Educational performance, 'clicker' engagement and ethnicity: Evidence from Finance 101

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Abstract:

We explore the nexus between academic performance, ethnicity and student engagement via learning technologies. We do so in the context of an introductory, high volume, finance course at a leading Australasian university. More specifically, we explore three research questions (1) What factors determine student 'clicker' based engagement? (2) Does engagement improve academic performance? (3) Do Māori and Pacific Island (MPI) students underperform their peers and do the determinants of performance differ to those of their peers? Our results support several important findings. First, male students in the early stages of their degree and living in a residential college attend lectures more often than other students. Second, Non-MPI students who attend lectures as measured by engagement through clicker participation achieve higher marks on both the formative (Quizzes) and summative assessments (a Midterm exam). Third, MPI students have lower average attainment in the Midterm compared to other Finance 101 students. Finally, this research highlights that drivers of success for MPI students are different and not well captured by our model. In particular, unlike other students, attendance did not prove to be an important determinant in attainment.

Keywords: Tertiary education; higher education; finance; learning technologies; Māori; Pacifica

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1. Introduction

We explore the nexus between academic performance, ethnicity and student engagement through learning technologies. We do so in the context of an introductory, high volume (approximately 500 students per semester), finance course at a leading New Zealand university. As such our paper addresses three issues of substantive concern in educational research and educational policy; (1) what individual (e.g. demographic) characteristics influence 'clicker engagement', (2) to what extent student engagement through learning technologies impact educational performance and (3) we explore the performance of Māori and Pacific Island students in terms of attainment, engagement and the nexus between the two.

Educational technologies are seen as a means of potentially improving student engagement and performance. They provide students and staff with frequent feedback on performance and facilitate blended learning and formative assessment approaches in tertiary education contexts that have large volumes of students (Angus and Watson 2009; Fies & Marshall, 2006; Hepplestone *et al*. 2011; Patterson *et al.*, 2010). One popular approach in this respect is to provide students with formative 'low stakes' quizzes via a web-based course management system such as Blackboard (Angus and Watson 2009; Hepplestone *et al*. 2011). This approach was employed on the finance course we evaluate in this paper, with four formative quizzes being offered over the course of the semester.

Another educational technology that is used less often but has grown in prominence is 'Classroom Response Systems' or 'clickers'. They are seen as a way of making large lectures interactive and giving students and teachers near instantaneous and frequent feedback on student comprehension and learning (Fies & Marshall, 2006; Patterson *et al.*, 2010). In this paper we explore 'clicker' data used during lectures in an introductory finance course over two semesters in 2013. From this data we derive a measure of student attendance at lectures thereby providing us with a clicker based measure of student engagement, which we refer to as 'clicker engagement'. This in turn provides us with the engagement data with which to explore the engagement, performance and ethnicity nexus.

In terms of ethnicity, one of the six strategic priorities of New Zealand's *Tertiary Education Strategy 2014-2019* is 'boosting achievement of Māori and Pasifika' students (MoE 2014, p.12). This strategic priority arises from a history of lower participation in

degree level higher education and achievement rates by both Māori and Pacific Island (MPI) students (see Section 2.2 and MoE 2014). In response, universities have developed their own strategies to address this issue. This paper was inspired by issues identified as part of Otago Business School Māori & Pacific Island Early Intervention Programmes (University of Otago) which indicated underperformance of MPI students on the compulsory introductory finance course (The course is compulsory for all students on the Bachelor of Commerce undergraduate qualification). From the offset we would like to make clear that Māori and Pacific Island students face distinct but related educational challenges and that even within these groups there are considerable differences often driven by socioeconomic status (Mayeda *et al.* 2014; Strathdee & Engler 2012). Due to the limited sample size of PI students we unable to separate the two, so our analyses groups them together.

To summarize and as noted above, we explore the nexus between student engagement, ethnicity and academic performance on an introductory finance course (hence forth referred to as Finance 101) at the University of Otago. More specifically, we explore three research questions:

- What factors or characteristic determine student 'clicker' based engagement?
- Does engagement as measured by clicker participation and online quiz participation improve academic performance?
- Do Māori and Pacific Island students underperform their peers and do the determinants of performance (e.g. 'clicker' engagement) differ to those of their peers?

We do so econometrically using three datasets, the first measures student 'clicker' engagement, the second provides data on student performance on Finance 101 (including results on both formative and summative assessment) and the third is enrolment data which includes a range of demographic variables. The rest of the paper is structured as follows: the next section develops research hypotheses, Section 3 outlines research design, Section 4 reports results, while Section 5 provides concluding remarks.

2. Hypotheses development

In this section we develop hypotheses around the use of educational technologies in the learning environment (Section 2.1) and in terms of expectations about the performance of MPI students (Section 2.2).

2.1 Clickers and Blackboard Quizzes: Engagement and Formative Assessment

Wang (2006, p.172) notes the "*purpose of the formative assessment during the teaching process is to illuminate learner difficulties and enhance teacher effectiveness"* with an important component of this being providing students with 'continuous feedback'. As noted in the Introduction to our study, the Finance 101 course utilised two learning technologies to encourage student engagement and to facilitate formative assessment: Clickers and Blackboard Quizzes. There is evidence in the educational research literature that both clickers and online quizzes can lead to superior academic performance (Angus and Watson 2009; Fies & Marshall, 2006; Hepplestone *et al*. 2011; Patterson *et al.*, 2010).

With respect to online quizzes, for instance, Wang (2006) in a study of 503 seventh-grade students in central Taiwan found that 'learning effectiveness' did increase with the use of online quizzes. McDaniel *et al.* (2011)'s study of 139 eighth-grade science students from the US had analogous results with 'low stakes' quizzes improving educational attainment between 13% and 25%. The notion that quizzes enhance performance is corroborated in the higher education context by Angus and Watson (2011) who conducted a study of first year business mathematics students in Australia.

With respect to clickers similar evidence is apparent. However, in the context of clickers, the potential for engagement and interactivity is much higher due to the nature of the technology. As such, clicker engagement can be seen to be closely tied with the literature showing a positive relationship between class attendance and performance (Moore *et al.* 2009; Credé *et al.* 2010). Indeed, a growing body of literature points to enhanced educational experience following the use of clickers (De Gagne, 2011; Fies & Marshall, 2006; Heaslip, *et al.* 2013; Keough, 2012; Newman-Ford *et al.* 2008; Patterson et al., 2010). This literature points to a myriad of benefits, ranging from heightened student interactivity and participation, increased student satisfaction and understanding of complex concepts taught through clickers, and, critically, improved performance. This noted some critiques of the use of clickers are apparent with Patterson et al., (2010, p604) summarising these as including concerns about the 'reliability of the system, cost, technical knowledge, and interruption in flow of class.' Interesting, these objections are not related to their effectiveness in enhancing learning; rather they are principally about the challenges of actually implementing their use.

