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Vicki Baard
Macquarie University

Edmund W. Watts
University of Wollongong, tedw@uow.edu.au

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Keywords
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The Value of Prerequisites: A Link between Understanding and Progression

Vicki Baard
Division of Economics and Financial Studies
Department of Accounting and Finance
Macquarie University

Ted Watts
Discipline of Accounting
School of Accounting & Finance
University of Wollongong
Telephone: (61 2) 4221-4005
Facsimile: (61 2) 4221-4297
Email: tedw@uow.edu.au

Abstract
This paper contributes to the debate about the value of discipline-specific prerequisites. The study compared the results of students from 2003 to 2006 completing the subject Principles of Finance and who had completed the subject Business Statistics, to students who had not. This comparison indicated that the students who completed Business Statistics performed significantly better overall than those students who had not. The findings imply that discipline-specific prerequisites provide students with a minimum level of understanding required to undertake advanced subjects, and can improve their chance of success.

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

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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 Bolton and Genck, 1971; Clayton, 1993; Gibbs, Habeshaw and Yorke, 2000). 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 programs, has been formally recognised in the USA by the accounting and finance profession since 1989, when the Accounting Education Change Commission of the American Accounting Association investigated how accounting education could 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 they are 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 that 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 scarce resources, it represents a mechanism to contain students within a particular cohort, thus improving administrative planning, or, by using the ubiquitous 'presumed knowledge', can allow a student to accelerate their program, thus ensuring a more controlled flow through the system.

This paper focuses on the academic view, and aims to demonstrate that the academic perception supports — and enhances — the other two views.

Research Question and Importance of the Study

This 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 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 the results of four groups of students over a four-year period.

The research question derived from this is: whether a significantly different relationship exists between achievement in Business Statistics and Principles of Finance. Specifically, we examine the effectiveness of using the subject Business Statistics, or its equivalent through exemption, as a prerequisite screening strategy to improve student's success levels in 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 could 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 development of an 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 1,084 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 for students 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) researched the effect of a mathematics prerequisite on student learning in principles of economics and found the results did not indicate the need for such prerequisites. These findings are consistent with those of Milkman, McCoy, Brasfield and Mitchell (1995), who 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 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 warn of additional factors that may affect 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 that higher marks in prerequisites, and through this, better 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 consist 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 (for example, marketing, management and so on).

The introductory finance subject, Principles of Finance, is required 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, is a prerequisite for any second-year 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 considered an imperative because of the increasing number of students failing the subject. Also, because 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, because 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 the 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 that affects 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, this exemption often did not include 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 students undertaking Principles of Finance in the autumn (first) semester of 2003, 2004, 2005 and 2006, a total of four groups. The population consisted of 443 students, 110 in 2003; 120 in 2004; 86 in 2005; and 127 in 2006. The descriptive statistics for our student sample for each year is shown in Tables 1, 2, 3 and 4. Seven variables were considered:

1. The average mark for **all students who completed** Principles of Finance
2. The average mark for **all female students who completed** Principles of Finance
3. The average mark for **all male students who completed** Principles of Finance
4. The average mark for **all students who completed** Principles of Finance **who received an exemption** from Business Statistics
5. The average mark for **all students who completed** Principles of Finance **who did not received an exemption** from Business Statistics
6. The average mark for **students in** Principles of Finance **who had completed** Business Statistics
7. The average mark for students in Principles of Finance **who had not completed** Business Statistics.

Table 1:

Descriptive Statistics – 2003

	n	**Mean**	**SD**	**Min**	**Max**
1 The average mark for all students who completed Principles of Finance	110	52.57	18.37	3	90
2 The average mark for all female students who completed Principles of Finance	41	52.07	19.00	3	87
3 The average mark for all male students who completed Principles of Finance	69	52.87	18.11	10	90
4 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
5 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
6 The average mark for students in Principles of Finance who had completed Business Statistics	84	59.19	13.84	9	90
7 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**	**SD**	**Min**	**Max**
1 The average mark for all students who completed Principles of Finance	120	53.93	17.40	5	88
2 The average mark for all female students who completed Principles of Finance	43	56.86	17.18	14	88
3 The average mark for all male students who completed Principles of Finance	77	52.23	17.41	5	86
4 The average mark for all students who completed Principles of Finance who received an exemption from Business Statistics	26	53.38	18.95	14	79
5 The average mark for all students who completed Principles of Finance who did not received an exemption from Business Statistics	94	54.09	17.05	5	88
6 The average mark for students in Principles of Finance who had completed Business Statistics	90	59.22	14.52	14	88
7 The average mark for students in Principles of Finance who had not completed Business Statistics	30	37.07	15.73	5	85

Table 3:
Descriptive Statistics – 2005

	n	**Mean**	**SD**	**Min**	**Max**
1 The average mark for all students who completed Principles of Finance	86	35.88	22.17	2	77
2 The average mark for all female students who completed Principles of Finance	31	38.52	24.07	4	77
3 The average mark for all male students who completed Principles of Finance	55	34.40	21.11	2	75
4 The average mark for all students who completed Principles of Finance who received an exemption from Business Statistics	7	12.71	4.39	6	19
5 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	77
6 The average mark for students in Principles of Finance who had completed Business Statistics	60	44.60	20.20	6	77
7 The average mark for students in Principles of Finance who had not completed Business Statistics	26	15.77	10.27	2	37

