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The Value of Prerequisites:
Providing the Links between Understanding and Progression

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The Value of Prerequisites: Providing the Links between Understanding and Progression

Abstract

This paper contributes to the debate about understanding and progression provided through the use of discipline specific prerequisites. The results were compared of those students from 2003 2004 and 2005 completing the subject Principles of Finance and who had, or had not, completed the subject Business Statistics, a desired but not a formal prerequisite for Business Finance.. First, the average mark in Principles of Finance for all students who had completed Business Statistics was compared to the average mark of all students who had not completed Business Statistics. Second, the average pass mark for all students in Principles of Finance who had passed Business Statistics was compared to the average pass mark of all students who had not passed Business Statistics. Third, the average pass mark for students who had been granted exemption from Business Statistics, based on prior learning, was compared to the average pass mark of students who had passed Business Statistics. The results indicated that students who completed Business Statistics performed better overall than students who had not completed Business Statistics and that students who had passed Business Statistics received significantly better grades in Principles of Finance than did students who had not undertaken Business Statistics. Students who had been granted exemption performed as well as those who had passed Business Statistics. The findings imply that the use of discipline specific prerequisites reinforce the view that such a prerequisite provides the student with a minimum level of understanding required to undertake advanced subjects and in doing so improves the student's chance of success.

Key words: Accounting education, finance education, prerequisites, student understanding

The Value of Prerequisites:
Providing the Links between Understanding and Progression

Introduction

It has long been recognised, by those involved in curriculum development. that the knowledge and skills that students acquire are fundamentally linked to the contexts within which those attributes are introduced. Likewise, the concept of progression, which focuses on the advances in students' learning over time, is important for planning the structure of a curriculum and for assessing students' attainments. This paper reports on the relationship between understanding and progression through the need for, and use of, prerequisites. The need for discipline specific prerequisites, specifically in Accounting/Finance programmes, was formally recognised by the accounting and finance profession in 1989 with the Accounting Education Change Commission of the American Accounting Association investigating how accounting education could best improve the students' capabilities for successful professional careers (Mueller and Simmons, 1989). This view was encapsulated by Carlson, Cohn and Ramsey (2002) who argued that the purposes of prerequisite courses were to ensure that students were prepared for advanced subjects.

However, prerequisites can mean different things to different stakeholders. To the student, wishing to complete in minimum time, the prerequisite represents the unnecessary subject he/she is being forced to undertake in order to do the subject they really want to do, and as such the prerequisite is perceived as having no value. To the academic developing an advanced subject, it represents a gate-keeping procedure that provides the minimum level of understanding required to undertake the advanced subject and to maintain an acceptable success rate. This concept of progression is seen by Bennetts (2005) as a process which focuses on student learning over time and is important for planning the structure of a curriculum and for assessing student attainment. To the administrator, confronted with the reality of ever diminishing resources, it represents a mechanism to contain students within a particular cohort, thus improving administrative planning, or, by using the ubiquitous 'presumed knowledge', or 'taken for granted', can allow a student to accelerate his/her program, thus ensuring a more controlled flow through the system.

This paper will focus on the academic view and in so doing will, hopefully, demonstrate that the academic perception actually supports, and enhances the other two views.

Research Question and Importance of the Study

The research provides a longitudinal study of students within an Accounting/Finance major undertaking a second year finance subject, Principles of Finance, where the first year subject, Business Statistics was not a formal prerequisite of the academic program, but considered by both the accounting and finance academics as a fundamental requirement for the success of the student. The study is unique in that it provides an opportunity to compare three groups of students over a three year period.

The research question derived from this is: whether a direct correlation exists between achievement in Business Statistics and Principles of Finance? Specifically we examine the performance of students who had undertaker Business Statistics as part of their standard degree pattern, those who were granted an exemption from Business Statistics based on prior study, and, those who had postponed undertaking Business Statistics at the time of undertaking Principles of Finance.

