TEST ITEM ORDER, ACADEMIC ACHIEVEMENT AND STUDENT PERFORMANCE ON PRINCIPLES OF MARKETING EXAMINATIONS

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ABSTRACT

Marketing educators often use multiple choice exams with various versions of question sequencing to minimize cheating with little consideration for the influence of test item order on student performance. This study replicates prior research on question sequencing and student performance; however, consideration is also given to academic achievement as a contributing factor. The results indicate that student scores on multiple choice exams differ significantly based on two measures of academic achievement, not test item order. This paper describes the research design, findings and implications for marketing educators.

INTRODUCTION

Marketing educators often utilize multiple choice exams to assess student mastery of content. This is an efficient and objective form of assessing student learning, particularly in courses with larger sections. Various versions of the same exam are commonly used to minimize the possibility that students collaborate on selecting their answers. Each version usually contains the same questions with test items presented in a different order. Intuitively one might assume that students do better on exams with test items appearing in the same order that material was covered in class. However, randomizing the order of test items is a fair and simple approach given the automated process provided by test bank software that accompanies most marketing texts.

Does randomizing the order of test items put students at a significant disadvantage? Research results regarding test item order are mixed. Some studies find no significant difference (Chidomere 1989; Russell, Fisher, Fisher, and Premo 2003) while others cite marginal or significant improvement in student scores based on a particular sequence of test items (Balch 1989; Carlson and Ostrosky 1992; Petit, Baker, and Davis 1986; Stout and Wygal 1990). However, there is little to no research in marketing education that considers other factors along with test item order that might influence student performance on multiple choice exams.

The purpose of this research is to investigate such influences in the Principles of Marketing course. Specifically, this study considers general academic achievement as measured by cumulative GPA and marketing academic achievement as measured by student performance on the short answer portion of exams in the Principles of Marketing course. Exam version is also considered as a differentiator of student performance on multiple choice questions. The results of the analysis are consistent with

several previous studies and provide meaningful insight for marketing educators.

LITERATURE REVIEW

The study of test item order on student performance on multiple choice exams is not new (Hughes, Prytula, and Schnelle 1974; Norman 1954). In fact, this line of inquiry has expanded to include testing expectation (Balch 2007), test anxiety (Burns 2005), and comparative performance on other assessment measures (Bacon 2003; Becker and Johnston 1999; Bible, Simkin, and Kuechler 2008; Chan and Kennedy 2002; Swartz 2006). However, the work in marketing education has focused primarily on test item order.

Petit, Baker, and Davis (1986) examined test item order with class standing, college major, and test paper color as covariates in a Principles of Marketing course. After controlling for college major (marketing majors performed significantly better than non-majors), students who received the forward-sequential version (i.e., test items appear on the test in the same order as they were covered in the course) scored significantly higher than those who received the random-sequential version. A number of studies support the finding that students perform significantly better on a forward-sequential than a random-sequential version of a multiple choice exam (Balch 1989; Carlson and Ostrosky 1992; Stout and Wygal 1990).

Chidomere (1989) also used a Principles of Marketing course to investigate test item order and student performance. He concluded from his study, which included four multiple choice exams with forward and random-sequential versions, that there was no significant difference in student performance based on test item order. This supports previous studies by Sax and Cromack (1966) and Schmitt and Scheirer (1977). A more recent

study focused on marketing courses also shows inconclusive results regarding test item order and student performance (Russell, Fisher, Fisher, and Premo 2003). Similar results are common in other business disciplines as well (Geiger and Simons 1994; Heck and Stout 1991; Peek 1994).

It is clear that there are mixed results regarding student performance and test item order for multiple choice exams in the Principles of Marketing course. However, only the work of Russell and his associates (2003) considered academic achievement as well. In their study, students in two sections of an Advertising course and one section of a Sales Management course as well as students in three sections of management courses were administered three multiple choice exams over one semester. Each student took one exam with exam questions in forward order, one in reverse order, and one in scrambled order. The researchers controlled for academic ability in their research design by averaging each student's mean score on the multiple choice questions across all three exams and used it as a blocking variable in their statistical analysis. Although students scored highest on the forward order exam, the difference in student performance across the three exam versions was not significant.

A more comprehensive approach to considering prior academic achievement is to utilize student cumulative GPA in the design of the study. This was the approach taken by Canlar and Jackson (1991) in their research on academic achievement, test item order, and student performance on multiple choice exams with accounting students. In their work they used cumulative GPA to divide students into three groups, namely highest third, middle third, and lowest third. They then randomly assigned students from each group to one of the exam versions (forward, random, reverse test item order). The results of their analysis showed that there was no difference in student performance based on academic achievement for students in the highest or lowest third but that students in the middle third performed significantly better on the reverse order version compared to the other two versions.

A similar approach is utilized in this study with some modifications. In this study, each student takes three exams with multiple choice questions over the semester rather than just one exam. Thus each student is exposed to each kind of exam version (forward, random, reverse) once and grouping students based on cumulative GPA is used for exam version assignment. Actual cumulative GPA, rather than a contrived blocking variable as was the case in the Russell and his associates study (2003), is used in the analysis of variance to compare general academic achievement and student performance on multiple choice exams. Since cumulative GPA includes academic achievement in courses from a variety of disciplines unrelated to business another measure is needed. Marketing academic achievement is measured by student performance on short answer questions on the same exams to reflect academic achievement in a similar content area as the multiple choice questions.