From the discussion above we derive our first hypothesis

Hypothesis 1: Student engagement as measured by quiz and clicker participation is one of the primary divers of academic performance in Finance 101

In terms of our contribution to this area, much of the established literature is outside business and management tertiary context (Keough, (2012) being one exception for clickers) and outside Australasia (Angus and Watson, (2011) being one exceptions for quizzes). Indeed, when reviewing 66 studies on clickers Keough (2012, p825) did not identify any in the context of finance. Accordingly, we can contribute to the literature by (1) focussing on both clickers and quizzes simultaneously thereby allowing us to reflect on their relative merits (2) doing so in terms of a challenging finance module taken by Business undergraduates whom are both finance and non-finance majors, and (3) providing evidence for Australasia in the context of New Zealand, thereby allowing us to explore the nexus of technology enabled engagement and performance of indigenous and minority groups.

2.2 Māori and Pacific student performance

There is well established evidence showing that MPI students have underperformed their peers educationally, reflected at tertiary level in lower participation and educational attainment (often measured by lower degree completions rates) (Lock & Gibson, 2008; Maani, 2000; MoE 2014; Shulruf *et al.* 2008; Scott 2006; Strathdee & Engler 2012).[1] This in turn is related to diminished life changes, in terms of employment and income (Lock & Gibson, 2008; Maani, 2000; MoE 2014). Policies to address the issue of educational underperformance would appear to have helped to 'close the gap', yet a gap still exists and is especially pronounced in postgraduate education (MoE 2014; Scott 2006).

From the discussion above, the following hypothesis was formulated

Hypothesis 2: MPI students are underperforming relative to their peers in Finance 101

Further, as noted in Section 2.1, educational performance seems to be closely tied to attendance or engagement. Indeed, Credé et al. (2010) observe that attendance is the best predictor of performance, better than any other predictor of performance. Indeed, evidence

[1] In terms of participations rates this is somewhat of a simplification since there are interactions between ethnicity and socioeconomic status. Some Māori students from high socioeconomic background are well represented and perform well, whereas it is those from lower socioeconomic groupings that tend to be underrepresented and underperform. See Strathdee & Engler (2012) for a fuller discussion of within ethnic group variability and the interaction of ethnicity and socioeconomic status.

outside New Zealand suggests that the relationship between lecture attendance/engagement and academic performance is stronger for minority groups (Moore *et al.,* 2009; Gatherer & Manning, 1998). This might suggest that lower educational attainment may be related to lower attendance/engagement. Thus, building on this and *Hypothesis 1* we develop our third hypothesis

Hypothesis 3. MPI students have lower lecture attendance/clicker engagement and this in turn is an important factor in explaining lower attainment in Finance 101.

Finally, the literature exploring MPI tertiary educational performance consistently highlights cultural differences between MPI students and their counterparts of European origin (in Māori described as Pākehā) (Adds *et al.* 2011; Mayeda *et al.,* 2014). For instance, in a novel contribution in this area that turns the issue MPI underperformance on its head, Mayeda *et al.* (2014) explore the factors that drive success among MPI students. Mayeda *et al.* (2014) find that MPI success is associated with family and university support and role modelling; indigenous teaching and learning practices; and resistance to everyday colonialism and racism. This would suggest that the factors driving educational engagement and attainment of MPI students might be considerably different due to cultural difference and a Pākehā bias or framework to how tertiary education is conducted

Hypothesis 4: Due to cultural differences the factors driving educational engagement and attainment of MPI differ to their (principally Pākehā) counterparts in Finance 101

There is an obvious tension between *Hypothesis 3* and *Hypothesis 4*. The former suggesting that the principal driver of attainment (namely attendance/engagement) is no different between MPI and Pākehā, while the latter emphasises cultural differences between the two groups that lead to different factors diving success. This tension is best addressed empirically.

Overall, our contributions to the literature exploring MPI tertiary educational performance is to provide evidence at a less aggregate level (i.e at a course specific level) and in a context where there was anecdotal evidence that MPI students appeared to be particularly struggling (This was an issue that came up in discussion as part of the Otago Business School Māori & Pacific Island Early Intervention Programmes). This lower level of aggregation allows us to empirically explore issues at greater detail, such as exploring the nexus between engagement/attendance and MPI educational attainment.

3. Methodology

This section reports the research design of the study.

3.1. Research Ethics

Ethical approval for this research was obtained through a category B application to The University of Otago Human Ethics Committee (UOHEC).

3.2. Finance 101 and the use of clickers

Finance 101 is a one of seven core courses which are a mandatory requirement for all BCom students at the University of Otago.[2] The course is offered in each semester of the academic year and typically hosts around 500 students per semester. Students are taught in a large classroom setting which makes engagement with the teacher and the topic challenging. Clicker technology was introduced into Finance 101 in semester 1 of 2013 as a tool to increase student engagement with the content being presented in the classroom. Clickers had been successfully used in the core statistics course two years earlier. Based on the positive response from students to the clicker technology a decision was made to use them in Finance 101 as an additional classroom teaching tool.[3] During the first week of the semester each student was issued with a clicker. Student identification numbers were matched to unique clicker identifier numbers to enable student attendance and performance to be tracked. The clicker technology is activated once a student registers the clicker online at the H-ITT website which is the free online technology that tracks student performance for each class and results are easily downloaded to an Excel spreadsheet.[4] Marks for clicker usage were awarded based on participation and correctness. Students earned 5 marks for a correct answer and 3 marks for an attempt. As an incentive to encourage clicker usage a participation mark of 5% was included in the overall grade. This was calculated using the best 7 out of 15 clicker scores.[5]

[2] The University of Otago BCom require all majors to taken seven core courses in addition to the major requirements for their degree. Core courses include Finance, Accountancy, Marketing, Management, Information Systems, Economics and Statistics. Students are advised to complete the seven core courses by the end of the second year of their degree.

[3] Course evaluations from Business Statistics 101 showed that students understood concepts more easily and enjoyed the interaction created by using clickers during lectures.

[4] www.h-itt.com H-ITT stands for Hyper-interactive teaching technology, a firm in Florida, USA that develops software to support the clicker technology.

[5] Students were told to bring clickers to each class however they were used on average for two out of every three classes a week in semester 1 2013 and in nearly every class of semester 2, 2013.

The primary importance of the clickers to our study is that they serve as a measure of attendance.

Finance 101 has several layers of internal assessment. Students are required to participate in at least three of four online quizzes throughout the semester together with a Midterm exam. The Midterm exam serves as a 'terms requirement' for entry to the final exam. Thus, a student must score at least 40% on the Midterm exam to be eligible to sit the final exam. Students who fail to meet this criterion must repeat the course in a subsequent semester. The Midterm is an exit point for underperforming students and is normally taken half way through the semester. Many students exit Finance 101 after the Midterm exam because they fail to meet the minimum 40% requirement. The purpose of our study is to examine the relationship between performance and attendance on the Midterm exam for MPI and non-MPI students. Our clicker data covers the first half of each semester.[6] Initially we use the clicker data to investigate what factors determine clicker based engagement. The second research question asks does engagement through clicker participation and online quiz assessment improve performance? Our study examines how attendance from the clicker data affects pass rates on Quiz1, Quiz2 and the Midterm exam. Finally, we test for differences in performance between MPI and other student groups after controlling for additional factors that may impact student performance. Results from early online formative assessment data for Quiz1 and Quiz2 are also used to test for performance differences. Our sample covers both semesters of 2013 and semester one of 2014.

