

Lessons learned: Understanding online engagement satisfaction in a large postgraduate Information Assurance Principles (IAP) course

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STRUCTURED ABSTRACT

CONTEXT

The Cyber Security discipline both attracts and requires students from diverse technical backgrounds, ranging from engineering and IT to social sciences, business and law. In order to accommodate and leverage such diversity, tertiary institutions require a program curriculum that allows students to share and acquire skills through interactions with course instructors and fellow students. However, students often find the group work frustrating due to the negative impact of any lack of participation by fellow students. Course instructors can also find the lack of student engagement and the administrative burden of facilitating online interactions, challenging. In this context, deeper understanding of student online engagement can lead to a better aligned curriculum, resulting in a more holistic understanding of the course materials and the way students learn.

PURPOSE

We wished to examine how an assignment structure and the degree of online engagement can be used to improve online engagement satisfaction and help students achieve a holistic understanding of the course.

APPROACH

For this pilot study, we used the course cornerstone assignment – a Case Study. The assignment scaffolds two online forums and a presentation. We used statistical *T-test* to monitor student performance across both forums and the presentation and examined whether there was any difference in the grades. We also used mid-semester course evaluation and the final *MyExperience* surveys to collect students' views on this scaffolded approach.

RESULTS

We found that students gradually improved their skills and understanding of the course material and in general evolved a more holistic command of the course content, since their later presentation results were better than early forum results. While some students felt adversely challenged by the new pedagogy, student dissatisfaction was largely related to the lack of fellow students' timely participation in online forums, as well as students dropping out of course prior to the census date and affecting group dynamics.

CONCLUSIONS

The concept of online engagement is not new but as yet there is no specific transformative recipe that can be applied to online course assignments to encourage student engagement. However, this work shows one way of gaining deeper understanding of the causes of student dissatisfaction and hence more effective ways of addressing them over time. This research also reiterates that creating effective online group assignments needs time and assumes skills and qualities that many educators will need to develop and practice.

KEYWORDS

Online learning; scaffolding assignments, student engagement

Introduction

This paper reports on a new curriculum design for the course Information Assurance Principles (IAP) within the Master in Cyber Security suite of programs at the University of South Wales Canberra. It describes a pilot with a specific focus on the scaffolding of the cornerstone assignment – a Case Study. The subject is taught online and as early as 2006, some university studies found '*students preferred online courses to the traditional classroom, saying that they learned more in these classes, spent more time on these classes, and found these classes to be more difficult yet of higher quality than traditional classes*' (Keengwe & Kidd, 2010). While this subject had leveraged such online preferences already, it had not yet mastered how to structure student interaction and engagement to facilitate deep learning in multi-disciplinary contexts.

Cyber security is cross-disciplinary in nature and attracts students with backgrounds ranging from highly technical disciplines such as engineering, IT and computer science to non-technical such as social science, business and law. To prepare these students for the reality that cyber security is *everybody's business*, tertiary institutions need to design curricula around course learning outcomes, achieved through student engagement and sharing skills and expertise. Students can complement each other's diverse skills through participation in online group assignments. However, group assignments do not always achieve desired outcomes, posing challenges for both instructors and students. Students experience frustration when working with fellow students who only participate sporadically or withdraw from the course late. Course instructors also face challenges in encouraging student participation and re-arranging groups. If we can better understand student engagement in online discussion forums, educators can construct curricula – in particular, online group assignments – which could lead to greater student satisfaction and improved final results. We report on our research and findings in the sections below.

The Context

The need to develop a scaffolded assignment in this cross-disciplinary online course was based on an IAP 2016 mid-semester informal course evaluation and the standard university *MyExperience* student survey. Approximately 75% of all surveyed students stated that online interaction supported their study and helped them engage better throughout the course. Also, 90% of students stated that digitised resources including online forums helped them and 80% of students found that the feedback received from the course instructors had a positive impact on their learning.