The study is important for a number of reasons. First, it expands the body of literature focusing on factors that determine students' success, by examining whether performance in a first year business statistics subject is related to performance in a second year finance subject. Second, its findings may have the potential to influence curricular decisions concerning advanced-level business subjects. Third, it is the first longitudinal study directed specifically at the success rate of students undertaking a finance subject. Finally, it is the first study of its kind undertaken in Australia.

Review of the Literature

Concerns about the shortcomings in accounting education have been a constant source of debate by accounting academics since the 1970s (Rosen, 1978; American Accounting Association, 1986; Matthews, 1990; Etherington and Richardson, 1994a, 1994b; Albrecht and Sack, 2000). Several studies have been undertaken on the impact or the value of prerequisites in the overall package of best practice in teaching and learning. These have focused on the relationship between student performance in

introductory accounting subjects and advanced accounting subjects (see Danko, Duke and Franz, 1992; Turner, Holmes and Wiggins, 1997; Krausz, Schiff, Schiff and VanHise (1999). However, despite this interest no empirical studies have examined the prerequisite skills and knowledge bases necessary for accounting or finance students to master introductory finance subjects within the Australian higher education environment.

Within the accounting discipline, the study by Huang, O'Shaughnessy and Wagner (2005), involving 1084 accounting students, found that students who had passed a prerequisite received significantly better grades than students who failed or who had not undertaken the prerequisite. In the finance discipline Didia and Hasnat (1998) demonstrated that a mathematics prerequisite enhanced students' performance in finance courses. In the related field of economics, Brasfield, McCoy and Milkman (1992) concluded that it would be desirable to institute mathematics prerequisites as the introductory subject for Principles of Economics. At an advanced level, Von Allmen's (1996) results indicated a strong link between performance in calculus courses and performance in intermediate microeconomics. Linking the accounting discipline to the finance discipline Turetsky and Weinstein (2003) demonstrated that the introductory accounting subjects, Financial Accounting and Management Accounting, had a high positive correlation with students' performance in Financial Management.

Similar positive relationships have been reported in studies unrelated to accounting and finance. Cheung and Kan's (2002) study of students' performance in a distance learning communication course, found it easier to understand the theories and concepts taught in an advanced subject where they had passed the prerequisite communication subject.

However, conflicting results have been found in similar studies. Cohn, Cohn. Hult, Balch and Bradley (1998) researching the effect of a mathematics prerequisite on student learning in principles of economics found the results did not indicate the need for such prerequisites. These findings are consistent with those of Milkman, McCoy, Brasfield and Mitchell (1995) whose findings indicated there was no need for mathematics prerequisites with respect to the study of economics. In the study

conducted by Gallegos (2002), the Report on the Impact of Prerequisite Enforcement on Underrepresented Students, which investigated the impact of prerequisite enforcement on retention and course completion rates, found an initial negative impact on course enrolment and a decline in course success rates. However, the success rates had gradually increased in subsequent years.

While the empirical studies suggest a strong relationship between the prerequisite and improved student performance, other researchers have raised issues in conjunction with the effectiveness of the teaching of the prerequisites and methods of delivery. Von Allmen (1996) raises the fundamental issue that it is more than passing the prerequisite; it is about understanding the concepts. This concern is reinforced by Boyd, Boyd and Boyd (2000, 39) who observed that:

> "in the absence of an effective enforcement of prerequisites, we find students, who are not accounting majors "putting off" taking Principles of Accounting II until their senior year because of a lack of understanding and a bad experience in Principles of Accounting I. This defeats the purpose of prerequisite requirements and retards the learning process."

Doyle and Wood (2005, 165) build on this and further warn of additional factors that may impact on the prerequisite issue, including:

> "there may be imperfect enforcement of prerequisites, the prerequisites may have poorly defined objectives, and even with well-defined objectives the staff teaching the prerequisites may not have taught them well and students may not have learned them well".

With respect to delivery, Dowling, Godfrey and Gyles (2003) suggest higher marks in prerequisites, and through this higher academic performance, are achieved through a hybrid flexible delivery model more so than a traditional face-to-face lecture/tutorial teaching method.