3.3. Variables and models

Definitions of the variables used in the study are given in Table A1 of the Appendix. We want to determine what increases student engagement in Finance 101. The study then investigates how engagement (attendance based on clicker usage) affects performance. Finally we wish to investigate differences in performance between the MPI and non-MPI student groups. We include controls for other external factors that may also impact student performance. Our data analysis is done in two stages. The first stage uses parametric and non-parametric tests to identify significant differences between the mean and median measures of lecture attendance, internal assessment marks (for Quiz1 and Quiz2) and Midterm exam marks for the whole sample, by semester and between MPI and non-MPI student groups. The

[6] We use the Midterm as the best guide to performance for two reasons (1) because many students exit the course at this point, the midterm provides the best comparator of relative performance since all students will have taken the same assessments (unlike the final exam where only those that passed the midterm take it) (2) for various reasons we only has clicker/attendance data for the first half of the semester in both semester 1 and 2 of 2013.

second stage fits two multivariate regression models to investigate what factors influence student attendance and how these vary between MPI and non-MPI student groups with respect to performance. The first model is given by equation (1).

$$Attendance = \alpha + \beta_1 Major + \beta_2 Study\_Year + \beta_3 Gender + \beta_4 College + \beta_5 Finalist + \beta_6 Decile + \beta_7 Asian + \beta_8 International + \beta_9 MPI + \epsilon \quad (1)$$

Equation (1) tests if there is a significant difference between attendance at lectures due to: the student being a Finance major, the year of study, gender, living at a residential college, being a finalist, the decile of the high school the student attended, if the student is of Asian ethnicity, an international or an MPI student. In particular we wish to test if attendance is significantly different for MPI students. We estimate equation (1) to test:

$$H_0: \beta_9 = 0$$
$$H_A: \beta_9 \neq 0$$

If attendance for MPI students is significantly different to that of non-MPI students we expect to reject the null hypothesis and accept that the MPI coefficient in equation (1) is either positive or negative.

The second multivariate regression model is used to test for an association between the assessment mark for the Midterm exam, lecture attendance and the MPI student cohort after controlling for other factors that also have the potential to influence the Midterm exam score. This model is given in equation (2).

$$MidTerm = \alpha + \beta_1 Quiz1 + \beta_2 Quiz2 + \beta_3 Attendance + \beta_4 Major + \beta_5 Study\_Year + \beta_6 Gender + \beta_7 Asian + \beta_8 International + \beta_9 MPI + \beta_{10} College + \beta_{11} Finalist + \beta_{12} Decile + \epsilon \quad (2)$$

The model is estimated using the full sample and across each semester, respectively. Equation (2) tests for an association between performance and each of the factors in the model. We are particularly interested in the sign and significance of β_3 and β_9. Based on the null hypothesis that attendance does not impact performance we are looking for evidence to test:

$$H_0: \beta_3 = 0$$
$$H_A: \beta_3 > 0$$

As noted in Hypothesis 1 (Section 2.1) our *a priori* expectation is that attending lectures enhances performance, hence better attendance should improve the assessment mark. This

should be true for Quiz1, Quiz2 and the Midterm mark. *Hypothesis 2* (Section 2.2.) looks at the association between Midterm mark and the MPI group. In order to test if MPI Midterm marks are significantly different to other students we estimate equation (2) to test:

$$H_0: \beta_9 = 0$$
$$H_A: \beta_9 < 0$$

If MPI students do score significantly lower on the Midterm exam we would expect to reject the null hypothesis and accept that the MPI coefficient in equation (2) is negative. The other factors in the model may improve or reduce the Midterm mark. Prior expectations suggest that Quiz1, Quiz2, major, year of study (study_year), Asian, finalist and decile will be positively related to the Midterm mark. In other words students who achieve higher marks on the quizzes preceding the Midterm exam, are finance majors, who have been studying longer, have Asian ethnicity or are finalists and come from a higher decile high school will get a higher mark on the Midterm. The relationship between Midterm, gender, international and college could be positive or negative. Equation (2) is also estimated across the subsample of MPI students for each semester as well as the whole sample.

The regression models expressed in (1) and (2) are both fitted with a proportional dependent variable (attendance measured as a percentage in (1) and Midterm score as a percentage in (2)) that is bounded between zero and one. Thus we employ regressions models that are appropriate for the proportional (i.e. bounded) nature of the dependent variables (Baum 2008). We perform a weighted least squares logit estimation on the transformed dependent variable which corrects for the heteroskedastic nature of the error term.[7] As a robustness check on our results we also estimate equations (1) and (2) using a linear regression to model the logit transformation of the dependent variable for each model respectively. The results from the two estimations give coefficients and test statistics that are not materially different.

3.3. Data and Descriptives

In order to examine our research questions and test our hypotheses we merged three datasets via student ID; the first was clicker data from the H-ITT software from which we

[7] The logit transformation on the dependent variable, $y^* = log\left(\frac{y}{1-y}\right) = X\beta + \epsilon$, ensures that predictions for the dependent variable lie within [0,1]. The models are fitted using the GLOGIT function in Stata.

derived our 'clicker' engagement/attendance variable (See Table A1); the second provides data on student performance as part of final grade reporting (on the Quizzes, the Midterm and Final); and the third is centrally held enrolment data which includes a range of demographic variables and student information (e.g. gender, major(s) and minor(s), year of enrolment, type of accommodation, national vs international, ethnicity etc.).

The sample summary statistics are reported in Panel A of Table 1. There are 1396 observations in our sample made up of 120 MPI students and 1276 other students. The data set contains information on student attendance based on clicker usage in class, marks for Quiz1, Quiz2 and a Midterm exam. In addition we also have the following control variables: age, year of study, gender, high school decile, major subject, ethnicity, accommodation while studying and if the student is a finalist. Summary statistics for the full sample are reported in Table 1 and show that students typically score better on Quiz1 than Quiz2 and achieve an average of 62% (median = 63%) on the Midterm exam. Average lecture attendance is 68% of the time (median = 79%). There are more males in the class (mean = 58%) with an average of 15% of students declaring Finance as their major. On average students are in their second year of study and come from high schools with a mean decile rating of 8 (median = 9). One quarter of the sample were living in residential colleges and 13% declared their ethnicity as Asian. International students make up 6% of the sample. These students are non-Asian and are not New Zealand citizens. Students in their final year of study comprise 6% of the sample.

