A Voting System Applied to Online Student Discussion Forums

Henry Larkin Deakin University, Melbourne, Australia Email: henry.larkin@deakin.edu.au

Abstract—Discussion forums enable students to both seek answers from teaching staff and discuss topics among themselves. However, there is often little incentive for students to post, especially to write poignant questions, answers and general discussion. This paper presents a study of the interactivity of students in online discussion forums when a voting system is added, enabling students to up-vote or down-vote any post. In addition, bonus marks were available for the highest voted posts during each week. Results show that overall student interactivity increased more than three-fold, and student satisfaction of the learning resources increased.

Index Terms—discussion forums, voting, e-Learning, student interactivity, online learning

I. INTRODUCTION

Numerous studies have recognised the challenges in student participation and engagement in the evolving blended learning experience. Many learning environments now include online systems to facilitate, or even entirely deliver, courses. A challenge for facilitators is to engage students in rich and active discussion to increase both their learning and their perceived experiences [1]-[4].

Student participation in the classroom has been investigated in many studies. Both in traditional lectures and tutorials, student engagement has been increased by using voting devices [5]-[7]. These devices typically have a master control unit, handled by the teacher, and individual voting units or voting apps (on mobile phones), given to students. A teacher is then able to pose questions to the group and get a simple group vote in response. The philosophy behind this is that by giving students some input and control over learning activities, student attention and interest is increased [8]-[14].

The use of online Content Management Systems (CMS) are used to facilitate, or even completely deliver, course learning. In many ways, this online portal becomes the central hub where communication to the entire cohort of students is centred. Within a CMS, discussion forums are frequently used as a means of increasing student interaction, as well as enabling students to pose questions or highlight their own learning difficulties and have these answered by teaching staff. These forums also, in theory,

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allow questions to be asked by students and answered by teaching staff in a way that allows all students to read the answer, thus avoiding repetition and reducing the teaching load of staff.

However discussion forums on their own do not always achieve interactivity. Students may feel shy or not otherwise motivated to ask questions on a discussion forum as opposed to emailing teaching staff. Also, the same question may be asked multiple times if students are unable to navigate questions already answered in the myriad of discussion posts. Furthermore, discussion forums on their own do not necessarily encourage communication and collaboration between students. Oftentimes the information communicated in discussion posts between students is of a more general nature and not necessarily assisting in the learning of a subject.

This paper summarizes a project that was conducted during 2014 and 2015. The question was asked, "Can we improve student interactivity within online discussion forums?" The project centred around changing the way online discussion both occurred and was rewarded. This involved designing a new form of discussion with built-in features aimed at encouraging healthy and productive engagement between students. A reward-based system was proposed due to the belief that many students focus on where they earn marks, rather than where they best learn.

The system was tested across 3 subjects at Deakin University in Melbourne, Australia. One of the subjects was offered in the previous year, where it previously used a typical discussion forum. This provided a basis for comparing results between a typical discussion forum and the proposed voting-enabled discussion system.

This paper is divided into the following sections. In Section II we outline the Design of System, documenting how the system was built and incorporated into teaching. In Section III, the Experiment Setup is defined, outlining how the system was applied to three subjects, and how results were collected. In Section IV, the results are presented and discussed. And finally in Section V, we present our conclusions.