The Setting

The subject university is a small government funded public university operating in New South Wales, Australia. The accounting and finance majors consists of a Bachelor of Business (Accounting) which is accredited for professional membership

by the professional accounting bodies in Australia and a Bachelor of Business (Financial Services). The student body consists mainly of school leavers with some international and mature age students. Both majors are designed as a three year 'full-time' course, with little accommodation given to part-time students or evening offerings. As with many accounting programs in Australia the first year is a common year for all Bachelor of Business students irrespective of their major (eg marketing, management etc.).

The introductory finance subject, Principles of Finance is a required subject for all students undertaking the accounting or the financial services major in the Bachelor of Business degree and is offered in the first semester of the second year of the course. The subject Business Statistic, is only offered in the first semester of the first year. None of the first year subjects, with the exception of the introductory accounting subject Principles of Accounting, are a prerequisite for any second or third year accounting or finance subjects.

For some time the academic staff teaching in the accounting and finance majors have attempted to make Business Statistics a prerequisite for Principles of Finance. This was seen an imperative due to the increasing number of students failing the subject. Also, as Principles of Finance formed the key prerequisite for all subsequent finance subjects in the finance major, a failure in Principles of Finance severely disrupted the student's progress. Recently, due to increasing enrolments and the decision to allow a mid-year intake, the problem has been exacerbated, as under existing University policy, students can enrol in second year subjects without completing all first year subjects.

Any student, following the standard degree pattern, would have completed Business Statistics in first semester of year one. With the admission of students mid-way through year one, many students are forced to undertake Business Statistics in the first semester of their second year, concurrently with Principles of Finance. This has been part of the reason for a reluctance to make Business Statistics a prerequisite for Principles of Finance, as making it a prerequisite would lengthen the student's time at university. Alternatives, such as offering the subject in second semester or offering it

in both first and second semester have been considered, and disregarded due mainly to staff constraints.

A secondary factor impacting on using Business Statistics as a prerequisite for Principles of Finance relates to the university's credit granting policy. For some years the university has had formal agreements with numerous private and government education providers. Students with a Diploma or Advanced Diploma in an appropriate discipline would receive up to 80 credit points or exemption from the first year of the Bachelor of Business degree. However, often this blanket exemption did not included a statistics subject, thus causing the student to be out of sequence with respect to Principles of Finance.

Data Collection

To examine our research question we collected data for student undertaking Principles of Finance in autumn semester for 2003, 2004 and 2005, a total of three groups. The population consisted of 316 students, 110 in 2003; 120 in 2004; and, 86 in 2005. The descriptive statistics for our student sample for each year as shown in Tables 1, 2, and 3. Ten variables were considered:

- The average mark for **all students who completed** Principles of Finance
- The average mark for **all students who passed** Principles of Finance
- The average mark for **all students who passed** Principles of Finance **having completed** Business Statistics
- The average mark for **students who passed** Principles of Finance and **who had not completed** Business Statistics
- The average mark for **all students who completed** Principles of Finance **who received an exemption** from Business Statistics
- The average mark for **all students who completed** Principles of Finance **who did not received an exemption** from Business Statistics
- The average mark for **students who passed** Principles of Finance **who received an exemption** from Business Statistics
- The average mark for **students who passed** Principles of Finance **who did not received an exemption** from Business Statistics
- The average mark for **students in** Principles of Finance **who had completed** Business Statistics, and

- The average mark for **students in** Principles of Finance who **had not completed** Business Statistics.

