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Student Success and the Influence of a Prerequisite Module for Investment Students at an Open Distance Learning Institution

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ABSTRACT Literature emphasises the inclusion of prerequisites in curriculum development in order for students to obtain foundation knowledge to be successful. Prerequisites assist students to assess their readiness by evaluating their familiarity with the discipline-specific knowledge. The research investigated whether a relationship exists between success in the prerequisite and the pass rate and success in the higher-level module. The population of the study consists of students who completed both modules between 2010 and 2012. Descriptive paradigm, applied regression and correlation analysis to establish whether a positive linear relationship exists. A significant moderate correlation, r (830) = .416; p <.001) exists between the percentage obtained in the two modules. The prerequisite mark is however not a good predictor of results in the higher-level module. The implications for higher education are to evaluate course development to align foundation and higher-level knowledge; to implement outcome-based assessment measures; and to highlight the importance of prerequisites to students.

INTRODUCTION

The importance of throughput in contemporary academic environments has resulted in academics focusing their efforts on finding ways to improve student performance. However the strategic goals of the institution is to simplify and streamline the Programme Qualification Mix (PQM) which includes the removal of as many as possible prerequisites, yet the paradox exist of increasing modules success and throughput rates within the institution. It is therefore important to assess the value of prerequisite modules for student success and throughput in the light of the teaching and learning policies and strategic goals of the institution. If it can be shown that the introduction of the prerequisite module in the curriculum improves the likelihood of success in the higher level module, it will provide the institution with useful information in the setting of policies and strategic goals.

Various studies have sought to find a relationship between prior knowledge and performance in higher level modules, although some studies had conflicting results on whether the introduction of a prerequisite module assists in student success in higher level studies. Shaffer et al. (2016) indicated that little has been done to evaluate the idea that the completion of a prerequisite has on the success of later courses. They further indicated that the prerequisite knowledge that students obtain may provide students with exposure to new information that might assist them in understanding the concepts within the later courses. Aoudia et al. (2015) suggested that one of the key reasons for failure of engineering students was due to the structure of the curriculum and suggested that introducing a prerequisite module might be the solution. Various other authors also proposed that the introduction of a prerequisite module was there to prepare students to cope better with difficult higher-level modules (Baard and Watts 2008; Bealing et al. 2008; Grover et al. 2009; Huang et al. 2005; Islam and Gygi 2011; Mccarron and Burstein 2016; Shaffer et al. 2016; Yousef 2011). This was supported by Sargent (2013) who indicated that literature provides evidence that the introduction of the prerequisite knowledge would improve the performance of students in the more advanced modules. Foundation knowledge is seen by most researchers as an important consideration in the success of higher-level knowledge and, as Grover et al. (2009) indicated, students perform better in higher level modules and learn more if they complete com-

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pulsory prerequisite modules. Blaylock and Lacewell (2008) and Grover et al. (2009) further indicated that almost all undergraduate business courses require students to do foundation courses in mathematics, financial accounting and economics before they enter into introductory finance courses. Mccarron and Burstein (2016) also investigated whether the introduction of a prerequisite mathematic course will assist in improving the pass rate in the introductory financial accounting module and found that the introduction of mathematics had a positive impact on the ability of students to pass introductory financial accounting.

Studies by Huang et al. (2005), Baard and Watts (2008), Bealing et al. (2008), Grover et al. (2009) and Touchton (2015) all indicated that the performance of the participating students in a prerequisite module showed a significant positive relationship with the percentage of marks obtained and the success rate in the higher-level modules. Li et al. (2012), however, found in their research that there was no significant relationship between the prerequisite module and student performance in the advanced module. Creech and Sweeder (2012) arrived at a similar conclusion, noting that the prerequisite module is not a good predictor of success in the higher-level module.