[Insert Table 1 here]

Panels B and C of Table 1 give the summary statistics for the MPI student cohort and the other students in the study, respectively. In line with *Hypothesis 2*, (see section 2.2) the mean scores for Quiz1, Quiz2 and the Midterm are all lower for the MPI group suggesting that these students may not perform as well as the non-MPI students. Consistent with *Hypothesis 3* MPI students also attend class less on average. Further, MPI students are more likely to be in a residential college and come from a high school with a lower decile rating than their non-MPI counterparts. Table A2 in the appendix reports the corresponding summary statistics for each semester and shows similar features to the results reported for the overall sample. Table A3 in the appendix reports the correlation coefficients for all the variables used in the regression models.[8]

[8] Variance inflation factors are calculated for all the regression models and they are in the range 0.5 to 2.

4. Econometric results

Our first research question examines what factors affect student engagement using the model given in equation (1). The model tests for an association between lecture attendance and the independent factors on the right hand side of the equation. Equation (1) is fitted using a logistic regression technique that takes into account the bounded nature of the attendance variable and corrects for the heteroskedasticity in the error terms. The results are reported in Table 2.[9] The results for the 2013 year show that attendance is associated with year of study, gender, residential college accommodation and belonging to an Asian ethnic group. Students living in a residential college or of Asian ethnicity have higher lecture attendance. Surprisingly male students who are in the early stages of their degree attend lectures more compared to female students who have been at university longer.

[Insert Table 2 here]

Consistent with the work by Credé et al. (2010) our second research question considers how lecture attendance (as measured by clicker engagement) impacts student performance.[10] Parametric and non-parametric tests based on the mean and median scores for Quiz1, Quiz2 and the Midterm exam by attendance are reported in Table 3. Panels A, B and C report the test statistics for semester 1, semester 2 and the full sample, respectively. These tests highlight two interesting results. First, attendance leads to better performance. Students who attend lectures have significantly higher scores for Quiz1, Quiz2 and the Midterm exam. Second, tests for the sample partitioned into MPI and non-MPI students show that while the impact of attendance on performance is statistically significant for the non-MPI students it only seems to have an impact on the mark for Quiz1 within the MPI sample. Hence attendance is critical to performance in Finance 101 but not for MPI students, thereby lending some support to *Hypothesis 4* that the context and determinants of MPI student success may be different to their counterparts.

[Insert Table 3 here]

[9] Attendance data is only available for 2013.
[10] Credé et al. (2010) show that attendance is the best predictor of performance.

Our third research question seeks to determine if there are differences between MPI and non-MPI students in terms of performance and attendance. Statistical tests for differences between mean and median measures of performance and attendance are reported in Table 4. Panels A, B, C and D report the test statistics for semester 1, 2013; semester 2, 2013; semester 1, 2014 and the full sample, respectively.[11] The most striking feature of the results in Table 4 is the consistent difference between the Midterm mark for the MPI compared to the non-MPI student group. Regardless of the time period over which the tests are carried out the test statistics show that the MPI students achieve a significantly lower mean and median mark on the Midterm exam compared to the other students in Finance 101. Attendance in semester 2, 2013 and for the full sample is also significantly higher for the non-MPI student group compared to the MPI group. The results show that non-MPI students have a higher average attendance rate compared to MPI students. These results suggest that average Midterm exam performance and average attendance is higher for non-MPI students.

[Insert Table 4 here]

Tests of significance for differences in the mean and median Midterm exam scores based on marks achieved on Quiz1 or Quiz2 are reported in Table 5. Quiz1 and Quiz2 are the first two marked formative assessment exercises prior to the Midterm exam. The tests reported in Table 4 are used to see if the marks achieved on either quiz can be used to determine how well the student does on the Midterm exam. There are two main results in Table 5. First, the tests for a significant difference in the Midterm exam result based on each of the Quiz1 and Quiz2 marks are all highly significant. This indicates that students who achieve a better mark on either Quiz 1 or Quiz 2 will also achieve a better mark on the Midterm exam. Second, there is a distinct difference between the effectiveness of the quiz scores in determining Midterm Exam performance between the MPI and non-MPI student groups. In particular, on a semester basis the performance on either quiz is a statistically significant factor in differentiating Midterm exam success for the non-MPI group only. Using the full sample results Quiz1 and Quiz2 may be useful in helping to identify MPI students who are at risk of failing the Midterm exam.

[Insert Table 5 here]

[11] Note that attendance data was only gathered for 2013, hence there are no tests for difference in attendance by student group reported in Panel C (semester 1,2014) of Table 3.

The final part of our study uses proportional regression models fitted to the bounded Midterm exam scores to examine the relationship between Midterm exam performance relative to student internal assessment marks (Quiz1 and Quiz2 scores) and other factors that may also impact performance or attendance. Equation (2) is estimated for the full sample of observations and the results are reported in Table 6. The results for the model fitted using data across each semester are reported in Table A4 of the Appendix. Our sample contains observations for international students who did not attend high school in New Zealand. These students do not have a high school decile rating. Column (1) of Table 6 reports the coefficients estimated for the model fitted using all the observations for which attendance and decile rating information is available. However international students who did not attend high school in New Zealand will be excluded as they do not have a decile rating. The model is re-estimated with the decile variable removed. The coefficients are reported in column (2). Since attendance data is not available for 2014, Column (3) reports the estimated model with the attendance variable removed. Column (4) shows the model estimated with both attendance and decile removed. Column (5) reports the estimated model for MPI students only.

[Insert Table 6 here]

The results in Columns (1) to (4) of Table 6 show quite consistently that students who are Finance majors, in their second or a later year of their degree, regularly attend lectures and do well on Quiz1 and Quiz2 achieve a higher score on the Midterm exam on average. The final column of Table 6 reports the coefficients for the MPI students. MPI Midterm exam scores are associated with a higher Quiz1 mark and the year of study. Contrary to *Hypothesis 3* and lending support to *Hypothesis 4*, attendance is not a significant factor in explaining MPI performance for the Midterm exam in Finance 101. Consistent with *Hypothesis 4,* the model shows that there is a significant difference between factors influencing performance for MPI and non-MPI students. It is not clear from our study what other factors may be affecting MPI performance in Finance 101 and this serves as an opportunity for future research.

5. Conclusion

This study asks three important research questions. First, what factors or characteristics determine student attendance measured using 'clicker' based engagement?