Table 1

Descriptive Statistics – 2003	*n*	Mean	StDev	Min	Max
The average mark for all students who completed Principles of Finance	110	52.57	18.37	3	90
The average mark for all students who passed Principles of Finance	77	61.81	11.15	50	90
The average mark for all students who passed Principles of Finance having completed Business Statistics	84	59.19	13.84	9	90
The average mark for students who passed Principles of Finance and who had not completed Business Statistics	3	51	1.00	50	52
The average mark for all students who completed Principles of Finance who received an exemption from Business Statistics	22	57.41	18.78	9	87
The average mark for all students who completed Principles of Finance who did not received an exemption from Business Statistics	88	51.36	18.17	3	90
The average mark for students who passed Principles of Finance who received an exemption from Business Statistics	18	64.11	12.11	50	87
The average mark for students who passed Principles of Finance who did not received an exemption from Business Statistics	59	61.10	10.85	50	66
The average mark for students in Principles of Finance who had completed Business Statistics	84	59.19	13.84	9	90
The average mark for students in Principles of Finance who had not completed Business Statistics	26	31.19	14.57	3	52

Table 2

Descriptive Statistics – 2004	*n*	Mean	StDev	Min	Max
The average mark for all students who completed Principles of Finance	120	53.82	17.42	4.50	88.30
The average mark for all students who passed Principles of Finance	81	63.52	9.90	50.30	88.30
The average mark for all students who passed Principles of Finance having completed Business Statistics	90	59.12	14.51	14.00	88.30
The average mark for students who passed Principles of Finance and who had not completed Business Statistics	30	37.93	15.86	4.50	85.00
The average mark for all students who completed Principles of Finance who received an exemption from Business Statistics	26	53.32	19.00	14.00	79.30
The average mark for all students who completed Principles of Finance who did not received an exemption from Business Statistics	94	53.96	17.07	4.50	88.30
The average mark for students who passed Principles of Finance who received an exemption from Business Statistics	18	63.94	9.46	50.30	79.30
The average mark for students who passed Principles of Finance who did not received an exemption from Business Statistics	63	63.40	10.09	50.30	88.30
The average mark for students in Principles of Finance who had completed Business Statistics	90	59.12	14.51	14.00	88.30
The average mark for students in Principles of Finance who had not completed Business Statistics	30	37.93	15.85	4.5	85.00

Table 3

Descriptive Statistics – 2005	*n*	Mean	StDev	Min	Max
The average mark for all students who completed Principles of Finance	86	35.88	22.17	2.00	77.00
The average mark for all students who passed Principles of Finance	38	58.37	8.57	50.00	77.00
The average mark for all students who passed Principles of Finance having completed Business Statistics	38	58.37	8.57	50.00	77.00
The average mark for students who passed Principles of Finance and who had not completed Business Statistics	1	Only one student passed who had not taken Business Statistics.			
The average mark for all students who completed Principles of Finance who received an exemption from Business Statistics	7	12.71	4.39	6.00	19.00
The average mark for all students who completed Principles of Finance who did not received an exemption from Business Statistics	79	37.94	21.95	2.00	77.00
The average mark for students who passed Principles of Finance who received an exemption from Business Statistics	1	Only one student who had been granted exemption from Business Statistics passed.			
The average mark for students who passed Principles of Finance who did not received an exemption from Business Statistics	38	58.37	8.57	50.00	77.00
The average mark for students in Principles of Finance who had completed Business Statistics	60	44.60	20.20	6.00	77.00
The average mark for students in Principles of Finance who had not completed Business Statistics	26	15.77	10.27	2.00	37.00

Hypotheses

To test whether success in the subject Business Statistics provided an effective predictor of performance in Principles of Finance two sets of data were analysed. First, the average mark in Principles of Finance for all students who had not completed the subject Business Statistics and second, the average mark of all students who had completed Business Statistics was computed. This resulted in the following hypothesis:

Hypothesis 1 (Null):

> The average mark in Principles of Finance for all students who had not completed Business Statistics will not differ significantly from the average mark for students who had completed Business Statistics.

Hypothesis 1 (Alternative):

> The average mark in Principles of Finance for all students who had not completed Business Statistics will be significantly different from the average mark for students who had completed Business Statistics.

A similar analysis was performed of all students who had passed Principles of Finance resulting in the second hypothesis.

Hypothesis 2 (Null):

> The average pass mark in Principles of Finance for all students who had not completed Business Statistics will not differ significantly from the average pass mark for students who had completed Business Statistics.

Hypothesis 2 (Alternative):

> The average pass mark in Principles of Finance for all students who had not completed Business Statistics will be significantly different from the average pass mark for students who had completed Business Statistics.