Bealing et al. (2008) argued that, in their study, the performance of students in a prerequisite accounting module showed a significant correlation with the performance in the subsequent higher-level accounting module and that the performance in the prerequisite module can be used as a valid predictor of the students' future success. This is supported by Sargent (2013) who concluded that the prerequisite module in the intermediate accounting course had a significant influence on students' performance as well as their grades in the more advanced accounting module. Baard and Watts (2008) concluded that students who received exemption or who had passed a prerequisite business statistics module had significantly better results in advanced finance modules. This was supported by Mccarron and Burstein (2016) who found a positive relationship between a prerequisite module in mathematics and students success in the introductory financial accounting course. Baard and Watts (2008) further emphasised the importance of a prerequisite module on the success rate of students in the more advanced modules.

Objectives

This study focused on investment modules in the undergraduate degree in financial management at an open distance learning (ODL) higher education institution in South Africa. The throughput rate of the higher-level Investments: Derivatives Module (Derivatives Module) has traditionally been very low, between 20 percent and 30 percent. In 2009, the university introduced the second-level investment module as a prerequisite for the higher-level Derivatives module in order to assist students to complete the module successfully, which created an increase in the pass rate by about 10 percent. The second-year module ensured that students have foundation knowledge in the investment environment, fixed income analysis, equity analysis and derivatives that form the baseline for the higher-level modules in investment management.

Based on the objectives of the institution to streamline the PQM and therefore decrease the amount of prerequisites in the qualifications and the findings of various other studies, it is important to evaluate whether the introduction of the prerequisite module had an effect of the pass rate of higher level Derivatives module. If a positive relationship exists between the two modules it can assist the institution in the formulation of policies and strategic goals for the future. The objective of the study was therefore to investigate whether the percentages that students obtained in this introductory module showed a significant correlation with the percentage obtained and the success of students in the higher-level module. A positive correlation would mean that the institution should take note of the following: the importance of the decision to include the prerequisite as a method to increase throughput; as well as the importance of the module for students who want to continue in the investment field.

Review of the Literature

Previous studies found that students' successes are increased in the higher-level modules if they complete the prerequisite modules (Alanzi 2015; Baard and Watts 2008; Bealing et al. 2008; Huang et al. 2005; Mccarron and Burstein 2016; Sargent 2013; Wisneski et al. 2016). Baard and Watts (2008) pointed out that the need for prerequisite modules in finance and account-

ing has been acknowledged by the accounting and finance professions in the United States of America since 1989. The importance of prerequisites were also investigated by Huang et al. (2005) who found that accounting students who completed a pre-test or the one-unit remedial course on accounting cycle performed significantly better than students who did not complete or failed this prerequisite module, which was also supported by the research done by Bealing et al. (2008), Sargent (2013) and Alanzi (2015). Grudnitski (1997), Islam and Gygi (2011) and Shaffer et al. (2016) further indicated that it is normal for courses to require prerequisite modules and that the mastery of these introductory courses will improve the understanding and achievement of the more advanced modules. This was confirmed by McMillan-Capehart and Adeyemi-Bello (2011) who indicated that prerequisite modules are a precondition in most curricula. It serves to prepare students for future courses and, in addition, valid prerequisite modules will increase the success of these students. Jackson (2012) goes on to comment that if a student met the requirements for the prerequisite module in business, academics can safely assume that such student has the core competency for the higher-level modules.

Bealing et al. (2008) proposed four implications that the positive correlation between the prerequisite and higher-level module could have on the accounting courses. The first implication is that course development is done by building on the existing knowledge of the students; therefore, the prerequisite can be used as a predictor of success in the higher-level modules. Secondly, they stated that if course design is done properly, it should integrate foundation knowledge and extend the knowledge in the higher-level modules. The third implication is that the relationship between foundation and higher-level modules can be used as an outcome assessment measure; and lastly, that students are focused on the bottom line in their studies and will only study materials if they feel it will be valuable to them in future (Brunig 2007 cited by Bealing et al. 2008).

The fourth implication was also recognised by Baard and Watts (2008) who claimed that students see the prerequisite module as an additional module they have to take in order to advance to the next module, and that this will have no value to them. Islam and Gygi (2011) arrived at a similar conclusion, noting that students fail to see the relevance of the prerequisite module for their career choices. Cresswell (2009), however, is of the opinion that the completion of the prerequisite module assists students in decreasing the time towards completing their relevant degrees. On the other hand, academics see the content of the prerequisite modules as the minimum knowledge the student requires in order to be successful in the advanced module (Cresswell 2009; Jackson 2012). Academics can, however, become frustrated if students enter a course without the foundation knowledge required to succeed (Islam and Gygi 2011). Evaluating the importance of the prerequisite module can also assist in informing students of the value that the module adds towards their future studies and the importance of foundation knowledge for success in their studies.

