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Does the discussion help? The impact of a formally assessed online discussion on final student results

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Abstract

While there is agreement that participation in online asynchronous discussions can enhance student learning, it has also been identified that there is a need to investigate the impact on student course performance of participation in online discussions. This paper presents a case study based on an undergraduate engineering management unit employing a formally assessed online discussion area. It was observed that while many students read a significant number of discussion postings, generally, the posting of new and reply messages occurred at the minimum level required to qualify for the assignment marks. Based on correlation and multiple regression analysis, it was observed that two variables were significantly related to a student's final unit mark – prior academic ability and the number of new postings made to the online discussion. Each new posting contributed three times as much to the final unit mark as its nominal assessment value, suggesting that the work in preparing their new discussion postings assisted students in the completion of a range of assessable tasks for the unit. The number of postings read was not significantly correlated with the final unit mark, suggesting

that passive lurking in this online discussion did not significantly contribute to student learning outcomes.

Introduction

Dialogue is considered to be an essential element of human learning, particularly for distance education (Gorsky & Caspi, 2005). It includes interactions between students and teachers, exchanges between students, interactions between students and others not directly involved in their learning processes and dialogue with oneself in the form of reflective thought (Webb, Jones, Barker & van Schaik, 2004). With the advent of online technologies in teaching and learning, particularly in distance education, the use of online discussion forums is now a widespread medium for learning dialogue. Online discussion can be synchronous through the use of real-time chat tools, but many examples of online discussions documented in the literature present the use of asynchronous discussion. That is, where students post new and follow-up messages to an electronic bulletin-board at the times that suit them, and not necessarily at the same time that other students are accessing the discussion system. The claimed benefits of online asynchronous discussion forums include:

- the time between postings for reflective thought that might lead to more considered responses than those possible in face-to-face situations (Garrison, Anderson & Archer, 1999);

- for off-campus students, two-way communication can be enhanced, reducing student isolation and making possible dialogue with other students (Kirkwood & Price, 2005);

- the convenience of choice of place and time to learners (Cotton & Yorke, 2006);

- the creation of a sense of community (Davies & Graff, 2005);

- the development of skills for working in virtual teams (Conaway, Easton & Schmidt, 2005);

- increased student completion rates from increased peer interaction and support (Wozniak, 2005); and

- increased student control, ability for students to express their own ideas without interruption, the possibility to learn from the collectively created content, the creation of a permanent record of one's thoughts, the creation of a reusable instructional tool that models expected answers and discussion use, and they create a valuable archive of material for investigation and research (Hara, Bonk & Angeli, 2000).

While there is wide agreement that participation in online asynchronous discussions can enhance student learning, and significant work has been done characterising, and theorising on the nature of student communications in online discussions, it has also been identified that there is a need to investigate the impact on student course performance of participation in online discussions (Hara et al., 2000). In a combined quantitative and qualitative analysis of the online discussion postings of education students studying by distance education in Australia it was found that those students achieving the highest final unit grade also had the highest frequency of posting, and that lower achieving students were less active online; though the authors do not claim these findings as conclusive evidence of the effect of online participation on learning outcomes (as measured by marked assessment activities) (Stacey & Rice, 2002). In a quantitative analysis of two online discussions in the UK involving 543 computing students, it was found that both the number of student accesses of the system and the number of student postings to the system were significant predictors of variance in final mark (in one case) and variance in final grade (in the other case) (Webb et al., 2004). In a quantitative analysis of online discussion usage involving 122 UK business students based on

what percentage of all online system accesses related to usage of the online communication system, it was found that students achieving high or medium passing grades were significantly more active in the discussion area than students achieving a low passing grade, and in turn, students achieving a low passing grade were significantly more active than students who failed (Davies & Graff, 2005).

