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Investigating the moderating effect of student engagement on academic performance

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The academic performance and success of students are important for both higher education institutions and students. Student engagement has been identified as a crucial factor in academic success. Studies investigating student engagement have typically used self-report measures of engagement, collected at a given point in time. Self-report measures are, however, prone to positive bias (social desirability). In an attempt to overcome these shortfalls, data were collected over three years (2010-2012) in a third-year Business Management module, presented at a South African university (n=380). Academic and behavioural student engagement was measured by assessing academic activities (class attendance and weekly homework assessments), rather than with a self-report measurement scale. Unlike previous studies that correlated student engagement with academic performance, this article argues that student engagement enhances academic performance. It was found that student engagement significantly moderated the relationship between early and late semester assessments of academic performance (semester test and examination marks). It was, therefore, concluded that higher levels of engagement enhance the learning experience and subsequent performance in the module. High levels of student engagement may even lead to higher, than would otherwise be expected, academic performance.

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Education plays a vital role in the lives of individuals, communities and countries. Students attend universities with the goal of acquiring qualifications that will, it is hoped, allow them to build a better future for themselves and their families. Over the past two decades, globally, higher education has been subjected to a substantial ferment, in which African universities have fully shared. However, over the last decade, the South African media has increasingly reported on the so-called South African education crisis. Various commentators refer to ever-increasing skills shortages, decreasing matriculation pass rates and a dearth of much-needed resources to meet the education needs of the country. In an attempt to resolve these challenges, the South African government continues to make significant monetary allocations to institutions of higher education (Gernetzky 2011; Swart & Greyling 2011; News24 2008; Sawyerr 2004).

The education sector received the largest proportion of South Africa's fiscal budget for 2012/2013 (SAGS 2012). Over the past three decades, South Africa has also received more international donor funding earmarked for education than many other countries in the world (Abrahams 2011). However, the academic results of current students do not necessarily relate well to the sizeable funding invested in them, nor with the implicit academic performance expectations of both the international donors and government. A recent report by Higher Education South Africa (HESA) indicated that the rate of students who withdraw before completing their degrees had reached 35% at some South African universities (Beck 2011). In addition, the overall graduation or throughput rate of 15% across South African universities is one of the lowest in the world and is reason for concern (Letseka & Maile 2008).

There are many factors, both external and internal to the classroom, that may influence the academic performance of students and these include factors related to the family of origin (socio-economic status and education level of the parents being most apparent); availability of extra-curricular educational support activities, and the quality of the classroom environment and teaching practices. All of these impact - positively or negatively - on the academic performance of students (Príncipe 2005). A recent research report published by the University of the Witwatersrand (Maher 2011) indicated that preparedness,

intelligence as well as reading and writing abilities should be considered as determining factors of the academic success of South African first-year students. Another important academic success factor being put forward is that of student engagement (Goodman et al. 2011; Strydom et al. 2010). Student engagement refers to the willingness of students to participate in routine academic activities such as attending class, submitting required homework assignments and doing well in continuous assessments, as well as meaningful student involvement throughout the learning process (Jackson 2011; Chapman 2003).

Few researchers have, to date, attempted to investigate the relationship between student engagement and academic performance in non-numerical/non-quantitative modules within the South African context (see Van Walbeek 2004; Kruger 2008). Van Walbeek's (2004) study focused on a Microeconomics module in which a combination of theory and calculations/quantitative aspects is taught. Non-numerical modules, on the other hand, focus on theoretical/textual content, with little or no calculations/quantitative aspects.

In addition, previous studies on student engagement have used self-report measures of engagement, measuring students' own perception of their engagement (Goodman et al. 2011; Appleton, Christenson & Furlong 2008; Smith & Colby 2007; Carini, Kuh & Plein 2006; Klem & Connell 2004; Kuh 2001). It is argued that such self-reported perceptions of engagement are most likely subjective and often influenced by social desirability (Rajamanickam 2005; Jackson 1977). It is expected that students would respond in a way that is more socially acceptable when asked about how engaged they are in their studies. It is, therefore, believed that students' responses concerning their own engagement are mostly positively biased.

In an attempt to overcome the possible bias in the measurement of student engagement, student engagement was measured, in the present study, using a different approach that, it was hoped, would provide a more accurate reflection thereof. Instead of using a self-report engagement scale, routine academic activities were used to measure student engagement. These activities included actual class attendance and weekly homework assignment marks that were recorded throughout a semester. The homework assignments were a form of continuous assessment that tested the students' mastery of the

content covered during the previous week. The semester test and final examination marks were used as measures of mid-semester and end-of-semester academic performance, respectively. Data were collected over a three-year period for a third-year non-numerical subject presented at a South African university.