Next was a comparison of the average mark in Principles of Finance for students who were granted an exemption from Business Statistics and those that had passed Business Statistics was computed. This resulted in the following null hypothesis:

Hypothesis 3 (Null):

The average pass mark in Principles of Finance for students who had been granted exemption from Business Statistics will not differ significantly from the average pass mark for students who had completed Business Statistics

Hypothesis 3 (Alternative):

The average pass mark in Principles of Finance for students who had been granted exemption from Business Statistics will differ significantly from the average pass mark for students who had completed Business Statistics.

Data Analysis

A 2 sided t-test was preformed with the following results.

Hypothesis 1

Table 4, Hypothesis 1 Group Statistics, tests the hypothesis that the average mark in Principles of Finance for all students who had not completed Business Statistics will not differ significantly from the average mark for students who had completed Business Statistics (the null hypothesis) during 2003, 2004 and 2005. For students who had completed Business Statistics the mean was 59.2, 59.1 and 44.6 respectively. For those who had not the mean was 31.2, 27.9 and 15.8 respectively. The *t* had a value of 8.66, 6.47 and 8.75 and the value of P was 0.000 for each year (Table 5). As 0.000 is below 0.050 we reject the null hypothesis and conclude that there is significant difference between the two groups of students.

Table 4

Hypothesis 1 - Group Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
2003				
Students completing principles with statistics	84	59.2	13.8	1.5
Students completing principles without statistics	26	31.2	14.6	2.9
2004				
Students completing principles with statistics	90	59.1	14.5	1.5
Students completing principles without statistics	30	37.9	15.9	2.9
2005				
Students completing principles with statistics	60	44.6	20.2	2.6
Students completing principles without statistics	26	15.8	10.3	2.0

Table 5

Hypothesis 1 – Independent Sample Test			
	Hypothesis 1 2003	Hypothesis 1 2004	Hypothesis 1 2005
T	8.66	6.47	8.75
Df	39	46	81
P-Value	0.000	0.000	0.000
Mean Difference	28.00	21.2	288
95% Confidence Interval of the Mean			
Lower	21.46	14.59	22.28
Upper	34.54	27.77	35.39
99% Confidence Interval of the Mean			
Lower	19.26	12.39	20.14
Upper	36.75	29.89	37.52

Hypothesis 2

The results for Hypothesis 2 are depicted in Tables 6 and 7. Table 6, Hypothesis 2 – Group Statistics, tests the hypothesis that the average pass mark in Principles of Finance for all students who had not completed Business Statistics will not differ significantly from the average pass mark for students who had completed Business Statistics (the null hypothesis) during 2003 and 2004.. For students who had completed Business Statistics the mean was 62.2 and 63.9 and for those who had not the mean was 51.0 and 53.9. For these years the *t* had a value of 7.92 and 4.64 and the value of P was 0.000 for 2003 and 0.004 for 2004 (Table 7). As 0.000 is below 0.050 we reject the null hypothesis and conclude that there is significant difference between

the two groups of students. There are no results for 2005 as only one student passed who had not taken Business Statistics.

Table 6

Hypothesis 2 - Group Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
2003				
Students who passed principles with statistics	74	62.2	11.2	1.3
Students who passed principles without statistics	3	51.0	1.0	0.6
2004				
Students who passed principles with statistics	75	63.9	9.6	1.1
Students who passed principles without statistics	5	53.9	4.4	2.0

Table 7

Hypothesis 2 – Independent Sample Test			
	Hypothesis 2 2003	Hypothesis 2 2004	Hypothesis 2 2005
T	7.92	4.44	
Df	43	6	
P-Value	0.000	0.004	
Mean Difference	11.2	10.0	
95% Confidence Interval of the Mean			
Lower	8.38	4.50	
Upper	14.11	15.50	
99% Confidence Interval of the Mean			
Lower	7.42	-17.52	
Upper	15.07	27.15	