It is noted that while the literature suggests a correlation between increased interaction and increased learning, there is limited research to understand the impact of different types of postings on learning outcomes (as measured by unit final grade) (Conaway et al., 2005). Simply encouraging students to get more involved in online discussions may not necessarily lead to better learning outcomes – there is a need to understand what are the 'salient factors' in online interaction that might enhance learning (Davies & Graff, 2005). One debated factor is whether student participation in online discussions should be optional or mandatory. It has been noted that some learning theories suggest that user motives largely determine how students engage with learning activities; intrinsically motivated learners will invest high levels of cognitive effort regardless of any associated rewards, whereas extrinsically motivated learners may be enticed to participate by gaining unit marks, but their engagement may be instrumental and shallow (Kuk, 2003). While there is evidence that online discussion interaction carried out on a voluntary basis may lead to better learning outcomes (as measured by unit final grade) (Weisskirch & Milburn, 2003), a pragmatic approach suggests that discussion contribution is likely to be low unless there is some compulsion to participate (Graham & Scarborough, 2001). Students have many competing demands on their time, and if their use of online learning tools is optional, the perceived benefits of participation will need to outweigh the perceived efforts of using the system. In this case, for some students,

there may be benefits in providing extrinsic motivators for students to learn and use the system (Garland & Noyes, 2004).

Another form of optional engagement with online discussion forums is 'lurking', where students enrolled in a discussion do not make postings, rather they simply read the postings of others. These lurkers may not be detected by some online systems, and the question remains, are these lurkers learning or not? (Hara et al., 2000) There is some evidence that both active participation (posting) and passive participation (lurking) may be beneficial to online discussion users (Webb et al., 2004). A final, but important question about student learning and participation in online discussions relates to the presumption that the often observed correlation between student participation (number of postings, assessed quality of posting, etc) and learning outcomes (student final unit mark/grade, etc) is causative, and not simply the result of more able and/or motivated students engaging more deeply with the online discussion than less able students (Cotton & Yorke, 2006). Is it possible that the students with the best results in a unit would have done well in the unit, regardless of whether an online discussion was employed or not?

Context

The School of Engineering and Information Technology at Deakin University in Australia offers a three year Bachelor of Technology (BTech) and a four year Bachelor of Engineering (BE) at undergraduate level. These programs are delivered in both on-campus and off-campus modes. These programs include the second-year engineering management / professional practice study unit SEB221 Managing Industrial Organisations. This unit consists of four modules:

1. Systems Concepts for Engineers and Technologists;

2. Managing People in Organisations;

3. Manufacturing and the Environment; and

4. Occupational Health and Safety.

Prior to 2005, this unit was delivered in both on-campus (weekly classroom lectures) and off-campus (printed study guides) modes, with on-campus students generally purchasing the printed study guides as well, and all students having access to an online area providing basic resources, including an optional asynchronous discussion forum and the capacity for academic staff to post 'announcements' to all class members. The unit assessment regime consisted of two assignments each worth 25 % of the unit marks and an end-of-semester examination worth 50 % of the unit marks. In 2005, this unit was converted to 'wholly online' delivery mode, where all teaching of the unit occurred online (Holt & Challis, 2007). The printed study guides were replaced by a CD-ROM version of the study materials, enhanced with interactive/animated diagrams and video material. Up to this time, the first author had academic responsibility for the Managing People in Organisations module, and was not responsible for unit overall. The assessment regime was not changed for wholly online delivery.

At the end of 2005, due to staffing changes, the first author assumed full responsibility for the entirety of SEB221, and a review of the wholly online delivery strategy for the unit was undertaken. Deakin University's policy and procedure for 'Online Technologies in Courses and Units' requires that wholly online units be, "… designed to help students to develop their skills in communicating and collaborating in an online environment…" (Holt & Challis, 2007). While the inclusion of an optional general online discussion area may have met the

'letter of the law' for the wholly online unit policy, it was considered inadequate as a means for genuinely developing student online communication and collaboration skills. For 2006, ten % of the unit marks were taken from the final examination and dedicated to formally assessed assignment activity based around the online discussion area. The other unit assessment items were retained. A summary of the assignment instructions given to students is provided below. 'DSO' refers to Deakin Studies Online, the local name of the Blackboard course management system (CMS) used at Deakin University.