In previous studies, student engagement has been correlated with academic performance (with a mark in a test and/or examination). In the present study, it is argued that student engagement not only correlates with academic performance, but also enhances the learning experience and subsequently improves academic performance. In other words, it is argued that student engagement moderates the relationship between early and late assessments of academic performance in a module, with greater engagement related to better marks in the final assessment.

1. Student engagement and academic performance

The student engagement construct has recently been at the centre of many academic discussions and a number of definitions have been put forward. The construct broadly refers to how much time, effort and energy students utilise to make their learning at university beneficial (Strydom et al. 2010; Krause 2005). Student engagement can be used as a proxy to describe how well or thoroughly students participate in daily academic life, which includes academic activities such as the completion of homework assignments, studying for tests and attending classes. Researchers concur that, when students are actively academically engaged, they will be likely to derive an educational benefit in the sense that they will pass final examinations and/or perform well (Esposito & Weaver 2011).

Literature indicates at least four types of student engagement, namely cognitive, psychological, academic and behavioural engagement (Gilman et al. 2009; Tinio 2009). Cognitive engagement requires students to evaluate the quality of their relationship with the academic institution, whereas psychological (emotional or affective) engagement refers to the student's relationship with peers and reactions to the academic material; for example eagerness, interest or boredom (Peacock et al. 2010; Wang & Holcombe 2010; Gilman et al. 2009). Thomas & Higbee (2000) noted that, irrespective of how

intellectually stimulating the lecturer is, or how clear the explanations are, even the best lecturer may not be able to reach the student who has no real interest in learning. Due to the nature of the first two components, self-report measures are generally used in cognitive and psychological engagement studies. By contrast, academic engagement refers to the time that a student spends on specific academic tasks, such as the completion of homework assignments or studying for a test or examination. The outcomes of academic engagement are, therefore, often determined by considering the measurable outcomes or results of written coursework. Behavioural engagement refers to the active participation of students in learning activities such as attending classes and/or tutorial classes (Gilman et al. 2009).

Students who attend higher education institutions are expected to be academically and behaviourally engaged and perform well in assessment activities. According to Bell (2012), educational institutions often determine their success in terms of their students' academic performance. However, the current reality is that students are not necessarily actively academically engaged and performance results often do not meet expectations.

The degree of student learning and academic success often depends on how students make use of available academic resources (Krause & Coates 2008). Constantly spending time reviewing and learning coursework through regular class attendance and the completion of (high standard) homework assignments could be effective in increasing the retention of information, while providing the opportunity for mastering study material. Effective learning is also associated with academic performance as measured by (high) test and examination marks (Credé et al. 2010: 274; Grabe 2005).

According to Bell (2012), educational institutions often determine their success according to their academic performance. Academic performance is measured by assessment activities that lecturers use to aid the learning of students. Semester tests and final examinations are generally used to assess the performance of students at a given time. A test or examination refers to a formal, systematic procedure in which a sample of the students' performance is scored (Berry 2008). One could, therefore, propose that the more students are engaged, physically and psychologically, in learning activities (by attending

class regularly and successfully completing homework assignments), the better they will perform in tests and, as a result, in the final examinations. The converse is also believed to be true.

For the purposes of the present study, academic and behavioural engagement was investigated. Academic engagement was assessed by means of the marks students achieved on weekly homework assignments (a measure of their mastery of the material). Their class attendance was monitored at every class and used as a measure of behavioural engagement. Class attendance is intuitively regarded as an important contributor to academic success. Several studies have investigated the relationship between class attendance and performance at university, with the common conclusion that a positive relationship exists between these two constructs (Allen & Webber 2010; Bevitt, Baldwin & Calvert 2010; Nyamafene 2010; Van Schalkwyk, Menkveld & Ruiters 2010).

One would expect that mid-semester and end-of-semester marks would be significantly positively correlated. However, based on the earlier discussion of student engagement and academic performance, it is proposed that the more engaged students are in their learning by, for instance, attending class regularly (behavioural engagement) and completing and doing well on the homework assignments that continuously assess their mastery of the material (academic engagement), the better they will perform in the final examinations (academic performance). It is, therefore, argued that student engagement moderates the relationship between mid-semester and end-of-semester academic performance. Based on the notions and arguments presented so far, the following proposition was formulated: The interaction between engagement (academic and behavioural) and semester test results produces variance in examination results not attributable to the main effect of semester test results.

