First Year Programming: Engagement vs. Success Measurements from UCOL

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Abstract

This research paper sought to confirm the notion that high student engagement results in high academic success rates in first year programming. It also aimed to discover if high face-to-face engagement is necessary for success within a blended delivery environment. The study measured various aspects of student engagement over the course of a semester and compared this data with each student's final grade. The results suggested that high face-to-face engagement most commonly results in high academic success, however a linear relationship could not be reasonably established from the data. The research also revealed limitations in using individual student Moodle hit counts as a measure for online engagement.

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Keywords

Programming, attendance, engagement, success

Introduction

D101 Software Development is the first year programming paper on UCOL's Bachelor of Information and Communications Technology (BICT) degree. This paper forms the focus of this study. The D101 paper covers the fundamentals of programming in the C# programming language. Delivery is blended, consisting of face to face lectures and practical's, and is also supported online through Moodle. Lecture and practical attendance is not compulsory. This research paper seeks to confirm the notion that student engagement has a direct impact on academic success, and that face-to-face engagement is beneficial even within a blended delivery environment. The approach taken to test this notion was to measure various aspects of student engagement throughout the semester and then compare the data with each student's final results for the overall paper. This paper will follow a standard format by first briefly examining related studies, outlining the approach taken, presenting the results with a corresponding discussion, and will end with conclusions about the research.

Related Studies

A 2008 journal article states that for over 80 years research has shown that class attendance predicts academic performance (Dollinger, Matyja, & Huber, 2008). The article cites studies from 1927 (Turner, 1927) and 1931 (Jones, 1931) both of which indicate a negative impact between classroom absences and students grade point averages, right through to more recent studies in 2003 (Clump, Bauer, & Whiteleather, 2003) and 2005 (Gump, 2005) that show similar relationships between attendance and success. Beyond attendance, their study also explores many other factors that contribute to academic success, including: personality, past performance and verbal ability (Dollinger, Matyja, & Huber, 2008). Although attendance is not the only factor that impacts student academic success, it is often shown as a consistently significant variable.

Approach

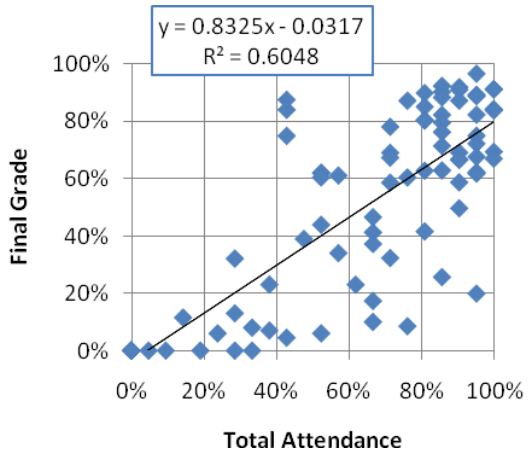
In order to examine the correlation between engagement and student academic success, a number of observable facts were recorded over the course of the semester. These facts were: lecture attendance, practical attendance, practical completions, and Moodle hits. This data was then used to derive some additional information: total attendance (lecture and practical attendance combined) and attempted practical completions (a percentage similar to practical completions that removes practicals that were not attempted from the equation). As a result, attendance and completion percentages were calculated for each student in each of the five categories: total attendance, lecture attendance, practical attendance, practical completions, and attempted practical completions. The attendance data was collected at the beginning of each lecture/practical. Practical completion data was collected during practical sessions as individual students completed the assigned work. Moodle hits were recorded automatically by the Moodle learning management system (LMS). At the conclusion of the semester the attendance and completion data was compared to each student's final grade. In addition, average attendance and completion percentages were calculated for students who passed the paper, students who failed the paper, and students who failed the paper (excluding no shows).

Results

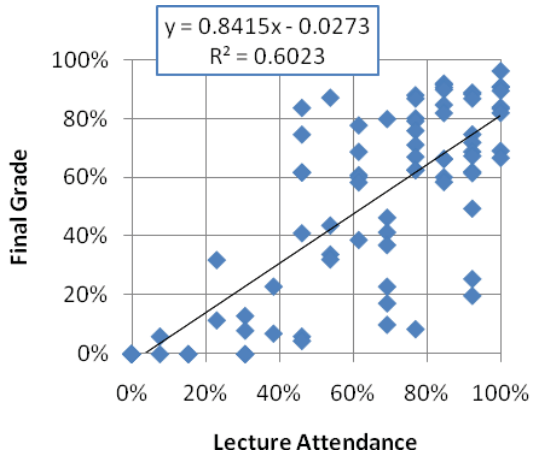
The D101 Software Development measured a total of 83 enrolled students. The data comparing final grades against attendance and completion percentages are presented in the form of scatter graphs.

- Graph 1: Final Grade VS Total Attendance
- Graph 2: Final Grade VS Lecture Attendance
- Graph 3: Final Grade VS Practical Attendance
- Graph 4: Final Grade VS Practical Completions
- Graph 5: Final Grade VS Attempted Practical Completion
- Graph 6: Final Grade VS Moodle Hits.