This assignment requires you to both reflect on your studies and to constructively engage with the wholly online environment used in this unit. You are required to post reflections on the course material and to comment on the postings made by other students during the semester. You have two types of task in this assignment.

Task 1 – Reflect on the course material you have studied in the current week. Identify what you think is the most important topic, access the DSO system for this unit, open the Assignment 1 forum area for the appropriate week, select 'Compose Message' and post a few paragraphs on your selected topic that explain why you think it is important.

Task 2 – Review some of the Assignment 1 posts made by other students and select one to comment on. With that message open select 'Reply' and post a follow-up to the original message. You may add your own additional thoughts/reasons for why that topic is important, you may wish to contribute an example related to that topic from your own experience, or something else.

You need to make at least five postings for each type of task given above, ie, at least ten postings in total, five of type one and five of type two. You should make only one of each type of posting in a given week. Only the best posting for either task type in a given week will be marked. If your postings demonstrate **constructive and thoughtful reflection**, you will be awarded up to 1 mark per posting, up to a maximum of 10 marks in total for the assignment. You can make more than five postings for each type of task to maximise your mark for Assignment 1. Please use your own thought/words, **do not simply reproduce the course notes**. Please note that the forum areas **will**

not remain open for posting all semester, ie, **it will not be possible to complete all your postings late in the semester**.

In summary, students were asked to make at least five 'new' postings reflecting on the course material, with up to one mark awarded for each of the five 'best' new posts, and, to make at least five 'follow-up' postings reflecting on the prior posts of their peers, with up to one mark awarded for each of the five 'best' follow-up posts. Student participation in the online discussion was made 'mandatory' in the sense that marks were assigned to participation. As noted previously, the literature suggests that some form of extrinsic motivation is required to ensure a high level of student discussion participation. A weighting of ten % was chosen for discussion participation – this figure is noted in case studies elsewhere in the literature (Graham & Scarborough, 2001; Hara et al., 2000). It was felt that this weighting would provide incentive for most students to participate, while at the same time not compromising the unit assessment regime should there be unforeseen implementation issues with this initial trial of the asynchronous discussion assignment. Strategies to promote a high level of participation in online discussions include requiring a specific number of postings per assignment and/or per week (Conaway et al., 2005). In this case, both these strategies were combined. It has been found that a key element in the effective use of computer conferencing is 'intentional design' of the online environment (Harasim, 1991). Intentional design includes designating conferences (online discussion areas) according the nature of the task (formal or informal), the duration of the task (one week, whole semester, etc), size of the group (plenary, small group etc), etc. Separate weekly discussion spaces were created to structure the formal student assignment postings. This permitted newer discussion areas to be progressively revealed, and older areas to be progressively set as read-only as the semester progressed. A separate informal area was maintained for general unit discussion and questions. As noted,

the assignment-related discussion areas did not remain open all semester, to encourage students to engage with the unit material in a timely manner across the semester. Due to the nature of the assignment task, all of the discussion areas were open to all students – there was no separate small-group discussions employed.

As this was the first time a formally assessed online discussion task was employed in this unit, it was decided to undertake a quantitative investigation to explore the forms of student engagement with the online discussion, the impact of participation on the students' final unit result, whether passive participation/lurking had any benefit, and whether any impact/benefit was separable from the students' prior general academic performance in their studies.

Method

Student participation in online discussions can be analysed in quantitative terms (number of postings, length of postings, number of messages read, etc), qualitative terms (does the posting exhibit cognitive/social/teaching presence?, does the posting exhibit knowledge/comprehension/application/analysis?, is the posting on task/off task?, etc) or some combination of quantitative and qualitative. Quantitative analysis can be performed quickly using system data, but may not yield a complete picture of student engagement in the discussion (Hara et al., 2000). However, qualitative analysis requires the examination of every student posting to classify the content, consuming significant time and open to the variation in message content classification by different assessors (Cotton & Yorke, 2006).