Based on the arguments presented above, the proposed conceptual model under investigation is illustrated graphically in Figure 1.

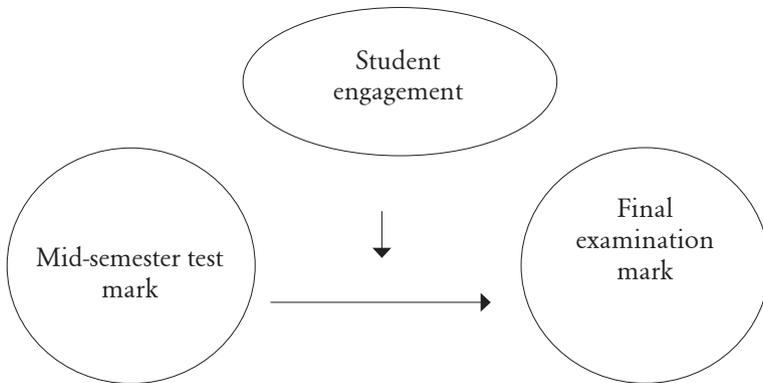


Figure 1: Conceptual model under investigation

2. Research method

Quantitative data were collected and used to statistically assess the relationship between semester test marks (mid-semester academic performance) and final examination mark (end-of-semester academic performance), as moderated by academic and behavioural student engagement.

Student engagement and academic performance data for a third-year Business Management module at a South African university was collected over three years. This was done to mitigate differences within and between student groups and to allow for a larger sample size. More specifically, records of students' marks for semester tests, weekly homework assignments and examination marks, as well as class attendance were collected and collated. The specific module was selected, as the methods of teaching and assessment during the three-year period remained relatively consistent. This module was further presented by the same lecturer over the three years.

Students completed a short in-class exercise handed out in each class during the semester (a total of 19 class exercises per semester). These exercises were used to record class attendance. Students were also expected to submit weekly homework assignments during the course of the semester. Homework assignments had a minimum length of

one and a maximum of four typed pages. Students had to write a semester test, usually within the first half of the semester. The semester test was based on a case study, and students were expected to apply the theory they had learnt to the case study. Most of the questions were essay-type questions. During the examinations, students wrote a three-hour paper. The format of the examination paper was similar to that of the semester test. No previous test and examination papers were used in any assessment and no questions were repeated or reused during the three-year period.

All marks (homework assignments, semester test and examination) were calculated as percentages. Class attendance was also calculated as a percentage (the number of classes a student attended divided by the total number of classes during the semester). For the purposes of the present study, a composite variable consisting of class attendance and the mean homework assignments mark was calculated and used as a measure of academic and behavioural student engagement.

3. Results

In total, 531 students were registered for the third-year module over the three years during which data were collected (2010: $n=214$, 2011: $n=170$, 2012: $n=147$). The final sample ($n = 380$) (2010: $n=139$, 2011: $n=131$, 2012: $n=110$) consisted only of students that had written both the mid-semester test and the end-of-semester assessment (final examination). The average age of the students was 22 years and the average throughput rate of the module, over the three years, was 76% (2010 = 75%, 2011 = 76%, 2012 = 77%). Table 1 summarises the sample demographics collected.

Although everything possible was done to keep the teaching input and assessments consistent across the three years, the average homework assignment, semester and final examination marks across the three years did seem to differ somewhat (see Table 1).

Table 1: Descriptive statistics¹ of demographic variables, class attendance, homework assignment, semester and final examination marks (n=380)

	2010	2011	2012	2010-2012
Average class test mark ¹	31% (8%)	31% (7%)	32% (8%)	32% (7%)
Average homework assignment ¹	42% (13%)	56% (13%)	51% (11%)	50% (17%)
Average class attendance ¹	59% (28%)	70% (21%)	60% (24%)	63% (25%)
Average examination mark ¹	50% (8%)	53% (9%)	52% (11%)	52% (10%)
Gender:				
Male	25%	28%	39%	30%
Female	75%	72%	61%	70%
Race:				
White	93%	88%	88%	90%
Generic Black	7%	12%	12%	10%
Faculty:				
Humanities (BA)	4%	5%	5%	4%
Commerce (BCom)	96%	95%	95%	96%
Residence:				
Lives in Residence	26%	11%	16%	18%
Not in Residence	74%	89%	84%	82%

¹Mean scores are presented with standard deviations in parentheses

The mid-semester test mark and examination mark were found to be significantly positively correlated ($r = .45, p < 0.01$). The student engagement score was further found to be significantly positively correlated with both the test mark ($r = .13, p < 0.05$) and the examination mark ($r = .29, p < 0.01$). Partial correlation was used to investigate the relationship between the mid-semester test mark and the examination mark, controlling for student engagement. The correlation coefficient was found to be smaller, but still significantly positively correlated ($r = .40, p < 0.01$).