Second, does engagement measured by clicker participation and online quiz participation improve academic performance? Third, do MPI students underperform their peers and do the determinants of performance differ to those of their peers? The questions are examined in the context of a large, first year Finance course. The purpose of the study is three-fold. We examine the relationship between lecture attendance, academic performance, and determinants of difference for MPI and non-MPI students using data collected from clickers employed in a Finance 101 class. The study combines course related performance measures, lecture attendance and other student specific data to test the importance and impact of attendance (measured using 'clicker' based engagement) on performance. The study has five key results. First, attendance at lectures is higher for male students in the earlier stages of their degree. Residential college accommodation also improves attendance in semester 1. This may be due to the ease with which groups of students can walk to class together based on sharing the same accommodation. However residential college accommodation is not important in semester 2. Second, attendance is an important component for success in Finance 101. Students who attend lectures as measured by engagement through clicker participation achieve higher marks on both the internal assessment prior to the Midterm exam and the exam itself. However, attendance is not a critical factor to success on the Midterm exam for MPI students. Third, MPI students achieve lower marks on the Midterm exam compared to the rest of the student cohort. In some semesters underperformance is also recorded for the internal assessment marks as well. Fourth, internal assessment can be used to identify those students who will achieve higher marks on the Midterm exam. However, internal assessment is not a good indicator of Midterm exam performance for MPI students. Fifth, performance on the Midterm exam is associated with good internal assessment, lecture attendance, students who intend to major in Finance and the year of study. Surprisingly decile rating, accommodation type, international and gender are not related to the Midterm mark. Finally, our study shows that the drivers of success for MPI students seem to be different and not well captured by our model. Our results show that MPI students have lower average achievement scores compared to other Finance 101 students. These results motivate future research to determine why average attendance for MPI students is lower as well as identifying other key factors that can enhance both engagement and performance by these students.

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Table 1: Summary Statistics

This table reports the mean, median, standard deviation, maximum and minimum score for each of Quiz1, Quiz2, Quiz3, Quiz4 and the Midterm exam together with attendance, the proportion of Finance majors (Major), year of study, proportion of male students (Male) , international students, students who are Asian, students living in a residential college, finalists and the decile of the high school the student attended prior to coming to university.

	Quiz1 (%)	Quiz2 (%)	Quiz3 (%)	Quiz4 (%)	Midterm (%)	Attendance (%)	Major	Year of study	Male	International	Asian	Residential College	Finalist	Decile
Panel A: Full Sample														
Mean	75.61	52.59	63.70	68.90	62.05	68.51	0.15	2.10	0.58	0.06	0.13	0.25	0.06	8.29
Median	75.00	50.00	70.00	70.00	63.00	78.57	0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	97.50	100.00	1.00	10.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	17.14	23.76	27.13	25.27	15.55	30.05	0.35	1.18	0.49	0.24	0.34	0.44	0.24	1.92
Sample size	1396	1336	1214	1144	1443	980	1469	1469	1469	1469	1469	1469	1469	1306
Panel B: Maori and Pacific Island Students														
Mean	71.88	50.35	57.29	63.44	55.48	58.70	0.17	1.93	0.56	0.05	0.00	0.34	0.04	7.38
Median	75.00	50.00	60.00	70.00	57.50	66.67	0.00	1.50	1.00	0.00	0.00	0.00	0.00	8.00
Max	100.00	100.00	100.00	100.00	90.00	100.00	1.00	10.00	1.00	1.00	0.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	21.42	25.49	32.75	29.41	18.97	21.30	0.38	1.40	0.50	0.21	0.00	0.48	0.20	2.38
Sample size	120	113	107	87	126	71	126	126	126	126	126	126	126	120
Panel C: All Other Students														
Mean	75.97	52.79	64.32	69.35	62.67	69.27	0.15	2.11	0.58	0.06	0.14	0.25	0.06	8.38
Median	75.00	50.00	70.00	70.00	65.00	78.57	0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	97.50	100.00	1.00	8.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	17.50	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	16.65	23.60	26.46	24.86	15.05	29.83	0.35	1.15	0.49	0.24	0.35	0.43	0.24	1.85
Sample size	1276	1223	1107	1057	1317	909	1343	1343	1343	1343	1343	1343	1343	1186

Table 2: GLOGIT Regression Results with Attendance as the Dependent Variable
This table reports the results for Equation (2) estimated using a logistic regression . Column (1) shows the coefficients for the full sample. Columns (2) and (3) report the model fitted for the data in Semester 1, 2013 and Semester 2, 2013, respectively.***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Dependent Variable: Attendance						
	S1 and S2, 2013		S1, 2013		S2, 2013	
Independent Variables						
Intercept	1.7542	***	1.8790	***	1.8537	***
Major	0.0485		0.1894		-0.1119	
Study_year	-0.1073	**	-0.1377	*	-0.0946	
Gender	-0.3902	***	-0.5194	***	-0.2850	**
College	0.396	***	0.5105	***	0.2761	
Finalist	-0.0106		0.1219		-0.1177	
Decile	-0.0231		-0.0080		-0.0564	
Asian	0.3319	*	0.0781		0.6533	**
International	-0.2049		-0.4354		0.1737	
MPI	-0.2448		-0.4314		0.0292	
Sample size	663		370		293	
F Statistic	4.60	***	361	***	2.02	**
Adjusted R^2	0.0596		0.0598		0.0304	

Table 3: Parametric and Non-Parametric Tests of Performance Based on Attendance at Lectures

This table reports the results of tests for a significant difference between the mean and median performance measures on each of the assessments Quiz1, Quiz2 and the Midterm exam based on attendance by the students at lectures. The test statistics and significance are reported for the whole sample, the MPI and non-MPI student groups. The results are shown for each semester of 2013 as well as for all of 2013. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.[12]

					MPI				OTHER			
	Mean (F statistic)	Median (Kruskal Wallis)	Variance (Levene)	Sample size	Mean (F statistic)	Median (Kruskal Wallis)	Variance (Levene)	Sample size	Mean (F statistic)	Median (Kruskal Wallis)	Variance (Levene)	Sample size
Panel A: Semester 1, 2013												
Quiz1	2.6219***	44.1696***	1.5024*	482	1.3393	13.0395	1.7775	31	2.4316***	41.4630***	1.3645	451
Quiz2	3.7650***	59.8045***	1.3624	453	0.4169	7.2986	1.4793	26	3.7517***	60.2387***	1.4013	427
Midterm	5.4018***	81.1650***	0.986	505	0.7294	11.2432	2.0878*	34	5.2907***	77.7515***	1.1649	471
Panel B: Semester 2, 2013												
Quiz1	3.2982***	44.3176***	1.5860*	448	2.3210*	14.4214	1.5175	37	2.8421***	38.8739***	1.0521	411
Quiz2	4.8826***	65.8275***	1.4649	429	1.8446	15.0459	2.2176*	37	3.8786***	53.3696***	1.305	392
Midterm	6.9834***	94.7185***	1.1526	456	1.2915	14.4214	1.8840*	37	6.8124***	84.7528***	1.0181	419
Panel C: Full Sample												
Quiz1	3.0796***	90.8740***	1.6946**	930	2.0216**	24.6476	1.6214*	68	2.8120***	84.1080***	1.3618*	862
Quiz2	5.3340***	145.6432***	1.4110*	882	1.2515	24.4850	2.2027**	63	4.9251***	134.7231***	1.2983	819
Midterm	6.3799***	171.7153***	1.1371	961	1.0651	25.7565	1.1635	71	6.1440***	158.5109***	1.1978	890

[12] Lecture attendance using clickers was only measured in 2013.