At the commencement of the semester, an initial model posting of the type expected was made to seed the discussion and provide an exemplar to students. During the semester,

student postings were assessed on an on-going basis according to the published criteria. Both in initial and follow-up postings, students were asked to discuss unit content, hence the postings were primarily assessed based on the quality of cognitive presence.

Following the completion of the semester, data on the student usage of the online discussion area was compiled from the following sources:

- student age (whole years at the end of semester);

- student gender (male or female);

- student normal mode of study (on-campus or off-campus);

- student course of study (BTech, BE or other);

- student prior general academic performance (measured at Deakin by the Weighted Average Mark (WAM));

- the total number of discussion messages read (or at least opened) by the student;

- the total number of new/initial discussion postings made by the student;

- the total number of follow-up/reply discussion postings made by the student; and

- the final unit mark obtained by the student for SEB221.

The collected data were analysed and the following information was compiled:

- descriptive statistics on the use of the discussion areas;

- visualisation of the patterns of usage of the discussion areas;

- investigation of correlation (Pearson's linear correlation coefficient) between data variable pairs; and

- multivariate linear regression to find the significant independent variables contributing to the dependent variable 'final unit mark'.

Results and discussion

Descriptive statistics

The number of student completing the unit (still officially enrolled at the end of the semester) was 86. The total number of assessable messages posted was 645. The average number of words per posting was 290. Figure 1 shows the distribution of assessable student postings across the semester.
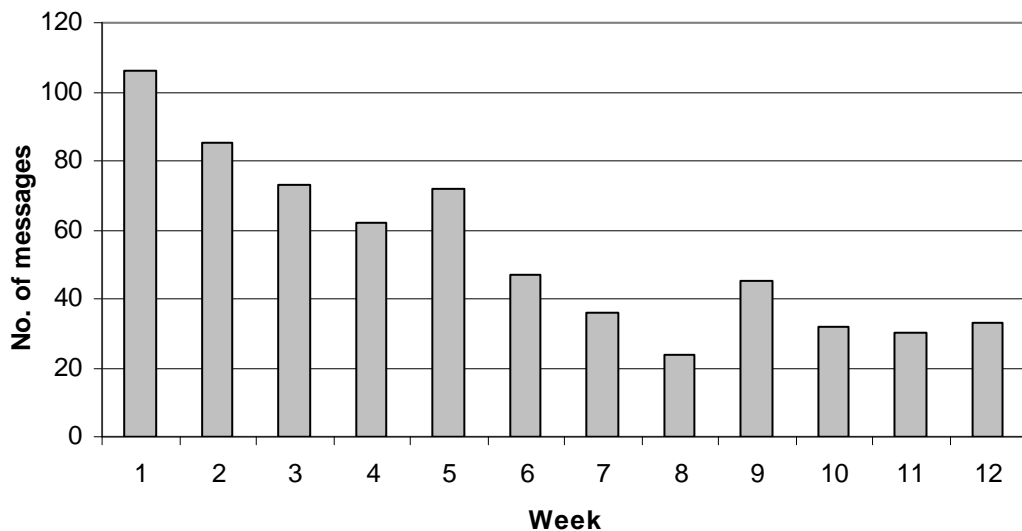