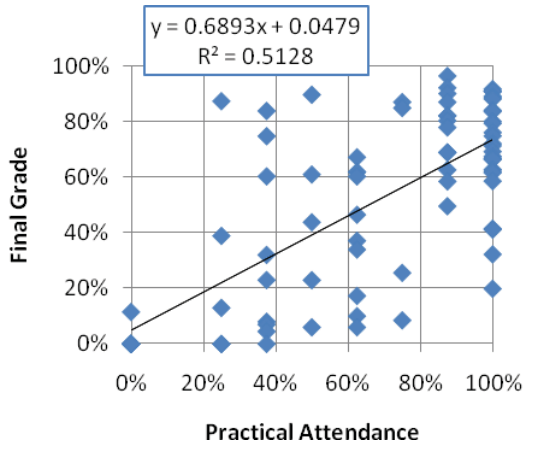
Trend lines are also included. It should also be noted that a limitation of the scatter graph is its inability to show duplicate values (e.g. students with the same final grade and same engagement level appear as a single point on the graph). Finally a column graph is used to display the pass/fail averages for each engagement type (Graph 7). Pass/fail averages for the Moodle hits category is given separately due to the hit count not being a percentage (Table 1).



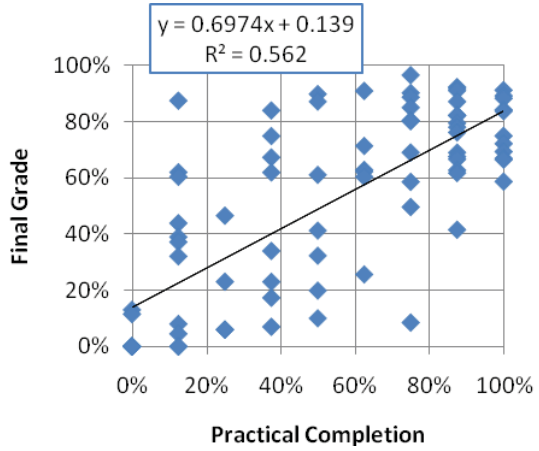
Graph 1. Final Grade vs Total Attendance



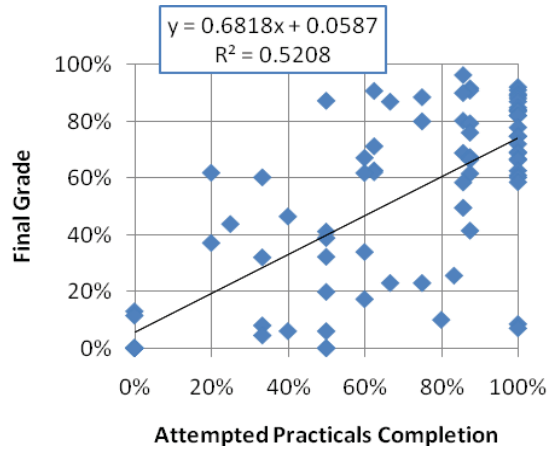
Graph 2. Final Grade vs Lecture Attendance



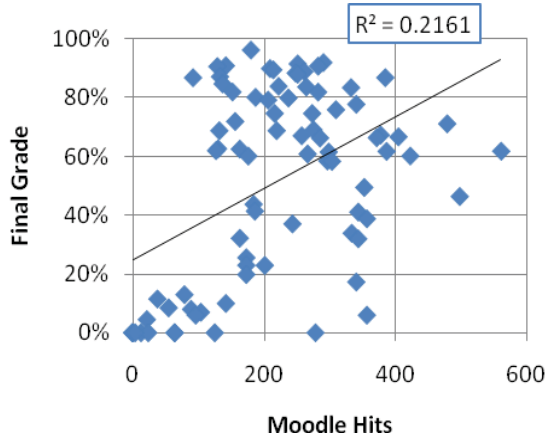
Graph 3. Final Grade vs Practical Attendance



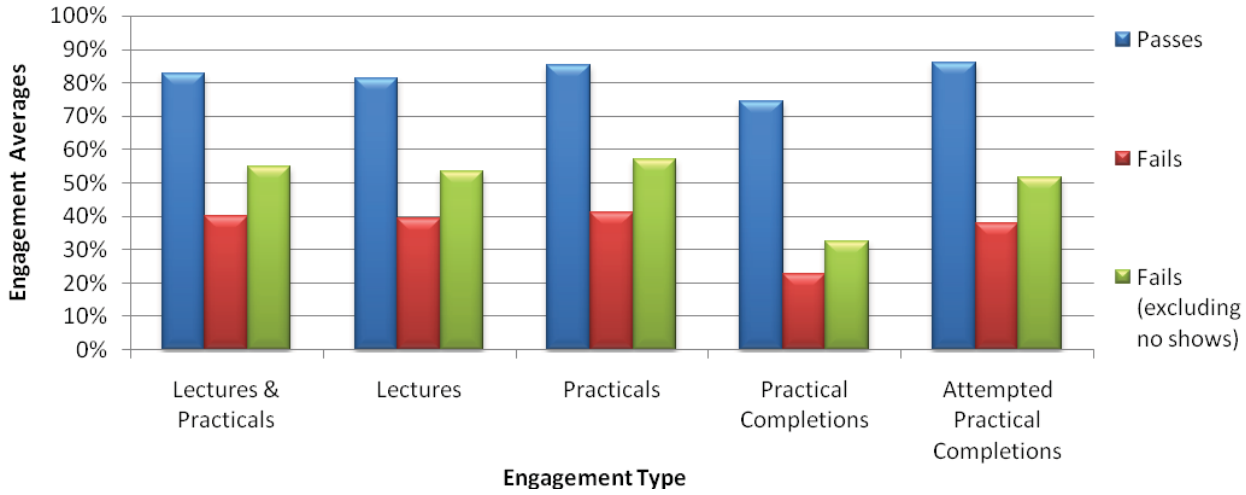
Graph 4. Final Grade vs Practical Completions