Table 4: Parametric and Non-Parametric Tests of Performance Between Māori and Pacific Island Students and Other Students

This table reports test statistics for significant differences between the mean and median marks for Quiz1, Quiz2, the Midterm exam and the lecture attendance score measured by clicker usage in class for the MPI students compared to the rest of the sample.*** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

	Mean (t test)	Anova (F Stat)	Median (Wilcoxon)	Median (Kruskal)	Variance (Levene)	Sample size
Panel A: Semester 1, 2013						
Quiz1	0.7259	0.5269	0.8958	0.8037	0.0240	482
Quiz2	0.0573	0.0033	0.1427	0.0206	1.5302	453
Midterm	2.6340***	6.9379***	2.6110***	6.8201***	0.0046	505
Attendance	1.1292	1.275	1.498	2.2459	0.3545	505
Panel B: Semester 2, 2013						
Quiz1	3.4772***	12.0910***	1.8314*	3.3567*	16.7502***	448
Quiz2	2.0832**	4.3396**	1.4828	2.2008	7.3722***	429
Midterm	3.5978***	12.9443***	1.7550*	3.0823*	18.6295***	456
Attendance	2.9036***	8.4311***	2.8843***	8.3234***	1.587	466
Panel C: Semester 1, 2014						
Quiz1	0.4481	0.2008	0.3201	0.1028	2.7983*	466
Quiz2	0.5727	0.3280	0.5570	0.3109	0.0133	454
Midterm	2.7970***	7.8232***	2.6557***	7.0554***	1.1376	482
Panel D: Full Sample						
Quiz1	2.5037**	6.2685**	1.6265	2.6458	10.8913***	1396
Quiz2	1.0454	1.0929	0.7900	0.6243	0.4410	1336
Midterm	4.9983***	24.9834***	3.9575***	15.6627***	8.2219***	1443
Attendance	2.8658***	8.2131***	3.1600***	9.9872***	0.2921	980

Table 5: Parametric and Non-Parametric Tests of Performance Based on Quiz Scores Leading up to the Midterm Exam

This table reports test statistics for significant differences between the mean and median marks achieved on Quiz1and Quiz2 prior to the Midterm exam for semester 1, 2013; semester 2, 2013; semester 1, 2014 and the full sample period. The results are reported for each student cohort within the testing period as well as for the MPI and non-MPI groups. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

	Sample		MPI Group		OTHER Group	
Panel A: Semester 1, 2013						
	Quiz1	Quiz2	Quiz1	Quiz2	Quiz1	Quiz2
Mean (F Stat)	7.8441***	7.4367***	1.2119	1.3207	7.4193***	7.1093***
Median (Kruskal)	60.2733***	60.4754***	7.1782	10.1784	56.4930***	58.0822***
Variance (Levene)	1.0282	1.8460*	0.8924	0.9057	1.0568	1.6313
Sample size	473	444	31	26	442	418
Panel B: Semester 2, 2013						
Mean (F Stat)	8.3077***	9.4112***	2.2698*	1.3765	9.2259***	9.6581***
Median (Kruskal)	88.9242***	87.7958***	13.0480	14.1727	78.8435***	76.1578***
Variance (Levene)	1.4915*	1.5667	1.9185*	1.766	2.1495***	1.6022
Sample size	439	419	37	37	402	382
Panel C: Semester 1, 2014						
Mean (F Stat)	10.9438***	11.3300***	1.5925	2.1928**	11.3860***	10.5247***
Median (Kruskal)	101.5073***	92.4734***	11.59997	15.4746*	94.0795***	83.1039***
Variance (Levene)	0.7469	0.6256	2.8066**	0.8519	0.6707	0.5806
Sample size	460	449	52	50	408	399
Panel D: Full Sample						
Mean (F Stat)	12.8145***	24.7761***	1.7855*	2.4184**	12.6518***	22.3378***
Median (Kruskal)	236.2126***	221.9790***	24.9652**	26.0518***	213.9463***	200.6580***
Variance (Levene)	1.3028	1.7204*	0.6746	0.9057	1.3869	2.0700**
Sample size	1372	444	120	113	1252	1199

Table 6: GLOGIT Regression Models for Performance on the Midterm Exam Using the Full Sample

This table reports the results for the GLOGIT regression model stated in equation (1). The equation is fitted to the Midterm exam scores using all observations available for each of the scenarios. Column (1) shows the full model for all observations with attendance data, Column (2) reports the model excluding the decile measure[13], Column (3) excludes attendance, Column (4) excludes both decile and attendance and Column (5) is for the subsample of Māori and Pacific Island students.***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

	Dependent Variable: Midterm									
	(1)		(2)		(3)		(4)		MPI	
Independent Variables										
Intercept	-0.8812	***	-0.9809	***	-0.7965	***	-0.8702	***	-0.6652	*
Quiz1	0.9482	***	0.9301	***	1.1866	***	1.145343	***	0.6072	**
Quiz2	0.7687	***	0.8013	***	0.9461	***	0.9739	***	0.7440	
Attendance	0.4972	***	0.4929	***					0.1743	
Major	0.2147	***	0.1831	***	0.2004	***	0.1525	***	0.2801	
Study_year	0.0575	**	0.0445	**	0.0509	***	0.0345	*	0.1522	**
Gender	-0.0008		-0.0014		0.0037		0.0109		-0.1294	
Asian	0.0289		0.0401		0.0649		0.0732			
International	0.0042		0.0119		-0.0340		0.0001			
MPI	-0.0715		-0.0556		-0.1534	**	-0.1511	**		
College	-0.0714		-0.0703		-0.0171		-0.0261		0.1324	
Finalist	-0.0159		0.0060		-0.0042		0.0275			
Decile	-0.0158				-0.0145				-0.0003	
Sample size	733		832		1125		1266		53	
F Statistic	18.95	***	24.11	***	32.21	***	39.95	***	2.57	**
Adjusted R^2	0.2273		0.2343		0.2340		0.2354		0.1948	

[13] Note that attendance data is only available for 2013 and decile information is only given for those students who attended a New Zealand high school before coming to university.

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Appendices

Table A1: Variable Names and Definitions

This table reports the definitions for each of the variables used in the study.

Name	Variable	Definition
Quiz1	Quiz1	Percentage score for quiz1
Quiz2	Quiz2	Percentage score for quiz2
Quiz3	Quiz3	Percentage score for quiz3
Quiz4	Quiz4	Percentage score for quiz4
Midterm	Midterm	Percentage score for the Midterm exam
Attendance	Attend	Proportion of the lectures attended. If a student used a clicker at least once during a lecture they are counted as present. Clicker usage is used to calculate the total lectures attended. Attendance is measured as the ratio of lectures attended divided by the total number of lectures where clickers were used.
Major	Major	Dummy variable that takes a value of 1 if the study declares Finance as a major subject in their degree.
Year of Study	Study_Year	Number of year since joining the university (measured from year of joining until the student enrolls in FINC 101)
Male	Male	Dummy variable that takes a value of 1 if the student is male and zero otherwise.
Gender	Gender	Categorical variable that takes a value of 1 for a male and 2 for a female. This variable is used in the regression models.
MPI	MPI	Dummy variable that equals 1 if the student is of Māori or Pacific Island heritage.
International	International	Dummy variable that equals 1 if the student is not a New Zealand citizen, and is not of Asian or MPI ethnicity.
Asian	Asian	Dummy variable that equals 1 if the student declares their ethnicity as being Chinese, Indian, Korean, Japanese, Vietnamese, Cambodian, Filipino or South East Asian.
Residential College	College	Dummy variable that equals 1 if the student lives in a university residential college.
Finalist	Finalist	Dummy variable that equals 1 if the student is in their final year of study.
Decile	Decile	Value between 1 and 10 that gives a socio-economic score of the high school the student attended prior to coming to university. This score is only available for those students who attended high school in New Zealand.