Figure 1: Distribution of assessable student postings across the semester

There was a general downward trend in discussion posting until week 8, after which the number of remaining weeks in the semester equalled the number of posts required from a student to maximise their possible mark, and after which the general trend picked up again slightly, perhaps indicating a belated effort by those students who hadn't actively engaged with the discussion assignment task previously. Figure 2 shows the ranked distribution of total new/initial postings made by students.
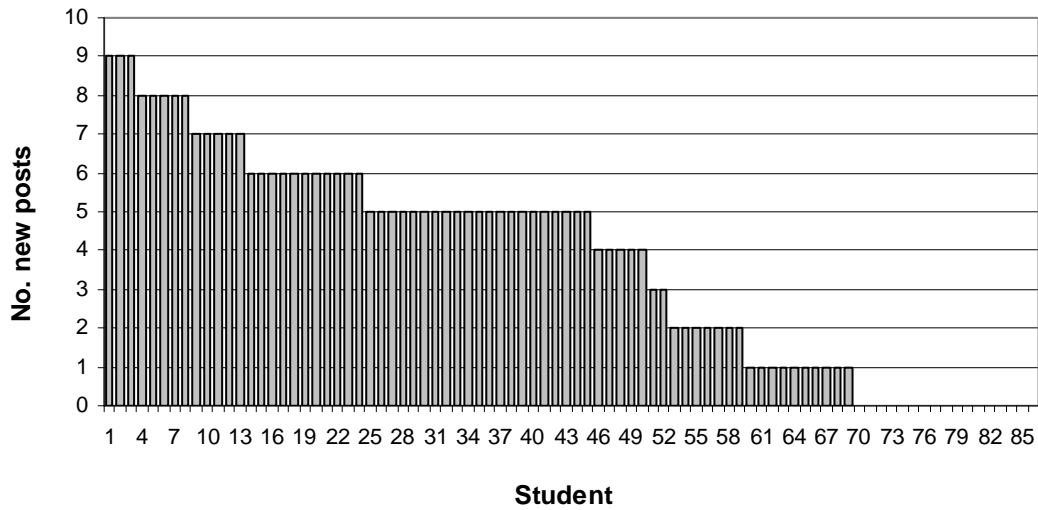
Figure 2: Ranked distribution of total new/initial postings made by students

The mean number of new postings was 3.8, with a standard deviation of 2.8. The median and modal number was 5, and the range was 0 to 9. Figure 3 shows the ranked distribution of total follow-up/reply postings made by students.
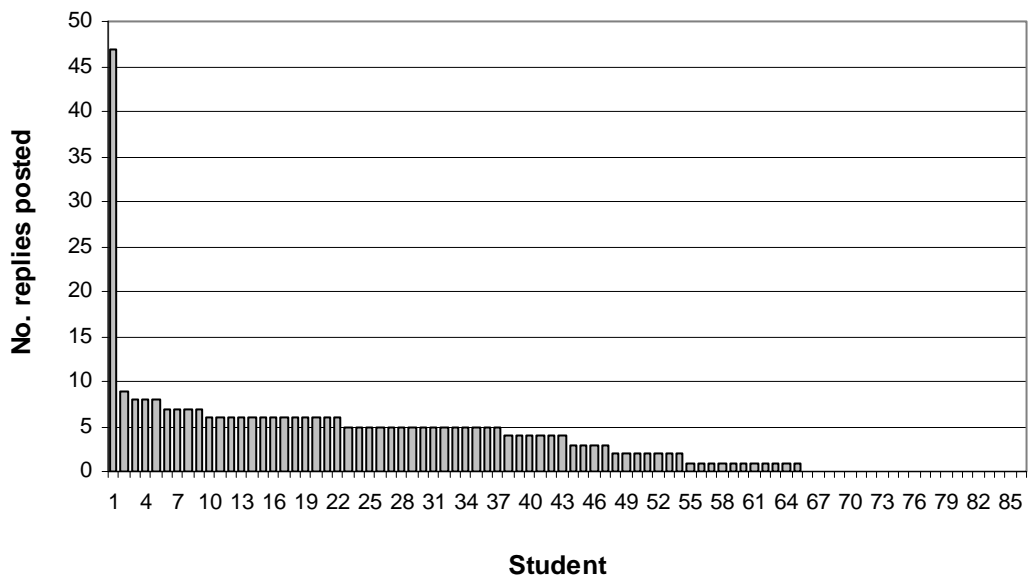