This paper discusses our response in 2017, when we introduced a pilot that included a new assignment structure. We aimed to maximise student' online engagement with a 'new way' of learning through scaffolding and constructive alignment (Vygotsky 1978, 2002; Biggs, 2008, Biggs & Tang, 2011). Student engagement has been linked by scholars to student satisfaction and learning (Kuh *et al.* 2006; Joiner, Malone & Haines, 2002). In new distance learning environmental research, the standardised scale reflecting engagement is called Student Interaction and Collaboration (Walker & Fraser, 2005). According to Walker and Fraser (2005, p.291):

Computer-mediated distance education classes have a distinctive social structure, unlike those found in a face-to-face class. This social structure has a strong influence on students' learning and students' satisfaction with the class and on the method in which the class is presented in the digital world (Swan, 2001). There is a firm need for a social connection and a sense of presence in electronically-mediated distance education

Hence, structured student engagement and collaboration offer the most significant means to positively affect student distance learning. This project also draws upon two interrelated definitions of student engagement, by connecting engagement with grading. Firstly, Kuh *et al.* (2006) state that student engagement is a form of participation that '*leads to a range of measurable outcomes*' (p.44). Secondly, Krause and Coates (2008) have defined student engagement as '*the extent to which students are engaging in activities that higher education research has shown to be linked with high-quality learning outcomes*' (p.493). One area of measurement is the extent to which students have an improved understanding of key concepts of the unit at the close of the semester (Parker, 2015, p.27).

The rapid advancement of Internet technology has changed traditional forms of teaching and new forms of online and blending based teaching have appeared (Wolbrink *et al.*, 2014). These have been complemented by wikis, forums, online collaboration and other supporting logistics whose positive roles are reported in the literature (Pito-Llorente *et al.*, 2018; Biasutti and el-Deghaidy, 2015). Many scholars have agreed that online discussion can help students in planning their course, deepen learning and sharpen critical assessment (Gasparic and Pecar, 2016). These new platforms also allow the students to collaborate during the course, a proven, effective way of increasing student engagement (Soundarajan, 2013).

According to Vygotsky, students' "readiness" for sophisticated learning is developed through their activities in scaffolded curriculum and assessment design. Online engagement and scaffolding assignments (Sims *et al*, 2002) had already been established and documented with students in the Master course, Engineering Research Practice (ERP), at the University of South Australia (Ferris *et al*, 2008, 2010). There, a series of formative assessment tasks were set in relation to writing a research proposal. Each task was 'nested' and built upon the other, so that students learned from feedback provided and through in-class workshops, from and with peers and from consultations with the staff. Another example of implementing a scaffolded curriculum and assessment, combined with discipline-specific writing support, resulted in students' higher quality work (Sitnikova & Duff, 2009).

While online courses have transformed distance education, received very positive reviews (Keengwe & Kidd, 2010), and are regarded by lecturers and administrators as being integral to any long-term growth plan for institutions, much scepticism remains about their quality (Parker, 2015). Some of the negativity is caused by the interchange of the terms 'online', 'web-based', and 'e-Learning' when describing learning environments, as well as a lack of clarity in perceptions and comparisons around the extent to which such learning is instructor-led, self-paced or self-directed (Moore, Dickson-Deane, & Galyen, 2011).

The context of the IAP online post-graduate course was to provide sufficient instructor leadership to facilitate student-to-student interaction and the learning objectives covered in the semester but still allow self-directed research and self-paced collaboration (i.e. within groups). The latter is key to improving student satisfaction, since according to Keengwe and Kidd (2010, p.534) *'online learning goes beyond planned subject learning to recognize the value of the unplanned and the self directedness of the learner to maximize incidental learning and improve performance.'*

Negative perceptions of online learning can be offset by research that critiques and reflects on our evolving online teaching and learning practices.

Purpose

Information Assurance Principles (IAP) is one of the online courses offered across several UNSW Canberra Master of cyber security programs — Cyber Security Operations, Systems Engineering, Space Engineering, Space Engineering Operations at the School of Engineering and IT (SEIT) and also Cyber Security Strategy and Diplomacy at the school of Humanities and Social Sciences (HASS). IAP is the fundamental course that provides basic understanding of cybersecurity threats and their mitigation, addressing information assurance principles and methods. It is large with a very diverse student cohort. The number of students has more than doubled since 2016 (42 students) to 2017 (99 students). Approximately 46% of the students are from Defence, more than 30% of students from the Cyber Security Strategy and Diplomacy program from humanities and social sciences, with no technical background; 50% students with some technical background and less than 20% with a strong technical background from engineering disciplines. This iteration of the course also had 17% females. Here, we discuss the IAP curriculum with a specific focus on the scaffolding of the cornerstone assignment. We examine its structure, analyse student grades and establish how online engagement might be different. Following from this we examine how we might enhance online engagement satisfaction, thus achieving better student satisfaction and results.

Assignment design

We used a cornerstone course assignment – a Case Study - as a pilot. The assignment scaffolds three components: two online forums (Forum 1 and 2) and a Case Study Presentation (see Fig.1).