II. DESIGN OF SYSTEM

The design of the project centred around creating a comment section beneath each page of learning content, rather than having a separate discussion forum. In this way, the discussion of content was related to each topic (each week's content, an assessment item, or a grades page, etc.). In fact, every page within the CMS had a comment section attached. In the tested subjects, a week's content usually consisted of between 1 or 3 videos of lecture content, followed by lab exercises. At the bottom of this content was a comment section where discussion could take place. The comment section was designed this way so that all questions were related to a specific topic. This on its own is not new, and is a feature of many CMS and blog systems. The next feature of the project was a voting system. A voting system was proposed to enable every comment to be anonymously up-voted or down-voted. This included whether a comment was posted by teaching staff or by students. Students could up-vote or down-vote any comment posted, with the instruction given that they should rate any post depending on how useful they found it. It was decided that comments that received a significant number of down-votes with a lack of corresponding up-votes would then be hidden from view and only visible when a filler comment was clicked. The threshold decided was 3 down-votes, but also required teaching staff approval for it to be hidden. A reference to the hidden comment was maintained within the thread, so students could still read it. Another decision was for comments that were up-voted above a certain threshold to be highlighted (in pale vellow in the test system), to draw student attention to the most valuable posts. In this way, it was hoped that students would be able to peruse through comments and look only at the most valuable comments, thus increasing propagation of useful information. This was also done in the hope of increasing useful information propagation among the vastness of information that is often present in discussion forums. Note that this was also aided by the fact that each week had its own comment section, also limiting how many comments students needed to read at any given time, as previous weeks' content was generally never commented on once a new topic was announced.

Furthermore, a bonus mark allocation was available to all students. One bonus mark was available for each of the top 3 comments in each week, up to a maximum of 5 bonus marks per student for the entire semester. This was done in the hope of both increasing the value that students put into their comments, as well increasing their participation in voting on other comments.

To facilitate testing of this proposal, the aim was to use existing tools as much as reasonably possible. To this end, WordPress was used as a temporary CMS specifically for this experiment, and not Deakin University's default CMS. Each week's content was given its own page and each page in WordPress can have a comment section enabled, which is built into the WordPress system. To add voting, a plugin called Comment Rating, developed by Bob King, was installed. This plugin added a thumbup and a thumb-down system to every comment. The system did have an inbuilt method for hiding comments that had a certain number of negative votes, and for highlighting comments that have above a certain number of positive votes. The plugin had not been updated since 2009 unfortunately, and so some editing of the plugin source code was necessary. Once this had been achieved, the system was ready for learning content to be added. For the collection of statistics, it was necessary to look at the database used by the Comment Rating plugin. This plugin added a database entry for every comment, listing the usernames and both up-vote anddown-vote tallies for each comment. There was no web system to view or analyse this data, so database queries in SQL were written to extract results and statistics.

For the learning content provided to students, each week was given its own topic and each topic had its own page. Assessment items also had their own pages, as did supplementary information such as the use of software, online webinar's session and grade pages. For the weekly content, videos of lecture content were placed at the top of the page, followed by lab exercises, followed by the comment section. To facilitate engagement, students were encouraged to upload profile pictures, which were displayed beside their names for each comment they posted. This was done to help students identify the common students that provided answers, and to further encourage useful discussion as there would be no anonymity in posting (only anonymity in voting). The decision was also made not to paginate comments. This was done due to a common student complaint in previous years that comments not on the first page were difficult to reach and thus not read. The idea, therefore, was that all comments related to a topic were displayed on that single page, no matter how lengthy that page became.

The system was configured such that comments could also be replied to up to 4 levels deep. These were indented appropriately so that students could see the containment of discussion within a topic, and could skip over comments as necessary.

An example screenshot of this system is included in Fig. 1 below. Names shown are not real names.



Figure 1. Screenshot of comment system

III. EXPERIMENT SETUP

The idea of using voting in student discussions was first proposed at a School of IT Teaching & Learning meeting in 2014. The School of IT has an advantage here, in that there is a greater capacity to develop computing solutions for education problems. For this experiment, one existing subject was chosen, Introduction to Apps Design (SIT120), a 1styear subject which teaches students the basics of creating mobile phone applications. The subject was selected as it had a decent size cohort of students (over 100 students) and because it is run in first semester of the 1st year, and thus students do not yet have any pre-disposition to the university's existing CMS and associated discussion forum. Therefore, there should be no bias between the two systems. In 2014, the subject was run using the existing discussion forum. This discussion forum is paginated, with a user-configurable number of topics per page of either 10 or 20, displayed in an email-like list of post titles and a window to display a post's content. The discussion forum did allow an unlimited number of replies to be visible in this list, largely defeating the purpose of pagination to begin with. On clicking any particular topic or reply, a single message is then displayed in the preview window at the bottom of the page. An example is shown in Fig. 2 below.

| \cap l | 2 😒 | What's your favourite app? | |
|------------|--|----------------------------|---------------------------------------|
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| □ / | * | What's your favourite app? | |
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Figure 2. Typical discussion forum

The main student complaints of the existing system were as follows:

- There was no real order to the discussion forums.
- Information could be anywhere on any of the topics.
- It was time consuming to click on every single post in order to view the post's content.
- The list of the headings for each post was largely redundant when it came to replies, as all headers were the same.