Figure 3: Ranked distribution of total follow-up/reply postings made by students

The mean number of follow-up postings was 3.7, with a standard deviation of 5.4. The median number was 3.5, the modal number was 0, and the range was 0 to 47. It is well known that students take a strategic approach to study, and the learning activities they engage most fully with are those most clearly associated with what will be assessed (James, McInnis & Devlin, 2002). Even though marks were attached to students' contribution to the online discussion as an overt indicator that participation was considered important, and disregarding students with a final mark of zero for the unit, 16.7 % of students made no new/initial postings and 11.9 % of students made no follow-up/reply postings. A similar rate of students foregoing assessment worth ten % based on participation in an online asynchronous discussion task is noted in the literature (Graham & Scarborough, 2001). Figures 2 and 3 suggest that even those students who did engage with the assignment task only tended to do the minimum required (one new post and one reply post per week, up to a maximum of ten combined) to qualify for the assignment marks on offer. This type of minimum student engagement in an assessable online discussion activity is reported elsewhere (Hara et al., 2000), and reinforces the idea that students are busy, and extrinsic motivation is likely to be necessary to encourage even a basic level of participation in online discussion activities. Figure 4 shows the ranked distribution of total number of messages read by students – technically, the CMS records the number of messages 'opened' by students, but this was taken as a proxy measure of number of messages 'read' by students.
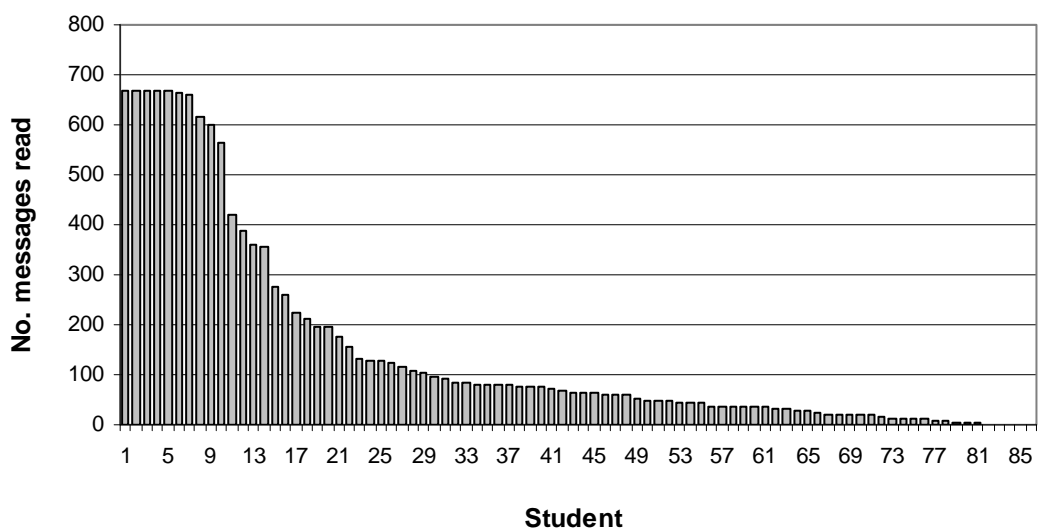
Figure 4: Ranked distribution of total number of messages read by students

The mean number of messages read was 149.6, with a standard deviation of 201.7. The median number was 63.5, the modal number was 669, and the range was 0 to 669. Note that the figure of 669 is higher than the figure of 645 assessable messages given above, as it includes some messages posted by students who did not complete the unit, but that were never-the-less read by the completing students. Interestingly, the modal number of messages read was also the maximum number, indicating that a significant proportion of students read every single discussion posting.