Abou-Sayf (2008) tested whether a higher success rate is evidence of the validity of including the prerequisite module in the curriculum. Abou-Sayf's study also indicated that insufficient prerequisite modules might lead to inadequate preparation and performance in the higher-level module, which would affect the dropout rate negatively and decrease the success rate of students; however, an excess of prerequisite modules increases the time required to complete the studies and carries the likelihood of increasing the dropout rate. Mccarron and Burstein (2016) also indicated that the introduction of a prerequisite module can create the consequence of possibly lengthening the time required to complete the degree and may be an obstacle in the throughput of students. Bealing et al. (2008) confirmed the findings of Abou-Sayf (2008) that prerequisite modules are necessary in curriculum development in order to build on the existing knowledge. It is therefore important to include the right number of prerequisite modules in the development of the curriculum for students to master the foundation knowledge necessary for success.

The second implication stated that a properly designed curriculum builds on the foundation knowledge in higher-level modules (Bealing et al. 2008). This was also indicated in the research by Grover et al. (2009) who found that acquiring a number of prerequisite modules, namely a challenging quantitative course for an introductory course in finance, assists students in establishing critical analytical skills and study

habits. The analytical skills and study habits are also an outcome-based assessment measure as indicated in the third implication. From the qualitative research of Dogan-Dunlap (2006) on the importance of foundation knowledge for linear algebra students, it was found that students require a firm knowledge of the basic theory in order to be successful in understanding the linear algebra concepts at a higher level. This was supported by Shaffer et al. (2016) who indicated that the knowledge students obtain in the prerequisite module may provide students exposure to new information that provide a basis for understanding the concepts within the later courses. This was also tested by Wisneski et al. (2016) who administered a 15-question multiple choice basic mathematics skills test to students in order to evaluate whether prior knowledge in statistics has an effect on the performance of students in the introductory statistics course, they found a positive and significant relationship between students' performance in the basic mathematics skills test and the introductory statistics course. The prerequisite module can therefore be used to assess the outcomes of the student in a higher-level module.

To improve the curriculum design and syllabus as well as assessment practices and teaching methods, higher education institutions should focus on the factors that influence students' success (Cheung and Kan 2002). These factors could include general demographics such as gender, age, race and language as well as workloads, prerequisite courses and the relevant academic background (Cheung and Kan 2002; Yousef 2011). Cheung and Kan (2002) investigated the performance of students in a business communication course offered through distance learning at the Open University Hong Kong (OUHK) based on gender, age, marital status and previous academic achievement and academic background. They found a correlation between gender and performance, no relationship was found between age and performance or marital status; and relevant academic foundation knowledge improves student success in higher education. Alanzi (2015) further found a statistically significant positive relationship between the prerequisite grade and the students' performance in the Principles of Financial Accounting (II) at a University in Kuwait. The research also found that the grades obtained in the prerequisite module significantly influenced students' performance when studying Principles of Financial accounting (II). A research done by De Swardt and Marx (2013) looked at the admission requirements for honours level studies at an Open Distance Learning (ODL) university. They tested whether the 60 percent admission requirement in the final year module enhanced the student's success and throughput in the honours level module. They found a significant correlation between a mark of 60 percent and the higher level module marks. This shows that the grade obtained in the lower level module had a significant influence on the success of the higher level module. This study investigated whether a mark of 60 percent obtained in the prerequisite module contributed to improved success and throughput in the higher level Derivatives module.

Based on the literature review, it is evident from previous studies that foundation knowledge is an important contributor to the success of students in higher-level modules and also that prerequisite modules are important in curriculum development. However some of the non-pedagogical reasons for implementing prerequisites within the curriculum is for administration to estimate future course enrolments in order to allocate efficient resources to the course (Shaffer et al. 2016).