Table 4:
Descriptive Statistics – 2006

	n	Mean	SD	Min	Max
1 The average mark for all students who completed Principles of Finance	127	59.93	13.75	5	85
2 The average mark for all female students who completed Principles of Finance	53	61.09	11.69	33	85
3 The average mark for all male students who completed Principles of Finance	74	59.09	15.08	5	83
4 The average mark for all students who completed Principles of Finance who received an exemption from Business Statistics	34	53.68	15.13	5	85
5 The average mark for all students who completed Principles of Finance who did not received an exemption from Business Statistics	93	66.22	12.53	11	83
6 The average mark for students in Principles of Finance who had completed Business Statistics	103	62.43	12.13	5	85
7 The average mark for students in Principles of Finance who had not completed Business Statistics	24	49.17	15.32	11	83

Hypothesis

In order 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, or had been granted an exemption based on prior learning, and second, the average mark of all students who had completed Business Statistics, including those who had been granted exemption, were computed. This resulted in the following hypothesis:

Hypothesis 1 (Null):

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

Data Analysis

An independent sample 2-sided t-test was preformed and consistent with Levene's Test equal variances were assumed. All t statistics were compared to the t critical value at the calculated degrees of freedom.

Hypothesis 1

Table 5: Hypothesis 1 Group Statistics tests the hypothesis that the average mark in Principles of Finance for all students who had not completed, or granted exemption from, Business Statistics will not differ significantly from the average mark for

students who had completed, or granted exemption from, Business Statistics (the null hypothesis) during 2003, 2004, 2005 and 2006. For students who had completed Business Statistics the mean was 59.2, 59.1, 44.6 and 62.4 for the four years respectively. For those who had not, the mean was 31.2, 27.9, 15.8 and 49.2 respectively. The t had a value of 8.90 (critical value 1.98), 6.77 (critical value 1.98), 6.89 (critical value 1.99) and 4.58 (critical value 1.96). The value of P was 0.000 for each year (see Table 6). As t cult exceeds t crit and 0.000 is below 0.050 in all cases, we reject the null hypothesis and conclude that there is a significant difference between the two groups of students.

A similar test was performed for students who had received exemption from Business Statistics based on prior learning and those who had passed Business Statistics prior to undertaking Principles. In this case there was no significant difference between the two groups. The same test was applied to all students who had completed Principles of Finance grouped by gender. This test indicated that there was no significant difference between females and males.

Table 5:

Hypothesis 1 – Group Statistics "All students who completed Principles of Finance"

	n	**Mean**	**Standard Deviation**	**Standard Error Mean**
2003				
Students who sat Principles with Statistics	84	59.19	13.84	1.51
Students who sat Principles without Statistics	26	31.19	14.6	2.86
2004				
Students who sat Principles with Statistics	90	59.22	14.52	1.53
Students who sat Principles without Statistics	30	37.07	15.73	2.87
2005				
Students who sat Principles with Statistics	60	45.60	20.20	2.61
Students who sat Principles without Statistics	26	15.77	10.27	2.01
2005				
Students who sat Principles with Statistics	103	62.43	12.13	1.20
Students who sat Principles without Statistics	24	49.17	15.32	3.13

Table 6:

Hypothesis 1 – Independent Sample Test "All students who completed Principles of Finance"

	2003	**2004**	**2005**	**2006**
T-Value	8.90	6.77	6.89	4.58
Df	108.00	118.00	84.00	125.00
P-Value	0.000	0.000	0.000	0.000
Mean Difference	27.998	21.156	28.831	13.270
95% Confidence Interval of the Mean				
Lower	21.76	14.97	22.50	7.54
Upper	34.23	27.35	37.16	19.00
99% Confidence Interval of the Mean				
Lower	19.75	12.97	17.80	2.90
Upper	36.25	29.34	39.86	20.48

Discussion

The results of this study are relevant in that they indicate, over a four-year period, that performance in Business Statistics is useful in predicting performance in Principles of Finance. The results support the claim that Business Statistics should 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), which argue that a mathematics prerequisite enhanced students' performance in finance courses.

Conclusion

In this study we have analysed one factor that affects students' success in introductory finance, specifically, the effectiveness of the subject Business Statistics or its equivalent through exemption, as a prerequisite screening strategy to improve student's success levels in Principles of Finance. This was achieved by comparing the performance of four groups of students undertaking the subject Principles of Finance during 2003, 2004, 2005 and 2006.

The average mark in Principles of Finance for all students who had completed Business Statistics, or given exemption based or prior learning, was compared to the average mark of all students who had not completed Business Statistics. The results indicated that students who had completed Business Statistics, or granted exemption, received significantly better results in Principles of Finance than students who had not completed Business Statistics.

Overall, the findings reinforce the view that the discipline-specific prerequisites provide students with the minimum level of understanding required to undertake advanced subjects, and improve student's chance of success.

While not specifically tested, the findings also suggest that prerequisites could actually shorten a student's time at university, because they reduce the risk of failure in advanced finance subjects and therefore the necessity to repeat subjects. This also increases through-put time and improves resource usage. 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 remove the current 'presumed knowledge' of what is a fundamental link between understanding and progression.

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