To get a more broad view of the effectiveness of using voting within discussions, the voting system was applied to two other subjects. The first was a 3rd year subject, Advanced App Development (SIT305), which was run for the first time. The second subject was a postgraduate subject, Mobile Systems Development (SIT708), which was also a new subject. As these were both new subjects being developed, the development overhead for adding all content into the test WordPress system was simplified, as the content was being developed new and could be input into any CMS without conversion. This made it easier to run the experiment instead of adapting and redesigning any existing subjects. The 3rd year and postgraduate subjects were selected to get a broad spectrum of users. 3rdyear students have been with the

university longer, and may feel inclined to comment or not comment based on their preference over the years. They would also be quite accustomed to the existing discussion forum and might display more of a liking (or disliking) of the comment voting system. Postgraduate students, often in the workforce and perhaps having a need to communicate with teaching staff online more often, were also represented. The purpose of analysing these three subjects was to get as broad a scope of the effectiveness of a voting system without putting an excess burden on teaching staff. The same lecturer was used for all subjects tested, to reduce as many other factors in influencing interactivity as possible.

IV. RESULTS AND DISCUSSION

At the conclusion of semester, results were extracted from the database of comment votes using SQL. Statistics were collected for the number of posts and number of upvotes primarily (shown below in Table I). Only students who submitted more than half of the assessment were counted, so that those who enrolled but did not complete the subject were not counted. Comments from teaching staff were also not counted. The number of down-votes was found to be surprisingly insignificant, and will be discussed later.

When run in 2014 using a typical discussion forum, the 1st year subject Introduction to Apps Design had 143 students in total who made a combined 224 posts or replies to posts. This averages at 1.6 posts per student. In 2015, using the new comment voting system, there were 115 students enrolled with 677comments or replies to comments. This averages at 5.9 posts per student. In this regard, there is a significant increase in the participation rate of students. However, in the opinion of the author 5.9 posts per student over the entire semester is still considerably low. Following on from these results, there were 441 up-votes recorded in total, given to 221 comments (221 comments had at least 1 vote). This averages at 3.8 up-votes per student over the entire semester. In other words, not many votes were made compared to posts. One possibility is that 1st year students didn't feel they had the authority or knowledge to judge a comment, despite it being anonymous. Another possibility was that there simply weren't many posts of quality.

Looking at the 3rd year subject with 39 students enrolled, 386 posts were made. This averages at a significant 13.3 posts per student. In the postgraduate subject, with 95 students, 386 posts were made, averaging 7.4 posts per student. Both of these are significantly more than in the 1st year subject, which is perhaps not surprising. Although it was predicted that postgraduates would communicate more online than undergraduates, as being in the workplace they may require more communication online than on-campus and in classes.

Looking at the information further, the 3^{rd} year subject had 200 up-votes cast, averaging at 6.9 up-votes per student. The postgraduate subject had 395 up-votes cast, averaging at 4.2 up-votes per student. Again, this shows that the 3^{rd} year students were the most interactive, casting more up-votes than either the postgraduates or the 1^{st} year students.