4. The moderating effect of student engagement

The proposition claimed that student engagement would moderate the relationship between the semester test and the examination mark. To test this interaction, a new variable, which is the product of the mid-semester test mark and student engagement, was created. However, if two variables are merely multiplied with one another to create a third variable, at least two problems arise. First, either one or both of these variables will be highly correlated with their product, making for multicollinearity (Howell 2002). This could seriously affect the magnitude and tests of significance of the coefficients for the main effects. Secondly, any effect of either variable in the regression analyses will be evaluated at a value of 0 for the other variable (Howell 2002). Both these issues (multicollinearity and evaluating one main effect at an extreme value of the other main effect) are problematic. To circumvent these two problems, Howell (2002) suggests that the data be centred (in other words, that the variable's mean be subtracted from the individual's observations). The two centred variables are then multiplied with one another to form the interaction term (Howell 2002). The equations used to derive the interaction term were as follows:

- centred semester test mark (cST) = $ST - \text{Mean}_{ST}$
- centred engagement (cENG) = $\text{Engagement} - \text{Mean}_{ENG}$
- centred interaction term (cST*cENG) = $cST \times cENG$

The interaction of the two predictor terms (semester test mark and student engagement) was then examined by including the interaction term in a hierarchical regression analysis. In an attempt to isolate the contribution of student engagement, a set of dummy variables were included in the first model to control for demographic or year group variables that predict variance in the dependent variable. These k-1 dummy variables included race (generic black/white), residence (yes/no) and dummy variables for each of the three year cohorts (2010, 2011, 2012). Table 2 presents the results of the hierarchical regression analyses investigating the proposed moderated relationship. In the hierarchical multiple regression analyses, tolerance (0.742 to 0.992, for instance, >.10) and VIF (1.008 to 1.325, for instance <10) did not indicate multicollinearity.

Table 2: Hierarchical regression of selected demographic variables, class mark and student engagement and the interaction with student engagement on examination mark (n=380)

Predictor	Model summary			Anova	Coefficients		
	R	R square	R square change	F(df)	B	Beta	t
Dependant variable: examination mark							
.509							
Model 1	.351	.123	.123	10.513**(5)			
(const)							
Gender					49.688		3.2128**
Residence					4.597	.221	4.508**
Gen_black/ white					-4.556	-.183	-3.698*
Y2012					.379	.012	.245
Y2010					-2.069	-.098	-1.762
					-5.093	-.257	-4.566**
Model 2	.537	.288	.165	21.486**(5)			
(const)							
Gender							
Residence					31.188		7.782**
Gen_black/ white					2.563	.963	2.660**
Y2012					-2.345	-.094	-2.056
Y2010					-.560	-.018	-.399*
Semester test					-2.924	-.139	-2.744**
Engagement					-5.398	-.272	-5.211**
					.333	.258	4.186**

Predictor	R	R square	R square change	F(df)	B	Beta	t
Model 3							
(const)	.543	.295	.007	19.384**(6)	31.998		7.967**
Gender					2.453	.118	2.551**
Residence					-2.190	-.088	-1.922
Gen_black/ white					-.611	-.019	-.437
Y2012					-2.628	-.125	-2.448*
Y2010					-3.741	-.189	-2.769*
Semester test					.264	.205	3.026**
Engagement					.181	.175	2.587**
cST*cENG					.002	.139	1.902**

Residence = lives in university residence (Y/N); Gen_black/white (generic black/white), cST = centred Semester Test, cENG = centred Student Engagement, * Significant at the 0.05 level (2-tailed), ** Significant at the 0.01 level (2-tailed)

From Table 2 it is apparent that the regression model was able to significantly predict variance in the dependent variable, examination mark. In total, 29.5% of the variance was explained: 12.3% by the selected demographic variables and year cohorts; a further 17% by the semester mark and student engagement, and another 0.7% by the interaction term (ST*cENG). Testing the amount of variance explained by demographic variables allows one to statistically control for these and show how much more variance can be explained by the test variables. A larger portion of the variance was explained by the test variables than by demographic variables only (18% vs 12%, respectively).