This research focused on the academic background and foundation knowledge obtained by students in the prerequisite investment management module at an ODL university in South Africa. This university is the largest open distance university in Africa with over 300 000 students. The importance of throughput and success is part of the university's institutional operational plan and enhances the importance of this study. One method to evaluate the value of the prerequisite module is to determine the correlation between the marks obtained in the prerequisite module and the subsequent higher level module (Shaffer et al. 2016).

The research investigated whether a relationship exists between the prerequisite module required for students to succeed in the higher-level Derivatives module that forms part of the investment curriculum and to evaluate whether the performance in the prerequisite module is a predictor of performance and success in the higher-level Derivatives module.

METHODOLOGY

The present research evaluated whether there is a significant relationship between the completion of the prerequisite module and the performance of students in the higher-level module. The research investigated whether there is statistical evidence that the introduction of the prerequisite Investment module had a positive influence on the pass rate of the higher-level module. This indicated that foundation knowledge obtained in the Investment module which includes the basics of investments and derivatives instruments is necessary for success in the higher-level derivative module. The research evaluated the following questions:

Does the mark obtained in the prerequisite module have a significant correlation with the mark obtained in the Derivatives Module?

What is the correlation between the mark obtained in the prerequisite module and the mark obtained in the Derivatives Module?

Will the mark obtained in the prerequisite module assist in the success of the higher-level module?

The purpose of the research was to investigate the correlation between the percentages obtained by students in the prerequisite Investment module and the percentage obtained and the success rate of students in the Derivatives module. This was covered by the first research question, namely that there is no significant correlation between the percentage obtained in the prerequisite module and success in the higher-level Derivatives Module. The second research question related to whether the mark obtained in the prerequisite module would have an influence on the success rate (measured by pass rate) of the higher-level Derivatives module. This question tested whether students that received a mark above 60 percent in the prerequisite module had an influence in the pass rate of the higher-level Derivatives module.

The research followed a descriptive paradigm with a quantitative research design and statistical analysis of secondary data as per the examination results for the period 2010 to 2012. The statistical analysis mainly consisted of regression and correlation analysis techniques in order to establish the relationship between the dependent variable (Derivatives Module) and independent variable (Prerequisite Module).

The population consisted of all Investment students who completed both the prerequisite module and the Derivatives module at an ODL University in South Africa during the period, 2010 to 2012. Students who only completed the second-level module were excluded from the research. The prerequisite module was waived in the case of those students who registered for their studies on the 'old' curriculum, and such students were therefore also excluded from this paper. The sampling for this population was based on a single-stage design involving 830 students.

The research made use of non-probability, convenience sampling. All data that met the inclusion criteria of completing both modules were analysed. The data set comprised student records that provided objective empirical data about student performance and consisted of the students' marks obtained in the prerequisite module and in the higher-level Derivatives module, as well as the pass rate for the higher-level Derivatives module. The results were audited before being released to the students, which assisted in the reliability and validity of the data used. As the data only contained data on students who passed the module in investment management at one ODL university in South Africa and in the discipline of Investments, the paper cannot be used to generalise the results to all universities or disciplines in South Africa.

The analysis of the data was carried out to determine the correlation between the prerequisite module and the pass percentage and success rate in the higher-level Derivatives module. Data analysis was conducted by means of SPSS software after all identifiers had been removed from the data set. The statistical analysis mainly consisted of the Pearson's correlation, regression analysis and frequency distribution. Regression analysis was used to evaluate the predictive relationship between the independent variable, namely students' marks for the prerequisite module, and the dependent variable, namely students' marks for higher-level Derivatives module.

RESULTS

The total number of students' results included in this research was 830. This number included the results of students who completed both the prerequisite and related higher level module.

The sample consisted of 450 (54.2%) female students and 380 (45.8%) male students. The data was collected from the University's database and only included the actual final mark of each student that received 50 percent or higher in the prerequisite module and the actual final mark that each of these preceding students obtained in the Derivatives module. These two marks were then correlated with each other across the sample. No other demographic information was considered for this research; this could provide an opportunity for further research in order to establish whether other variables might have an influence on the pass rate.