As for the success of encouraging voting, the number of up-votes per student was lower than the number of posts made, which was not expected. It was expected that, as clicking a vote is easier than responding to a post, that voting would have been more frequent than posting. However, across all subjects, this was found not to be true.

| Subject | Number of Students | Number of Posts | Number of Posts per Students | Number of Up-votes Cast | |
|----------------------|-----------------------|--------------------|------------------------------------|-------------------------------|--|
| 1 st year | 115 | 677 | 5.9 | 411 | |
| 3 rd year | 29 | 386 | 13.3 | 200 | |
| Postgrad | 95 | 707 | 7.4 | 395 | |

TABLE I. OVERALL STATISTICS

Breaking down the data further, Table II below looks at both the comments with the highest positive votes, and the overall number of comments voted on. In the 1st year subject, the highest number of votes on a comment was 26. After 7 posts, these had dropped off to a maximum of 6 up-votes per comment. This means that, out of 115 students, only 7 posts had at least 6 students voting positively on them. Before the experiment, it was predicted that some posts would be very highly rated, particularly posts by teaching staff. However that was found not to be the case (although the highest-rated post was one made by teaching staff). In total, 221 of the comments posted had received at least 1 vote, almost one third of all comments posted. While there were several user IDs who were regular voters, there was no particular student who stood out as voting significantly more than any other student.

TABLE II. HIGHEST UP-VOTED COMMENTS

| Subject | Highest Up-Voted Comments | | | | | | Number Comments Voted On | |
|----------------------|---------------------------|----|----|---|---|---|--------------------------------|-----|
| 1 st year | 26 | 16 | 15 | 7 | 7 | 7 | 6 | 221 |
| 3 rd year | 11 | 6 | 6 | 4 | 4 | 4 | 4 | 125 |
| Postgrad | 19 | 11 | 8 | 6 | 5 | 5 | 5 | 243 |

Looking at the 3^{rd} year subject with 39 students enrolled, the highest number of votes on a comment was 11 up-votes. After 4 posts, this had dropped down to a max of 4 up-votes per comment. This follows the same pattern as occurred in the 1^{st} year subject, with very few posts receiving a high number of votes. In fact, out of 386 posts in the 3^{rd} year subject, only 3 posts had a reasonable number of votes. This was very surprising, and no single reason has been identified. In total 125 comments had at least one vote, being almost one third of the total number of comments posted.

In the postgraduate subject, the highest number of upvotes was 19, with this dropping down to a maximum of 5 votes per comment after the top 4 comments. This follows the same pattern seen previously. Overall, the postgraduate subject had 243 comments have at least 1 up-vote, again at almost one third of the total number of comments posted. In all three subjects, there appears to be a predictable one-third of posts which will receive at least one up-vote. There was no obvious reason identified for this pattern.

Down-votes were not previously included in the tables because it was found that hardly any down-votes were cast. In Table III below, the comments with the most down-votes across all three subjects are shown. As can be seen, only three comments received down-votes in both the 1st year and 3rd year subjects, with four comments receiving down-votes in the postgraduate subject. There are many reasons why this could be so. It could be that the qualities of comments are simply high enough that students didn't feel a need that any comment was lacking in value or had a negative impact on discussion within the group. It could also be that students did not want to speak negatively of their peers. Or it could be that students did not feel they had the confidence or authority to downvote a comment, unsure if some content was really lacking in value or if the student perhaps didn't understand the possible value in the comment. Or it could have simply been that the students were not motivated to down-vote comments and did not see any value in doing so.

TABLE III. HIGHEST DOWN-VOTED COMMENTS

| Subject | Highest Down-Voted Comments | | | | | |
|----------------------|-----------------------------|---|---|---|---|--|
| 1 st year | 2 | 1 | 1 | - | - | |
| 3 rd year | 1 | 1 | 1 | - | - | |
| Postgrad | 1 | 1 | 1 | 1 | - | |

Overall, all subjects had a significant number of posts per student compared to the one subject sampled in 2014. To investigate this further, two subjects were later selected from 2014, a 3^{rd} year subject (Mobile Computing) and postgraduate subject (Mobile and Ubiquitous Computing), to identify any patterns with the previous discussion forum system on both 3^{rd} year and postgraduate students. Both subjects were selected as they were within the same field as those tested in 2015, and thus were more likely to contain similar students. The 3^{rd} year subject from 2014 had 78 students and the postgraduate subject had 96 students. It should be noted that the number of students for the 3^{rd} year subject were unfortunately higher, and may be a factor in results as the size of the cohort may affect discussion.