Table A2: Summary Statistics by Semester

This table reports the mean, median, standard deviation, maximum and minimum score for each of quiz1, quiz2, quiz3, quiz4 and the Midterm exam together with attendance, the proportion of Finance majors (Major), year of study, proportion of male students (Male) , international students, students who are Asian, students living in a residential college, finalists and the decile of the high school the student attended prior to coming to university.

	Quiz1 (%)	Quiz2 (%)	Quiz3 (%)	Quiz4 (%)	Midterm (%)	Attendance (%)	Major	Year of study	Male	International	Asian	Residential College	Finalist	Decile
Panel D: Semester 1, 2013														
Mean	74.79	46.29	66.93	79.50	61.39	67.39	0.13	2.21	0.57	0.07	0.14	0.22	0.08	8.37
Median	80.00	50.00	70.00	90.00	62.50	78.57	0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	97.50	100.00	1.00	8.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	10.00	10.00	10.00	17.50	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	17.53	22.63	27.13	21.80	15.57	30.02	0.34	1.21	0.50	0.25	0.34	0.41	0.27	1.94
Sample size	482	453	437	418	505	514	514	514	514	514	514	514	514	460
Panel E: Maori and Pacific Island Students														
Mean	72.58	46.54	55.52	77.69	54.63	61.55	0.12	2.00	0.47	0.09	0.00	0.21	0.03	6.79
Median	70.00	50.00	50.00	80.00	53.75	67.86	0.00	2.00	0.00	0.00	0.00	0.00	0.00	8.00
Max	100.00	100.00	100.00	100.00	87.50	100.00	1.00	5.00	1.00	1.00	0.00	1.00	1.00	10.00
Min	40.00	10.00	10.00	30.00	25.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	17.51	21.34	33.12	22.15	15.23	29.32	0.33	1.02	0.51	0.29	0.00	0.41	0.17	2.86
Sample size	31	26	29	26	34	34	34	34	34	34	34	34	34	33
Panel F: All Other Students														
Mean	74.94	46.27	67.74	79.62	61.87	67.80	0.14	2.23	0.58	0.06	0.15	0.22	0.08	8.49
Median	80.00	50.00	70.00	90.00	62.50	78.57	0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	97.50	100.00	1.00	8.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	10.00	10.00	10.00	17.50	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00
Standard Deviation	17.54	22.73	26.51	21.80	15.50	30.06	0.34	1.23	0.49	0.25	0.35	0.41	0.27	1.80
Sample size	451	427	408	392	471	480	480	480	480	480	480	480	480	427

Table A2 continued

	Quiz1 (%)	Quiz2 (%)	Quiz3 (%)	Quiz4 (%)	Midterm (%)	Attendance (%)	Major	Year of study	Male	International	Asian	Residential College	Finalist	Decile
Panel G: Semester 2, 2013														
Mean	76.43	55.83	60.36	63.55	61.39	69.74	0.15	1.95	0.59	0.08	0.15	0.26	0.05	8.28
Median	75.00	60.00	60.00	70.00	63.00	75.00	0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	95.00	100.00	100.00	8.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	16.80	23.67	27.34	23.59	15.72	30.06	0.35	1.21	0.49	0.26	0.36	0.44	0.22	1.89
Sample size	448	429	390	355	456	466	466	466	466	466	466	466	466	403
Panel H: Maori and Pacific Island Students														
Mean	67.34	48.11	53.06	61.74	52.59	56.08	0.22	1.92	0.62	0.05	0.00	0.32	0.03	7.74
Median	75.00	50.00	55.00	70.00	58.00	66.67	0.00	1.00	1.00	0.00	0.00	0.00	0.00	8.00
Max	100.00	90.00	100.00	100.00	80.00	100.00	1.00	8.00	1.00	1.00	0.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	4.00
Standard Deviation	27.03	29.71	36.47	25.88	24.66	33.20	0.42	0.61	0.49	0.23	0.00	0.47	0.16	2.11
Sample size	37	37	36	23	37	37	37	37	37	37	37	37	37	34
Panel I: All Other Students														
Mean	77.25	56.56	61.10	63.68	62.17	70.92	0.14	1.95	0.59	0.08	0.17	0.25	0.05	8.33
Median	75.00	60.00	60.00	70.00	63.00	83.33	0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	95.00	100.00	1.00	8.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	8.33	10.00	0.30	0.70	18.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Standard Deviation	15.34	22.93	26.18	23.00	23.46	29.53	0.35	1.17	0.49	0.27	0.37	0.43	0.23	1.87
Sample size	411	392	354	332	419	429	429	429	429	429	429	429	429	369

Table A2 continued

	Quiz1 (%)	Quiz2 (%)	Quiz3 (%)	Quiz4 (%)	Midterm (%)	Attendance (%)	Major	Year of study	Male	International	Asian	Residential College	Finalist	Decile
Panel J: Semester 1, 2014														
Mean	75.68	55.81	63.41	62.08	63.36		0.16	2.12	0.58	0.04	0.11	0.29	0.06	8.21
Median	75.00	60.00	70.00	60.00	65.00		0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	95.00		1.00	10.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	20.00		0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00
Standard Deviation	17.06	23.74	26.56	26.51	15.32		0.37	1.09	0.49	0.21	0.31	0.46	0.23	1.93
Sample size	466	454	387	371	482		489	489	489	489	489	489	489	443
Panel K: Maori and Pacific Island Students														
Mean	74.68	54.00	62.14	54.74	57.95		0.18	1.89	0.56	0.02	0.00	0.44	0.05	7.53
Median	75.00	60.00	70.00	60.00	57.50		0.00	1.00	1.00	0.00	0.00	0.00	0.00	8.00
Max	100.00	90.00	100.00	100.00	90.00		1.00	10.00	1.00	1.00	0.00	1.00	1.00	10.00
Min	25.00	0.00	0.00	0.00	27.50		0.00	1.00	0.00	0.00	0.00	0.00	0.00	3.00
Standard Deviation	18.74	24.07	29.09	32.53	16.53		0.39	1.49	0.50	0.13	0.00	0.50	0.23	2.19
Sample size	52	50	42	38	55		55	55	55	55	55	55	55	53
Panel L: All Other Students														
Mean	75.81	56.04	63.56	62.91	64.05		0.16	2.15	0.58	0.05	0.12	0.27	0.06	8.30
Median	75.00	60.00	70.00	70.00	67.50		0.00	2.00	1.00	0.00	0.00	0.00	0.00	9.00
Max	100.00	100.00	100.00	100.00	95.00		1.00	7.00	1.00	1.00	1.00	1.00	1.00	10.00
Min	0.00	0.00	0.00	0.00	20.00		0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00
Standard Deviation	16.86	23.72	26.27	25.66	15.04		0.37	1.03	0.49	0.21	0.33	0.45	0.23	1.87
Sample size	414	404	345	333	427		434	434	434	434	434	434	434	390