Forum 1 (5%) is an Online Activity in which students read the Verizon's 2017 Data Breach Investigations Report and get a broader view on cyber security threats in various industry sectors; who is generally regarded as responsible for attacks and what generally motivates the cybercriminals. Students participate in an online forum by addressing the question: *"Understanding the threats that organisations face is the key to effective cyber security"*. This forum is semi-structured, with students posting one "initial" post and having no limit on their "reply" posts.

In **Forum 2** (10%) students are randomly divided into a group of three. Each student selects a preferred industry sector from three allocated to their group and finds a specific case study of a cyberattack. In both Forum 1 & 2, students initiate discussions, participate in online forums, critique each-other's online post and peer-evaluate fellow students' responses to their initial posts. A week is allocated for the "initial" post and a week for two "reply" posts.

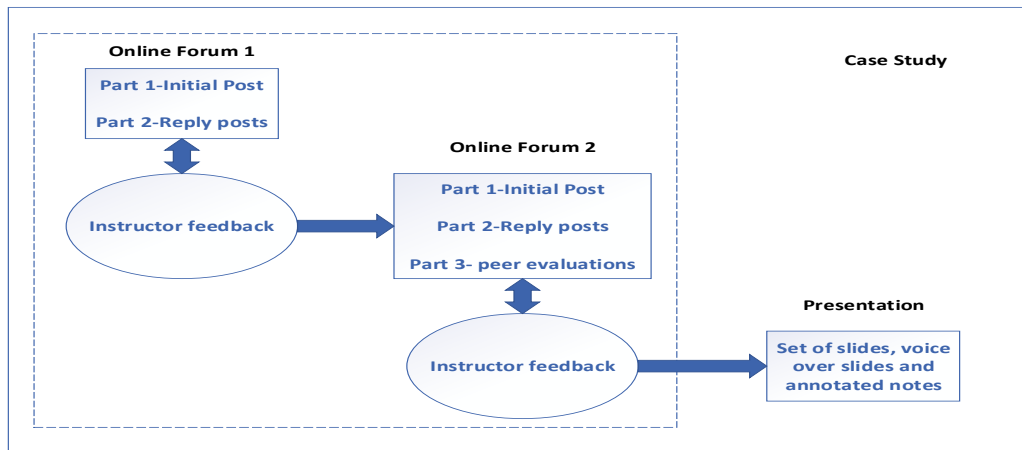


Figure 1: A cornerstone course assignment – a Case Study

The Case Study Presentation (25%) builds on the previous online assignments by requiring deeper research into a specific case study and further analyses using cybersecurity literature. Required online reading materials, book chapters and research papers are provided in a Reading Material section in Moodle. These materials and students' own internet research provide essential background. They then prepare a short PowerPoint (PPT) presentation with a voice-over narration for each slide. There are two more assessment components in the course curriculum: the Final Quiz and the major assignment – a Reflective Portfolio, which are not the focus of this paper.

Teaching strategies and research methodology

This research is aligned with UNSW's 2025 strategy of developing a distinctive model of education for students with different academic backgrounds, ranging from very technical to non-technical disciplines and with the Scientia Education Investment Fund priorities. It also addresses four of UNSW's teaching and learning pillars: (1) diversity of the community, (2) students' feedback, (3) innovative teaching and (4) use of digital resources. It is built on listening to students' voices and implementing their feedback (survey results from IAP 2016). This research has implemented innovative ideas to encourage student online engagement by developing a scaffolded assignment using digital resources provided through the online Moodle discussion forums.

We test a hypothesis:

If a Case Study assignment designed to encourage student engagement within online group discussions is undertaken throughout the course, then students will gradually obtain better marks as the assignment progresses, leading to overall course satisfaction and improved final grades.

We used a mixed methods approach – a combination of qualitative and quantitative methods to examine factors that might influence online engagement satisfaction of an IAP cornerstone assignment.

Quantitative: Using statistical *T-test* we conducted experiments for the 2016 and 2017 student cohorts, comparing the performance of students for Forum 1 and 2; Forum 2 and a Case Study Presentation; and the combined results for Forum 1 and 2 with the final grades. We also examined the average performance of students over the first and second forum using their final grades. We examined whether there is a difference in the grades of students in Forum 1 and Forum 2:

$$\text{Statistical hypothesis} = \begin{cases} H_0: \mu_{\text{Forum1}} = \mu_{\text{Forum2}} \\ H_1: \mu_{\text{Forum1}} \neq \mu_{\text{Forum2}} \end{cases} \quad (1)$$

Formula 1 shows two counter hypotheses. Null hypothesis assumes that the average of grades over two assessments is equal while the second hypothesis does not support this statement. A similar approach is used for analyses of other grade correlations.