Graph 5. Final Grade vs Attempted Practicals Completion



Graph 6. Final Grade vs Moodle Hits



Graph 7. Engagement Averages vs Engagement Type

Table 1. Average Moodle Hits for Passing and Failing Students

Student Group	Average Moodle Hits
Passing Students	258
Failing Students	155
Fails Students (excluding no shows)	178

Discussion

The scatter graphs (excluding the Moodle Hits graph) show stronger concentrations in the top right corners, indicating that high engagement generally results in higher marks. Graphs 1-5 lean towards a linear relationship existing between face-to-face engagement and academic success for approximately 50-60 percent of the population (given by the r-squared values). This relationship is also supported by the attendance/completion averages (Graph 7) which also show that on average, students who passed the paper had much higher attendance and completion rates. Although a correlation appears to exist this should not be used to imply direct causation as there are many other factors that contribute to academic success (Dollinger, Matyja, & Huber, 2008), a discussion of these factors is however outside of the scope of this research.

In interpreting the data it should also be noted that the practical completions and attempted practical completions only measure students who completed practicals during their timetabled practical sessions. Accordingly, these measurements do not take into consideration students who completed the practicals in their own time outside of the timetabled classes. This factor may account for the reduced r-squared value in Graph 3.

Although the graphs show a stronger concentration in the high engagement/high grade area, the data begins to splay substantially in the middle section of the graphs. This splaying of the data is caused by students with relatively low engagement who still achieved high grades, and also students with relatively high engagement who ended up with low grades. These occurrences are contrary to the idea of linear relationship. Closer examination of the (for want of a better word) offending students reveals likely reasons for the splaying of the data. The low engagement/high grade students were individuals with prior programming experience, and it would be feasible to assume these students may have felt engagement was not a necessary requirement in order to be successful in this particular paper. Secondly, the high engagement/low grade students consisted of two main groups. The first were students who engaged strongly during the first half of the semester but did not complete the major assessments toward the end of the semester (i.e. the final assignment worth 35% and the final exam worth 30%). The second were students who were unfortunately awarded a zero grade for a 35% final assignment due to plagiarism.

Interestingly, even though the Moodle hits averages from Table 1 seems to suggest that higher Moodle hits result in higher grades, Graph 6 (Moodle hits scatter graph) is less conclusive than Graphs 1-5. This can be seen in the large spread of hit counts amongst both passing and failing students. The r-squared value (~20%) also indicates a low probability of a linear relationship between Moodle hits and final grade. This

phenomenon either implies online engagement has little impact on academic success, or is perhaps more likely due to factors that surround how the Moodle hit count is generated by Moodle. According to Moodle documentation, the hits figure represents a count of the areas of the site students have visited since the creation of their account (Moodle.org, 2009). A closer examination of the data reveals that repeated actions (e.g. multiple views of the exam roster) are all counted as individual hits. The validity of the hit count is also degraded due to the fact that it is not a true measurement of how long students spend with a particular online resource (e.g. a student who opens the weeks lecture slides and views them slide by slide extensively for two hours is awarded the same individual Moodle hit as a student who accidently opens the weeks lecture slides and quickly closes it). The data may also be skewed by students who choose to download material for offline viewing. For example, instead of accessing lectures slides via Moodle on multiple occasions (which would result in multiple hits), some students may access the lecture slides once (resulting in a single Moodle hit) and then elect to save the information to portable storage devices for future use (a practice relatively common amongst the student body).

Conclusions

This study agrees with the existing literature and supports the notion that high student engagement, in general, translates to increased student success rates. The study also suggests that high face-to-face engagement is still necessary and beneficial for success in blended delivery courses. However, the notion of a linear relationship existing between engagement and success is not conclusively supported by the research results.

Due to the blended delivery of the D101 Software Development paper, the study attempted to measure individual student online engagement by examining the Moodle hit count. However, little correlation was found to exist between the Moodle hit count and students final grades. Although interesting, it was felt this observation was not sufficient to conclude that online engagement had no direct impact on student success. This was due to closer examination revealing that Moodle hit counts are likely not an accurate measure for student engagement with regards to online resources. This position is based on the manner in which the figure is generated, coupled with the variety of student habits surrounding the use of online resources. Consequently, if a future replication or related study were to occur it is recommended that a more valid way of measuring student engagement with regards to online resources be formulated.

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