The 3^{rd} year subject from 2014 had 506 posts which average 6.5 posts per student. This compares to 13.3 posts per student on average for the 3^{rd} year subject using the comment voting system. The postgraduate subject had 202 posts over the semester, averaging at 2.1 posts per student, compared to 7.4 posts per student in the postgraduate subject tested using the comment voting system. While these are not the same subjects nor are the subjects the same size, they are in the same major and degree, thus being a reasonable sample to compare with. The postgraduate students in particular increased communication significantly between the two systems, and in this comparison the student numbers between the two years were almost identical.

It should be noted however that no comparison is perfect, even in the same subject between years, as the amount of communication per student maybe affected by class size, change in life events for that generation, change in environmental factors between the two years, or any number of external events. For example, smaller class sizes may have a more communal feel where all students know each other which may encourage chatting. Or alternatively small subjects may have infrequent chatting where students do not post anything because hardly anyone is online. Furthermore, there may be specific groups who know each other or students who have worked previously in other subjects that might communicate differently even if the subject is identical between years, thus all results should be taken within context. That being said, a pattern does emerge between the two sets of results from 2014 to 2015. Firstly, regardless of class size, there are significantly more posts per students using the comment voting system than without. Furthermore, 3rd year students post significantly more regardless of other factors. It is worth mentioning again that the same lecturer was used for all of the subjects presented here, both in 2014 and 2015, so the teacher and the teaching style should not be as significant factor on these results.

In comparing the comment voting system with the existing discussion forum, one other result was obtained from the end-of-semester subject evaluations that are run by Deakin University. There were two questions from this survey that are significant. The first survey question that is relevant is the overall satisfaction with the subject. In 2014, the 1st year subject received 83% overall satisfaction with the subject as a whole (out of 48 responses). In 2015, the same subject got 82% overall satisfaction with the subject (out of 38 responses), slightly down but otherwise almost identical. There are many factors which determine the overall satisfaction so this number alone is not necessarily informative. The other survey question is "the online teaching and resources in this unit enhanced my learning experience". In 2014, the 1styear subject received only 66%, whereas in 2015 the same subject received 87%. While there are a number of factors that changed, including a number of resources that changed in the subject, there is a clear increase in this metric for which it is possible that the voting system played a large part.

V. CONCLUSION

There were several aims to this project. First, it was hoped that voting of comments would encourage more student engagement than typical discussion forums. Secondly, it was hoped that voting would allow stronger responses to be more easily recognized by students, especially if the students visited the comment section on an infrequent basis. Thirdly, it was hoped that by encouraging voting, especially with the addition of bonus marks, that students would write better questions and even better answers. To this end, it was also hoped that students would end up answering each others' questions and reduce load on teaching staff, especially if a question asked was something that had already been answered in lectures or other materials (which is unfortunately a common occurrence). While many of these later goals are not easy to measure definitively, student engagement is able to be measured by analysing the number of posts per student.

In the end, across all three subjects in 2015, it was intended that up to three students each week will be given bonus marks for top posts. However, as it turned out there were very few posts with a significant number of votes, and thus few bonus marks were allocated. The threshold for allocating bonus marks was initially 5 but this was later reduced to 3 up-votes due to the lack of votes in general. Despite the lack of up-votes, the overall activity of comments had significantly increased compared to regular discussion forums in 2014. It is possible that the thought of bonus marks or at least the thought of other students getting bonus marks encouraged students to post. Or it is possible that students, simply knowing that their peers were likely to be participating due to the incentives, where then motivated to post. It is not entirely conclusive as to what caused the increase in interactivity. However the results across three subjects are demonstratively positive.

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Henry Larkin is an Australian researcher. He completed his PhD degree at Bond University (Gold Coast, Australia), as well as a Graduate Certificate in Teaching and Learning at the University of New South Wales in 2007 (NSW, Australia). His major field of research is in mobile computing.

He is currently a Lecturer at Deakin University in Melbourne, Australia. He has previously held positions at the University of

Aizu, University of New South Wales, and Bond University.