gender and academic achievement with women outperforming men. Female students in the study achieved an average (median) mark of 72%, while male students achieved an average of 63%. This difference is statistically significant ($z = 4.31$, p-value < 0.001) and confirms that female students did indeed perform better than their male counterparts in this online course. This would imply that female IT students undertaking online courses perform better than male students in similar courses. Gunn *et al.* (2003, p. 24) suggests that the reasons for better performance of women in OLEs include 'stronger motivation to succeed, greater ability to work independently and to self manage multi-tasking lives, while male students appear to need more motivation and discipline'.

3.3.2 Does a relationship exist between student age and academic achievement in an OLE?

Although the literature surrounding the effect that age may have on a student's academic achievement in an OLE is scant, previous studies have found that mature-aged students do perform better than younger students (Hoskins and Hooff 2005). However, the results from the current research do not support this finding, since there was no discernable difference between the age groups: the average (median) mark for mature-aged was 65% which was virtually identical to the 64% average achieved by the younger students. Note that in the study more (in percentage terms) mature-aged students achieved a High Distinction. However, this was balanced by the fact that mature students also had a higher percentage of failures compared to their younger counterparts.

3.3.3 Does a relationship exist between student nationality and academic achievement in an OLE?

There have been several studies that have identified Australian students and those of Western cultures as being more accepting and confident working in an online learning and students from Asian cultures generally preferring the traditional instructor-centred approach. Other studies have found that students of Western cultures are more confident than Asian students in using web-based learning environments.

Table 8: Average (median) academic results according to student nationality/culture

	Australian Citizens	Permanent Residents	International Students	Temporary Residents
Student Culture	*Predominantly Western*		*Predominantly Asian*	
Overall Course Result	72	72	64	61

The results from this study appear to support these views. Australian citizens and permanent residents, got substantially better grades than did the international students and temporary residents. As shown in Table 8 on average Western students are achieving a Distinction (D), while Asian students obtained a Credit (C) average.

We compared the predominately Western cohorts to the predominately Asian cohorts and the differences in marks were statistically significant ($z = 6.5$, p-value < 0.001). Thus it is possible to conclude that on average, students of Asian cultures do perform poorer than those students of Western cultures in online courses. A potential reason for this may have been that Asian students in this study were inhibited by language barriers due to the nature of the subject which was predominately discussion-based – relatively unusual for an technical IT programme of study.

4. Conclusion

The findings reported here, with the limited exploration of culture possible, indicate that there is no evidence that students of differing backgrounds are disadvantaged by the delivery of education through online learning; with the changing needs of today's society it is important that such courses are not only designed from an Australian-centric point of view. As stated by Lanham and Zhou (2003, p. 290) 'the dissolving of cultural boundaries in online learning will only occur if we first understand what those boundaries are. Universities have the technology to provide global education; the focus must now be placed upon ensuring that the educational content and resources we provide can be utilised by all students.' The categorisation

into the subgroups we adopted has the potential to hide diversity caused by culture. This limitation was unavoidable as the demographic data available to us only allowed such gross generalisations. A more detailed study, including collection of more specific cultural dimensions, is required before generalisations can be made which apply to the wider student body. This research has presented a detailed analysis of how students in one large online class participated and performed in the OLE, looking specifically at students' gender, age, nationality and culture (as defined earlier). The findings from this research study are supported by those indicated in the literature with regard to gender and culture and participation and performance in an OLE. However the findings regarding age did not show a significant effect as suggested by the literature. These findings have the potential to inform educators by helping them to understand which students participate more and perform better than others in OLEs. This may lead to the introduction of changes to online course structure and delivery to ensure that they are suitable for diverse student populations. Educators must be aware of the diversity in classes and take into consideration the needs of all students. Designing and delivering OLEs that are understood and welcomed by all students should be of highest priority.

The key research findings from this study have been summarised in Table 9.

Table 9: Key research findings

Participation and Performance	There was a strong positive relationship between student participation in an OLE and student academic performance. Students who achieved higher grades (C, D or HD) in general participated in an OLE more than those students who only received a P or even fail.
Gender	Female students participated more than male students in an OLE by reading and posting more discussion messages. Female students performed better than male students
Age	There was no significant relationship between student age and their participation and academic performance.
Nationality/ Culture	In this study Asian students had a high level of participation but generally did not perform as well as students of Western cultures.

The literature has identified that the shift in learning accountability from the instructor to the student in online learning is one of the major difficulties that exist in the transition to wholly online courses. Lanham and Zhou (2003) suggest that because Asian students rely strongly on their instructors, this cohort of students may experience problems when placed in an environment where the instructions require students to apply their own ideas. It has also been noted that the reasons for better performance of females and mature-aged students in an OLE are believed to include a stronger motivation to succeed, a greater ability to work independently and to be able to multi-task. Educators need to consider the demographics of their students undertaking online learning to ensure that they are providing suitable environments for them all. It is necessary to gain an understanding of how different students participate and perform in OLEs. This could enable institutions to better target their audiences for these types of courses to ensure that students are going to participate and perform to the best of their ability. With the increasing demands placed on institutions by Australian Government to monitor the progress of international students in particular, using tracking data to monitor the level of participation in the early part of semester can provide an easily accessible early indicator of students who potentially could be experiencing difficulties with their studies. Implementing proactive measures to identify students at risk is surely a better solution than relying on reactive measures after they have failed an assessment for example.

5. Further work

This research has identified a link between early participation in the OLE and course outcomes, for courses where students are expected to be active in the OLE on a regular basis. Whether causation exists or other factors are contributing is not clear. However, as an early indicator of potential students at risk, this relationship cannot be ignored. Further research which investigates a wider range of possible factors linked to causation needs to be undertaken. A more detailed study which is able to take account of finer-grained cultural factors would likely give us a better insight into any special needs of international students, in particular when introduced to online learning. It would also be interesting to replicate this study as both staff and students become more experienced with online learning and to identify whether students' learning habits online are changing (or possibly improving).

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