Table 1 shows the pass rate for the Derivatives module which was historically very low, between 13 and 30 percent, before the introduction of the prerequisite module in 2009. Based on the passed rate of Derivatives module, Table 1 also indicates that, it is clear that there was an improvement in the overall pass rate after the introduction of the prerequisite module from 30 percent to 42.8 percent and higher, from 2009 onwards. In Table 1 it can be seen that the pass rate increased by about 10 percent from the second semester of 2008 to the first semester of 2009 and by about 38 percent to the second semester of 2009. Table 1 further shows that the average pass rate was consistent, around 50 percent over the next three-year period with a slight decrease in 2013.

This section deals with the first objective, namely to evaluate whether there was a significant positive correlation between the prerequisite module and the Derivatives module. A Pearson's correlation was computed to assess the relationship between the prerequisite and Derivatives module as depicted in Table 2. The results from the Pearson's correlation shows that there is a significant positive relationship ($r(830) = .416$; $p < .001$). Overall there was a moderate positive correlation between the prerequisite module and the Derivatives module at a 1 percent level of significance. Variance is the proportion of variation that can be explained and is calculated by taking $r = .416$ to the power of two. The data implied that the performance of students in the prerequisite module explains 17.3 percent of the variance in the Derivatives module.

The paired sample t-test revealed that the average mark for the Derivatives module was 52.08 percent with the average mark for the prerequisite module higher at 60.43 percent. As only data of students who passed the prerequisite

Table 1: Total overall pass rate for Derivatives module (2007–2014)

Data	*May'07*	*Oct' 07*	*May'08*	*Oct' 08*	*May'09*	*Oct' 09*	*May'10*	*Oct' 10*	*May'11*	*Oct' 11*	*May'12*	*Oct' 12*	*May'13*	*Oct' 13*	*May'14*	*Oct' 14*
Total examination sitting wrote	508	637	718	828	575	569	171	336	321	372	310	394	358	422	372	267
Total examination sitting pass	133	84	142	262	259	395	91	177	151	220	151	249	139	134	187	163
Total overall pass rate (%)	25.4	13.8	19.6	30.0	42.8	68.8	45.2	49.8	47.8	57.6	43.4	59.4	34.8	31.8	50.3	61.0

Source: Author

Table 2: Pearson's correlation between the prerequisite and derivative modules

		Derivatives module	*Prerequisite module*
Derivative Module	Pearson correlation	1	.416**
	Sig. (2-tailed)		.000
	N	2928	830
Prerequisite Investment Module	Pearson correlation	.416**	1
	Sig. (2-tailed)	.000	
	N	830	889

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Author

module with 50 percent or above were used in the research this could be a possible explanation for the higher average mark in the prerequisite module as seen in Table 3.

Table 3: Paired sample statistics

	Mean	*N*	*Std. deviation*	*Std. error mean*
Derivatives module	52.08	830	15.131	.525
Prerequisite module	60.43	830	10.591	.368

Source: Author

The regression analysis in Table 4 indicates that, although the effect of the prerequisite module ($b = 0.594$, $p<.000$) is significant, and the coefficient is positive indicating that the prerequisite module have an influence on the derivative module, the prerequisite module only explains 17.3 percent of the variance in the derivatives module. The prerequisite can therefore not be used as a good predictor of the mark obtained in the higher level derivatives module. The coefficient for the prerequisite module was .594 meaning that for a one unit increase in the prerequisite module we can expect a .594 increase in the derivatives module. However, one standard deviation increase in the prerequisite module leads to a .416 standard deviation increase in the derivatives module. The t-test for the prerequisite module equalled 13.145 and was statistically significant, meaning that the regression coefficient for the prerequisite module was significantly different from zero.

This section deals with the objective of whether the mark obtained in the prerequisite module assist in the success of the higher-level module. Table 5 indicates that there was no significant difference between the pass rate in the Derivatives module (30% and 34%) for students who received a mark between 50 percent and 60 percent and those who received a mark above 60 percent in the prerequisite module, respectively. As the regression analysis in Table 4 indicates, the mark obtained in the prerequisite module was not a good predictor of the mark obtained in the Derivatives module.