Qualitative: Two different types of surveys were used to collect students' opinions about their online experience. The first mid-semester evaluation allowed us to receive early student feedback. The second one was a standard UNSW end-of-semester *MyExperience* survey where students were invited to provide overall course feedback. Both surveys were anonymous. Students rated their experience in online assignments, as well as their group engagement and the impact on their studies and further assignments. In both surveys open questions were provided to enable students to suggest course improvements. The response rate in the mid-semester survey was higher than for the *MyExperience* survey. Anonymous surveys were coded using summative content analysis. Student results and feedback from both surveys were coded and quantified into categories relating specifically to student

engagement, quality of discussion forum, dependence upon other students, structure of discussion forums, and instructor/marker interaction.

Results

As the course instructor altered the 2016 structure in 2017, statistical tests have allowed us to assess how effective these changes have been. Initial findings demonstrate that after revising the assessment structure in 2017, students gradually improved their skills and understanding of the course material. We have tested this statement by *T-test* as reported in Table 1. For example, test value of 0.694 in the first row of Table 1 shows that the averages of grades between Forum 1 and Forum 2 are not statistically equal as this value is not in the correspondence interval: (-0.06,0.14). The same reasoning was applied to analyzing other grade correlations. In fact, in 2017, when assessment was linked to online discussion groups (i.e. scaffolded), we observed that particular aspects of the online engagement became predictive of overall student grade and performance.

Table 1: T-test results

Year	Forum 1,2		Forum 2 and Presentation		Forum 1,2 and Final grades	
	t-value	interval	t-value	interval	t-value	interval
2016	0.694	(-0.06; 0.14)	0.708	(-0.05; 0.11)	-1.25	(-0.15; 0.03)
2017	-3.073	(-0.12, -0.02)	-0.29	(-0.052; 0.03)	-7.38	(-0.16; -0.09)

Table 1 and Figure 2 show that both cohorts achieved higher final grades when compared to previous assignments. Results from 2017 also show that the student performance improves gradually after the new framework for course assessment is implemented, compared to 2016, where student performance decreased between Forum 1 and the Case Study Presentation. However, we see poor performance in Forum 1, 2017 because five students did not participate. This may have due to the fact the deadline for completion was at the end of the first week and the assignment began in preliminary week "0" when many students were still away. This problem has been addressed for the 2018 IAP by re-scheduling group assignments after the Census day.

Table 2. Student results

Year	Forum 1	Forum 2	Presentation	Final grades
2016	0.74	0.71	0.67	0.78
2017	0.66	0.73	0.74	0.81

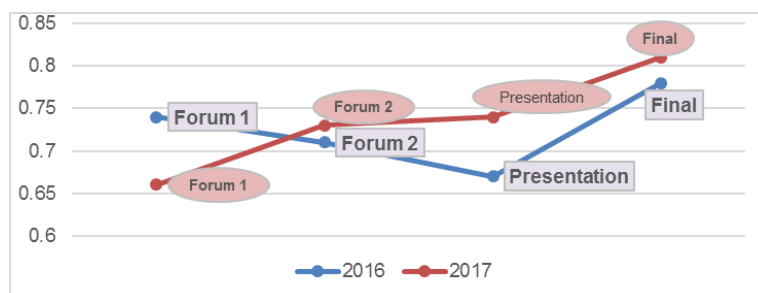


Figure 2: Student results in both 2016 and 2017

The marked positive effect that online group engagement had in 2017 in comparison with 2016 is encouraging. Initial findings demonstrate that after we revised the assessment structure in 2017, students gradually improved their skills and understanding of the course material. The improvement is likely due to students becoming more experienced through participating in online forums; with their skills gradually improving and their understanding of the course material becoming more holistic. Thus, the more experience gained, the greater the impact on their final grade.