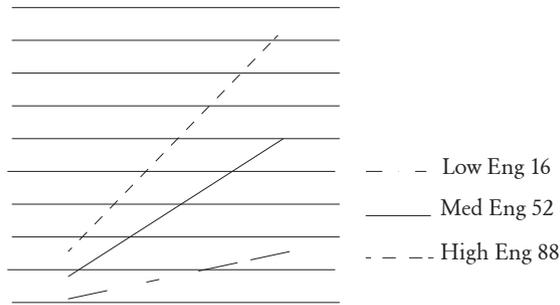
Most of the demographic variables (except race), as well as the test variables (semester mark and composite student engagement score) predicted unique variance in the dependent variable, academic performance (as measured by the examination mark). In addition, the interaction term (cST*cENG) was able to significantly predict unique variance in the examination mark, thereby allowing the rejection of the null hypotheses and so providing support for the proposition

stated earlier. The multiple regression equation can be written as follows:

- Examination mark = $31.998 + 2.453 * \text{Gender} - 2.190 * \text{Residence} - .611 * \text{Race} - Y_{2012} * 2.628 - Y_{2010} * 3.741 + .264 * \text{ST} + .181 * \text{ENG} + .002 * \text{cST} * \text{cENG}$

To better illustrate the moderation result found in the present study, the relationship between the semester mark and the predicted examination mark are shown at three fixed levels of student engagement (see Figure 2). The mean plus and minus two times the standard deviation ($M \pm 2 * SD$) of the semester mark and student engagement scores were arbitrarily chosen to represent low and high scores on the variables, with the mean representing a neutral/medium level (low engagement = $\text{Mean} - 2 * SD$, medium engagement = Mean , and high engagement = $\text{Mean} + 2 * SD$). Predicted examination mark values were then calculated and plotted for the examination mark at low, medium and high levels of student engagement (see Figure 2). Semester Test results are plotted on the X axis (at three chosen levels representing low, medium and high scores) and the predicted examination mark is plotted on the Y-axis for three chosen levels representing low, medium and high engagement. The three line graphs, therefore, represent the relationships between the mid-semester test and the examination mark at the three chosen levels of engagement.

Figure 2: An illustration of the moderated relationship



10	20	48
Low ST	Med ST	High ST

Note: Eng = Student Engagement, ST = Semester Test mark

First, it is noted that highly engaged students do better than medium and low engaged students, even at the mid-semester test. Considering the gradients of the line graphs (see Figure 2), it can be noted that, at low levels of student engagement, increases in semester marks are related to seemingly small increases in the expected examination mark. However, at high levels of engagement as the semester mark increases, more dramatic increases in the projected final marks are observed over that expected for students with lower levels of engagement.

5. Discussion and conclusion

This article investigated the relationship between the mid-semester test and the final semester examination performance, as moderated by student engagement. Results revealed that class attendance and homework assignment marks, as a measure of academic and behavioural student engagement, have a significant moderating effect on the relationship between the semester marks and the final examination mark. There is evidence to suggest that, if students submit homework assignments of high standard and attend class regularly, in other

words, fully engage with the academic activities of the module, they will most probably do better in the final examination than they would have if they were not as academically engaged. This result supports the notion that performance is a linear multiplication of both being willing (motivation) and able (skill, competence, ability) and that being motivated to put in the effort will result in higher performance than relying on ability alone.

Future research could include assessing whether a significant difference exists between students' perception of their own engagement and their actual engagement, as measured in this instance. In a future study, attention can further be paid to social desirability theory, by comparing the number of classes that students said they attend and the number of classes that students actually attended. If universities understand student engagement, strategies to enhance student performance could be implemented to increase throughput results.

The findings of this study corroborate that of others, which also found that students should attend class, and that class attendance will ultimately influence final examination marks.¹ The results obtained in the present study are similar to those found by Van Schalkwyk et al. (2010) who argued that it remains the responsibility of the student to make use of learning opportunities if they are to be successful. In other words, if students take responsibility for learning opportunities, they will possibly be more engaged in their learning experience and, therefore, study for tests and examinations. In doing so, students would be likely to achieve good examination marks, thus increasing throughput rates of universities.

1 See Kruger 2008; Cheung 2009; Van Walbeek 2004; Romer 1993.

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