Table 5: Predictor based on pass percentage of derivatives module

Students' mark obtained in prerequisite module	*Pass rate for derivatives module*
Between 50% and 60%	30%
Above 60%	34%

Source: Author

OBSERVATIONS AND DISCUSSION

From the literature, it is evident that the introduction of a prerequisite module in the finance and accounting field contributes to the pass mark and success of students in the higher-level module. This is ascribed to the foundation knowledge gathered in the prerequisite module which forms the basis of the higher-level modules. In this research, the relationship between the prerequisite module and the higher-level module in Investment management and Derivatives was analysed. There was a moderate correlation between the results of the two modules, which supports the outcomes obtained by Blaylock and Lacewell (2008), Grover et al. (2009), Alanzi (2015), Mccarron and Burstein (2016) and Wisneski et al. (2016). The research however found that the prerequisite module is not a good predictor of success in the higher-level module (Creech and Sweeder 2012), which is in contradiction to the findings by Bealing et al. (2008), McMillan-Capehart and Adeyemi-Bello (2011) and Alanzi (2015) all of whom found that the prerequisite is a predictor of the success of higher-level modules. The discipline-specific prereq-

Table 4: Predictor of mark obtained

Module	*Unstandardised coefficients*		*Standardised coefficients*		
	B	*Std. error*	*Beta*	*t*	*Sig.*
(Constant)	16.201	2.771		5.847	.000
Prerequisite module	.594	.045	.416	13.145	.000

a. Dependent variable: Derivatives module
Source: Author

uisite does however provide students with the foundation knowledge in investment in order to increase their chances of success in the higher-level modules (Dogan-Dunlap 2006) and should be a consideration in curriculum development and outcome-based assessment.

The results can assist students by informing them of the importance of the prerequisite module in their future studies (Grover et al. 2009), as well as institutions in the setting of policies and strategic goals. By grasping the necessary foundation knowledge, students can increase their success in future studies (McMillan-Capehart and Adeyemi-Bello 2011; Sargent 2013), decrease their time at university (Cresswell 2009) and decrease their risk of failure. Mccarron and Burstein (2016) however found that the introduction of prerequisites might increase the time students spend on completing their degrees and have a negative influence on throughput. The aim of the prerequisite module is for students to do the best they can with the discipline-related information in order to give them all the resources they require to be successful in their future studies.

CONCLUSION

This paper analysed prerequisite modules as a factor that affects students' success in investment management. The study population included a total of 830 students and the following results were concluded from the research:

1. The mark obtained in the prerequisite module did show a significant correlation ($r(830) = .416$; $p < .001$) with the mark obtained in the Derivatives module in Investment management.
2. There was a moderate positive correlation between the marks obtained.
3. The marks for the prerequisite module is not a good predictor of the higher-level success rate.

Overall, the results strengthened the view that a prerequisite module is necessary in order to provide students with the basic foundation knowledge in investments and to improve their overall success and throughput within the institution.

The benefits of the results are that the university can assist and inform students and academics of the importance to understand and critically analyse foundation knowledge in the Investment module before they attempt the higher-level module in derivatives. Although the prerequisite module was not a predicator of success, it gives students a firm understanding of the investment field for higher studies. It would also assist in the curriculum development and teaching and learning policies not just in Investment module but also in other related finance fields. Introducing a prerequisite module should be carefully considered in order to make sure that the foundation knowledge required is addressed in the prerequisite module.

RECOMMENDATIONS

The results showed a significant positive correlation between the prerequisite module and the higher-level module in Derivatives. This shows that the introduction of the prerequisite adds value to the student and institution in terms of throughput and student success. Although the research did not show that the prerequisite is a predictor of success in the higher-level module, the knowledge that students obtain still assisted them in understanding concepts in the higher-level module. The research was conducted at only one university and in one academic discipline, conclusions cannot be generalised to the greater higher education population. Further research should be conducted at other South African universities and other disciplines in order to establish whether the results are institution- and subject-specific. Further studies could be conducted on the influence of demographic factors such as age, gender, work and social responsibilities on the performance of the students. This would assist in generalising the results as well as emphasising the importance of curriculum development and prerequisite modules as a success factor in higher education.

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