The University of NSW administers a standard set of student experience questions known as *MyExperience*. Student satisfaction from 2016 to 2017 declined by 7.2% and this is difficult to statistically analyse due to the large-scale standardised and anonymous way that it is administered by the University. We know that introducing an innovative approach can challenge students, especially in distance and online modes, where students may have to make sense of the task, compared with a face-to-face explanation where they may perceive innovation as evidence of the instructor's commitment to improving teaching. Encouragingly, the recent 2018 *MyExperience* survey showed that the overall course satisfaction score increased by 13.8% compared to 2017 results and 6.6% compared to the first course offering in 2015. This increase in the second year reinforced instructors' beliefs that with practice and persistence the pedagogy would realise more satisfied students. Further analysis showed that the decrease in 2017 student satisfaction in conjunction with an increase in grades, contradicts the perceived wisdom that increased student satisfaction correlates with increased grades. The coded qualitative material reveals that student dissatisfaction was largely due to lack of fellow student timely

participation in online forums, as well as students dropping out of course prior to census date and affecting group dynamics. For example, 50% of coded comments relating to online learning from the mid-semester survey reflected frustration about assessment (online discussion forums) being dependent upon fellow students. Instructors provided better cues and administration to alleviate these problems for 2018. Evaluations are central to greater understanding, which leads to more effective changes.

Lessons Learned

In 2017, we introduced a pilot that included a new assignment structure. Students were required to demonstrate engagement by sharing their skills and expertise with their instructor and fellow students by participating in three scaffolded assignment components: two online forums and the summary presentation. Forum 1 (preliminaries) and Forum 2 (comprised with 3 parts: Part 1 “initial” post, Part 2 “reply posts” and Part 3 “peer evaluation”) (refer to Fig1.) The most noticeable difference between 2016 and 2017 was in the data that students provided in response to the question: *Instructors’ feedback helps to improve future assignments*. In 2016 students were marked only by instructors, however in 2017 they received feedback from peers and instructors/markers. In particular, Part 3 of the assignment required students to evaluate each other’s work. Students disliked peer assessment; just 29% of the students agreeing with peer evaluation while 86% prefer tutor evaluation and the rest believe in self-evaluation. Moreover, 59% of surveyed students see peer-evaluation as an inaccurate measurement of their online engagement and only 16% believe in its accuracy, while the rest are neutral. Furthermore, overall belief in the importance of feedback on student progress through this course considerably decreased compared to 2016, showing an overall agreement of only 48% (Fig.3).

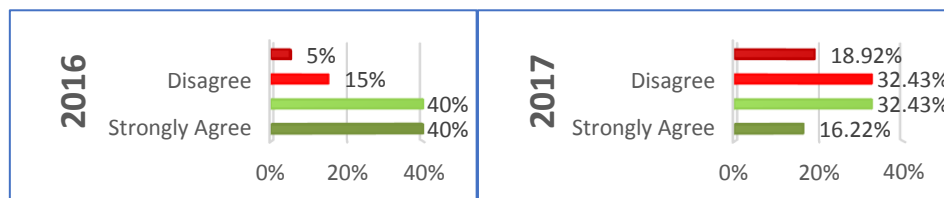


Figure3: Question: “Instructors’ feedback helps to improve future assignments”

The coded qualitative material reveals that student dissatisfaction was largely due to lack of fellow students’ timely participation in online forums, as well as students dropping out of course prior to the census date and affecting the group dynamic. For example, 50% of coded comments relating to online learning from the mid-semester survey reflected frustration about assessment (online discussion forums) being dependent upon peers. Also 92% of all surveyed students preferred a “structured assignment” that included strict deadlines for each parts of Forum 2.

As a result of the project findings and initial data analysis, the 2018 course has already implemented changes in the revised framework. For example, previous students stated:

... we were divided into small groups of 3 [for Case Study], and as it was over census many students dropped out. In my group I was the only student remaining which meant that I had difficulty completing the task and it was detrimental to my case study preparation. [Student, semester 2 2017]

In 2018, the Forum 3 timeslot has been moved and students notified as follows:

You will notice that Forum 3 - A Case Study Discussion is now scheduled in week 6 of the course (after the Census date) [Note from the course convenor on Moodle, semester 2, 2017]

Authors recommend that course convenors follow this approach and only schedule group online assignments after the Census date. In the qualitative analysis, when discounting the dysfunctional effect of non-continuing groups, online engagement with fellow students has a positive impact on students’ final grades and leads to a more holistic understanding of course content.

Conclusion

There is no specific transformative recipe that can be applied to online course assignments to encourage student engagement. However, this work offers one approach to gain deeper understanding of the causes of student dissatisfaction. This is leading to more effective ways of addressing them in each subject iteration. Creating online group assignments also needs time and assumes skills that course instructors and educational designers need to understand, develop and practice. This is a work-in-progress, but we hope that results from our experience encourage and support other educators facing similar challenges.

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