Visualisation of patterns of usage

A method for visualising the message posting profile of all students together as a group was devised. A ranking factor was computed for each student, based on weighting postings early in the semester higher, and postings later in the semester lower. This factor was used to rank order all students from highest to lowest. Figure 5 shows the rank ordered profile of new/initial postings made by students across the semester.
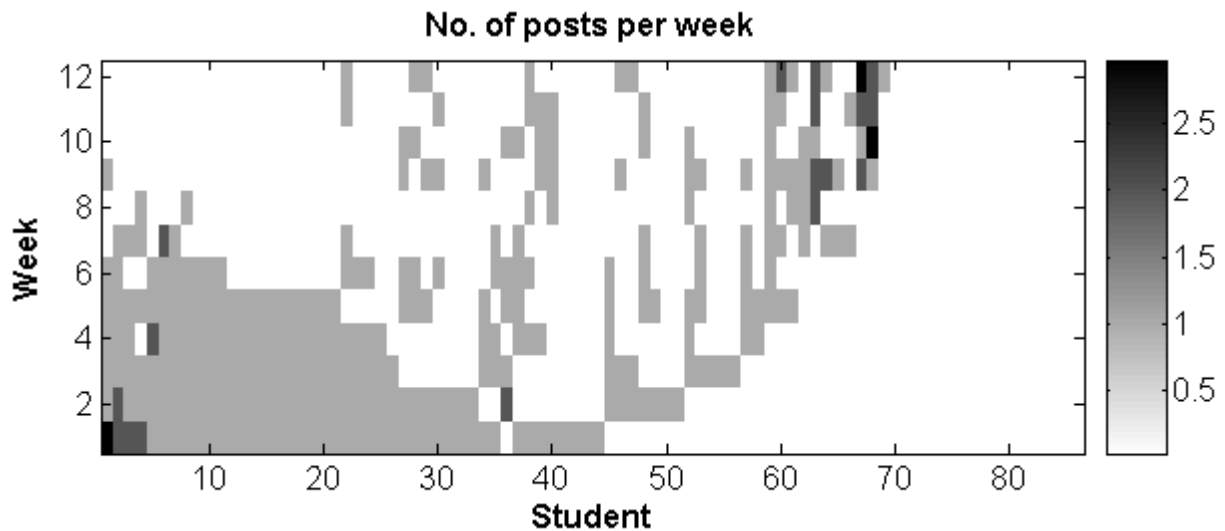
Figure 5: Rank ordered profile of new postings by students across the semester

Four relatively distinct discussion new posting profiles, with approximately equal proportions of students in each can be observed. Students 1-21 (21 students, 24.4 %) made their required five (or so) posts, commencing at week one, and then generally left the discussion space. Students 22-44 (23 students, 26.7 %) commenced their posts in week one and then had a range of posting profiles, typically not continuous, re-entering the discussion space at various points over the twelve weeks. Students 45-69 (25 students, 29.1 %) commenced their posts some time after week one and then had a range of posting profiles, typically not continuous, with students who commenced their posting late in the twelve week period exhibiting more intense posting in an attempt to meet the assignment criteria of making five new posts in total. Students 70-86 (17 students, 19.8 %) made no postings at all during the twelve week period.

Data variable paired value correlations

Two significant correlations were observed; final unit mark and WAM ($r = +0.43$, $p < 4\times10^{-5}$), and final unit mark and total number of new postings ($r = +0.49$, $p < 2\times10^{-6}$). Inspection of variable pair scatter plots revealed that the relationship between final unit mark and number of

new postings plateaued after five new postings. After the data range for the number of new postings was limited to five or less the correlation was ($r = +0.59$, $p < 4 \times 10^{-9}$). As might be expected, a correlation was observed between previous academic performance (as measured by the student's WAM), and final unit result in SEB221. The observed correlation between total number of new postings and final unit mark was strongest for number of new posts between zero and five. This is not surprising as, while students were allowed to make multiple new postings per week, only the single 'best' new posting result was taken as the mark for that week. While both WAM and number of new posts appear to have a positive correlation with final unit mark, they do not have a significant correlation with each other ($r = +0.23$, $p > 0.033$), suggesting that they are not significantly multicollinear with the final unit result, and that both contribute independently and positively to the final unit mark.