Hypothesis 3

The results for Hypothesis 3 are displayed in Tables 8 and 9. Table 8, Hypothesis 3 – Group Statistics, tests the hypothesis that the average mark in Principles of Finance for all students who had been granted exemption from Business statistics will not differ significantly from the average mark for students who had completed Business Statistics (the null hypothesis) during 2003 and 2004. For students who had been granted exemption from Business Statistics the mean was 64.1 and 63.9 and for those who had passed Business Statistics the mean was 62.2 and 60.9. The *t* has a value of 0.60 in 2003 and 0.02 in 2004 and the value of P was 0.557 and 0.981 respectively (Table 9). Since 0.557 and 0.981 are both above 0.05 we accept the null hypothesis that there is no significant difference between the two groups of students. There are

no results for 2005 as only one student who had been granted exemption from Business Statistics passed.

Table 8

Hypothesis 3 - Group Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
2003				
Students granted exemption from statistics	18	64.1	12.1	2.9
Students who completed statistics	74	62.2	11.2	1.3
2004				
Students granted exemption from statistics	18	63.9	9.46	2.2
Students who completed statistics	75	60.9	9.61	1.1

Table 9

Hypothesis 3 – Independent Sample Test			
	Hypothesis 3 2003	Hypothesis 3 2004	Hypothesis 3 2005
T	0.60	0.02	
Df	.24	26	
P-Value	0.557	0.981	
Mean Difference	1.9	0.0	
95% Confidence Interval of the Mean			
Lower	-4.60	-5.06	
Upper	8.34	5.18	
99% Confidence Interval of the Mean			
Lower			
Upper			

Discussion

The results of this study are relevant in that they indicate, over a three year period, that performance in Business Statistics is useful in predicting performance in Principles of Finance. The study's results support the need that Business Statistics be adopted as the prerequisite for Principles of Finance. These results are consistent with the findings of Huang, O'Shaughnessy and Wagner (2005) who found similar results with intermediate accounting students, specifically, that students who had passed a prerequisite received significantly better grades than students who failed or who had not undertaken the prerequisite. The results also support the findings of Didia and Hasnat (1998) that a mathematics prerequisite enhanced students' performance in finance courses.

Further, the study puts to rest the debate about granting exemptions from Business Statistics based on prior learning obtained with a private provider. The results, at the 95 percent confidence interval, for 2003 and 2004, suggest that there in no significant difference between students who have passed Business Statistics as part of the program and those who were granted exemption.

Conclusion

In this study we have analysed one factor that impacts on students' success in introductory finance, specifically, the effectiveness of the subject Business Statistics as a prerequisite screening strategy to improve the success levels in Principles of Finance. This was achieved by comparing the performance of three groups of students undertaking the subject Principles of Finance during 2003, 2004 and 2005

First, the average mark in Principles of Finance for all students who had completed Business Statistics was compared to the average mark of all students who had not completed Business Statistics. Second, the average pass mark for all students in Principles of Finance who had passed Business Statistics was compared to the average pass mark of all students who had not passed Business Statistics. Third, the average pass mark for students who had been granted exemption from Business Statistics, based on prior learning, was compared to the average pass mark of students who had passed Business Statistics. The results indicated that students who had completed Business Statistics received significantly better grades in Principles of Finance than students who had not completed Business Statistics, further, students who had passed Business Statistics received significantly better grades in Principles of Finance than students who had not undertaked Business Statistics Finally, those students who had been granted exemption based on prior learning performed as well as those who had passed Business Statistics. The findings reinforces the view that the use of discipline specific prerequisites provides the student with the minimum level of understanding required to undertake advanced subjects and in doing so improves the student's chance of success.

While not specifically tested, the findings suggest that the use of prerequisites could shorten a student's time at university as it reduces the risk of failure in advanced finance subjects and therefore the necessity to repeat subjects. It is hoped that this

study, and further studies in the area, will provide additional empirical evidence of the need for discipline specific prerequisites and in doing so, remove the current ‘presumed knowledge’ or ‘taken for granted’ status of what is a fundamental link between understanding and progression.

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