Table A3: Correlation Coefficients for Factors in the GLOGIT Regression Analysis

This table reports the Pearson correlation coefficients for each pair of variables in the proportional regression models fitted to the bounded Midterm exam marks reported in the study. Tests for correlations significantly different from zero are shown. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

	Quiz1	Quiz2	Attendance	MAJOR	Year of Study	Male	Asian	International	MPI	Residential College	Finalist
Quiz2	0.2727 ***										
Attendance	0.2482 ***	0.3193 ***									
Major	0.0784 ***	0.1229 ***	0.1005 ***								
Year of Study	-0.0999 ***	-0.1747 ***	-0.2385 ***	-0.1997 ***							
Male	-0.0207	0.0019	-0.1156 ***	0.1666 ***	-0.0461 *						
Asian	0.0056	0.0861 ***	0.1578 ***	0.0813 ***	0.0322	-0.0317					
International	-0.0379	-0.0381	-0.0204	-0.0513 **	0.0553 **	-0.0452 *	-0.1002 ***				
MPI	-0.0669 **	-0.0286 **	-0.0913 ***	0.0232	-0.0443 *	-0.0160	-0.1195 ***	-0.0182			
Residential College	0.1033 ***	0.1834 ***	0.1522 ***	0.1442 ***	-0.4728 ***	0.0747 ***	-0.0895 ***	-0.0659 **	0.0609 **		
Finalist	-0.0467 *	-0.0871 ***	-0.0964 ***	-0.1070 ***	0.4538 ***	0.0292	-0.0585 **	-0.0543 **	-0.0283	-0.1437 ***	
Decile	0.0501 *	-0.0090	0.0070	0.0348	-0.0710 **	-0.0264	-0.0656 **	0.0063	-0.1495 ***	0.1169 ***	-0.0182

Table A4: GLOGIT Regression Results for Midterm Performance for Semester 1, Semester 2 of 2013 and Semester 1 of 2014

This table reports the results for the GLOGIT regression model stated in equation (1). The results are reported in Panels A, B and C corresponding to semester 1, 2013; semester 2, 2013; semester 1, 2014, respectively. The equation is fitted to the Midterm exam scores using all observations available for each of the scenarios. Column (1) shows the full model for all observations with attendance data, Column (2) reports the model excluding the decile measure, Column (3) excludes attendance, Column (4) excludes both decile and attendance and Column (5) is for the subsample of Māori and Pacific Island students.***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Panel A: Semester 1, 2013										
	Dependent Variable: Midterm									
	(1)		(2)		(3)		(4)		(5)	
Independent Variables										
Intercept	-0.7892	***	-0.9560	***	-0.4603		-0.6714	***	-0.9031	
Quiz1	1.0120	***	1.0441	***	1.0978	***	1.1242	***	0.6926	*
Quiz2	0.7999	***	0.7870	***	0.9044	***	0.9131	***	1.1322	
Attendance	0.4673	***	0.4785	***					0.0772	
Major	0.1736	*	0.1307		0.1985	*	0.1510		0.5386	
Study_year	0.0549		0.0424		0.0353		0.0280		0.3626	*
Gender	-0.0450		-0.0220		-0.0804		-0.0502		-0.3893	
Asian	0.1025		0.0196		0.1408		0.0661			
International	-0.0450		0.0008		-0.0592		0.0140			
MPI	-0.3196	**	-0.2586	**	-0.3320	**	-0.2636	**		
College	0.0144		0.0022		0.0489		0.0384		0.4857	
Finalist	-0.1248		-0.0801		-0.1133		-0.0692			
Decile	-0.0157				-0.0186				-0.0322	
Sample size	384		427		384		427		24	
F Statistic	9.77	***	11.25	***	9.33	***	10.92	***	1.22	
Adjusted R^2	0.2155		0.2141		0.1931		0.1888		0.0709	

Table A4 continued

Panel B: Semester 2, 2013										
	Dependent Variable: Midterm									
	(1)		(2)		(3)		(4)		(5)	
Independent Variables										
Intercept	-0.9422	***	-1.0390	***	-0.6704	***	-0.8400	***	-0.7276	
Quiz1	0.9441	***	0.8406	***	1.0891	***	0.9728	***	0.8387	**
Quiz2	0.8670	***	0.9254	***	1.0204	***	1.0851	***	0.4829	
Attendance	0.4870	***	0.4859	***					0.4988	
Major	0.2495	**	0.2280	**	0.2292	**	0.2178	**	0.1879	
Study_year	0.0480		0.0383		0.0303		0.0227		0.0463	
Gender	0.0245		0.0105		0.0005		-0.0007		0.0261	
Asian	-0.0388		0.0600		0.0202		0.1426	*		
International	0.0665		0.0384		0.0430		0.0551			
MPI	0.15721		0.1286		0.1154		0.0801			
College	-0.1895	**	-0.1700	**	-0.1648	**	-0.1567	**	-0.0063	
Finalist	0.1642		0.1422		0.1933		0.1657			
Decile	-0.0237				-0.0307	*			-0.0048	
Sample size	349		405		349		405		29	
F Statistic	11.45	***	14.43	***	10.69	***	13.67	***	2.08	*
Adjusted R^2	0.2649		0.2678		0.2346		0.2388		0.2363	

Table A4 continued

Panel C: Semester 1, 2014								
	Dependent Variable: Midterm							
	(1)	(2)	(3)		(4)		(5)	
Independent Variables								
Intercept			-1.2082	***	-1.1073	***	-1.4213	*
Quiz1			1.4369	***	1.3916	***	1.2045	*
Quiz2			0.9713	***	0.9571	***	1.1878	**
Attendance								
Major			0.1837	**	0.0988		0.4733	
Study_year			0.065	*	0.0360		0.0663	
Gender			0.0681		0.0683		0.0606	
Asian			0.0726		0.0067			
International			-0.0883		-0.0540			
MPI			-0.2299	**	-0.2473	***		
College			0.0106		-0.0109		-0.1353	
Finalist			0.0167		0.0585			
Decile			-0.0019				0.0066	
Sample size			392		434		46	
F Statistic			15.31	***	18.10	***	2.03	*
Adjusted R^2			0.2871		0.2831		0.1376	