Multivariate regression

Following removal of three data items with an unknown (not BE or BTech) course of study and four data items for students with a final unit mark of zero (did not complete unit but did not official withdraw their enrolment), multivariate linear regression analysis was conducted with final unit mark as the dependent variable. All other known variables were initially introduced as independent variables, and step-wise regression was performed until all remaining variables were significant. Table 1 shows the coefficients of the regression model and their significance.

Table 1: Multivariate linear regression model for dependant variable 'final unit mark'

Variable	Coefficient	Standard error	Beta	Significance
No. new posts ($\leq$ 5)	3.05	0.47	0.50	$p < 1 \times 10^{-8}$

WAM	0.51	0.08	0.48	$p < 3 \times 10^{-8}$
Constant	28.17	5.50	-	$p < 3 \times 10^{-6}$

An Analysis of Variance (ANOVA) test suggests that the regression model is significant (F_{78} = 47.29, $p < 5 \times 10^{-14}$), though the model predicts only 55.4 % of the variation on final unit mark (R^2 = 0.554). The regression residuals were approximately normally distributed. The model explains only just over half of the variation observed in the final unit mark, hence there exist other factors with a significant influence on final unit mark that were not available in the data collected for this analysis. The results of the regression analysis support the results of the data pair correlation analysis that both the number of new postings and WAM contribute significantly and independently to final unit mark. Based on the marking scheme of 'up to 1 mark per posting', it would be expected, all other things being equal, that posting one new message would add approximately one mark to the final unit result. Instead, the regression analysis indicates that there was a significant benefit (up to three marks per new posting) beyond the notionally allocated marks for new postings. This suggests that the work that students completed in preparing their new discussion postings engaged them with the unit material and assisted them in the completion of other assessable tasks for the unit.

None of the student demographic characteristics (age, gender, mode of study and course of study) were found to be significantly correlated with levels of participation in the discussion (messages read, new postings and reply postings), suggesting that all students were able to participate in the online discussion exercise on a generally equal basis. It has been proposed that the ways in which students engage with online asynchronous discussions will influence the learning outcomes achieved (Cotton & Yorke, 2006). The four types of student engagement with the discussion space identified in Figure 5 were used as a grouping variable

and entered into the multiple regression analysis, but it was not found to be a significant contributor to final units result.

Conclusion

A formally assessed online discussion task was introduced into an engineering management unit delivered in wholly online mode, as a response to a perceived need to better-develop student online communication skills. While it was qualitatively observed that student participation in unit online discussions increased significantly compared to previous unit offerings, following the introduction of a formally assessed online discussion task, a quantitative examination was undertaken to investigate the impact of the students' participation in the online discussion on their final unit results. It was observed that while many students read a significant number of discussion postings, generally, the posting of new and reply messages occurred at the minimum level required to qualify for the assignment marks. Based on new postings to the online discussion, four distinct patterns of posting were observed. Based on correlation and multiple regression analysis, it was observed that two measured variables were significantly related to a student's final unit mark – their weighted average mark (used as a proxy measure for general prior academic ability) and the number of new postings that they made to the online discussion. In addition, these two variables were not significantly correlated with each other, and were both significant in the regression model obtained, suggesting that both contribute independently to the final unit mark. The regression model explained more than half of the observed variation in final unit mark, and while it shouldn't be interpreted literally as the 'formula' that determines a student's final unit mark, it does suggest that the influence of active participation in the online discussion assignment through the posting of reflective contributions based on the course material made about the

same contribution to a student's final unit mark as their general prior academic ability. Further, the regression model indicated that each new posting contributed three times as much to the final unit mark as its nominal assessment value of 'up to 1 mark per posting' would otherwise indicate, suggesting that the work in preparing their new discussion postings engaged students with the unit material and assisted them in the completion of a range of assessable tasks for the unit. However, while active contribution to the online discussion in the form of new posts was a significant factor in the final unit mark, simply reading the posts of other students was not. The number of postings read was not significantly correlated with the final unit mark, suggesting that passive 'lurking' in this online discussion did not significantly contribute to student learning outcomes (as measured by final unit mark).

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