METHODOLOGY

This study was conducted at a small public institution in the north east. Test item order was manipulated on three exams in two sections of the Principles of Marketing course taught by the same instructor. The course is required of all Business Management majors. In each case, multiple choice questions were placed at the beginning of the exam followed by five or six short answer questions requiring answers of two to three paragraphs each. Other assessment measures in the course included weekly quizzes, four short written case studies, and two group presentations.

There were three versions of each exam. In the first version, multiple choice questions were placed in forward order, that is, questions appeared in the same order that material was presented in class. In the second version, multiple choice questions were placed in random order, that is, the order that the questions appeared was unrelated to the order that the material was presented in class. In the third version, multiple choice questions were placed in reverse order, that is, questions appeared in the opposite order that material was presented in class.

Students in each section were divided into three groups based on cumulative GPA. On the first exam, the instructor administered the random order version of the exam to students in the highest third, the forward order version to students in the middle third and the reverse order version to students in the lowest third. Over the next two exams students were administered the exam versions to which they had not been previously exposed. Thus, every student took three exams and was exposed to each exam version (forward, random, reverse) once throughout the semester. Exposing each student to all three version types ensured that the final grade earned by a certain student had not been skewed by the test item order of one particular exam. All exams, regardless of version, were printed on white paper, so students had no visual cues as to the order of test items.

There were 24 multiple choice questions and six short answer questions covering five chapters on the first exam. There were 20 multiple choice questions and five short answer questions on the second and third exams covering four chapters of material each. The difference in the number of multiple choice questions on each exam was a reflection of the number of chapters covered on each exam with approximately five questions per chapter. As a result, percentages were used as the measure for student performance rather than raw scores to account for the variance in the number of multiple choice items on each exam.

Short answer questions were the same for both sections and appeared in the same order. Although multiple choice questions varied between sections, everyone in the

same section was administered an exam with identical multiple choice questions. All multiple choice questions in both sections were selected from a test bank and were of equal difficulty. Having questions on the exam for one section that differed from those on the exam for the other section did not result in a significant difference in student scores for the multiple choice portion with an average of 75.1 percent for one section and 75.4 percent for the other. The examination periods were timed, but in each testing situation every student completed the exam in the time allotted.

Cumulative GPA and test item order were recorded with the student scores on the multiple choice and short answer questions to allow for further analysis of the results. Analysis of variance was utilized to determine if student performance on the multiple choice portion of the exams in the Principles of Marketing course differed significantly based on general academic achievement, marketing academic achievement or test item order.

RESULTS

There were 57 students enrolled in the course; however, only the results of 50 students were recorded for the purpose of this study since two students withdrew from the course before taking all three exams, four students were transfer students in their first semester of attendance and thus had not established a cumulative GPA at the institution, and one student was a post-master's student seeking continuing education.

Of the 50 students observed in this research 22 percent were seniors, 38 percent were juniors, and 40 percent were sophomores. Eighty percent of the students enrolled in the course were business management majors, 12 percent were sport and recreation management majors, and 8 percent were from other disciplines.

An analysis of variance was conducted to see if marketing academic achievement and general academic achievement are consistent measures. The analysis found that students in the highest third based on cumulative GPA scored significantly better on short answer questions than students in the middle and lowest thirds ($p = 1.72E{-}07$). The average scores for the three groups on short answer questions were 85.7 percent, 70.1 percent, and 66.4 percent respectively with an overall average of 74.2 percent. This suggests that there is a positive relationship between marketing academic achievement and general academic achievement in that students who score high on general academic achievement also score high on marketing academic achievement.

An analysis of variance was also conducted to see if student performance on multiple choice questions differed significantly based on academic achievement or test item order. The dependent variable in the analysis was the percentage of correct answers on the multiple choice portion of the exams. The independent variables included test item order, general academic achievement represented by cumulative GPA and marketing academic achievement represented by student performance on short answer questions. The analysis was conducted at the .05 alpha level.

Table 1 shows that students scored highest overall on the reverse version and lowest on the forward version. There was no significant difference in student performance based on test item order in the analysis of variance ($p = 0.49$). Table 1 also shows the average student performance on multiple choice questions based on general academic achievement. It is clear that students with the highest cumulative GPAs performed the best on each of the exam versions used. When considering academic achievement based on cumulative GPA students in the highest third scored significantly better in average multi-

TABLE 1
STUDENT PERFORMANCE AND GENERAL ACADEMIC ACHIEVEMENT

General Academic Achievement	Test Item Order			
	Forward	Random	Reverse	Overall
Highest Third (17)	81.8	78.2	84.1	81.4[a]
Middle Third (17)	66.7	75.3	76.2	72.7
Lowest Third (16)	72.8	71.9	69.8	71.5
Overall (50)	73.8	75.2	76.8	75.3

[a] Highest third is significantly different than both middle and lowest third ($p = 8.22E{-}05$).

ple choice exam scores compared to students in the two other groups ($p = 8.22E–05$).

Table 2 shows the average student performance on multiple choice questions based on marketing academic achievement. When academic achievement is defined by student performance on short answer questions an analysis of variance shows that those in the highest third performed significantly better on multiple choice questions than those in the middle third ($p = 0.02$). Interestingly, those in the lowest third also performed better than those in the middle third but the difference was not significant ($p = 0.13$).

These two tables show that those students in the highest third based on general or marketing academic achievement consistently scored better than other students on the multiple choice questions regardless of test item order.

DISCUSSION

The results of this research support those of previous studies which show that test item order does not significantly influence student performance on multiple choice exams in the Principles of Marketing course (Chidomere 1989; Pettijohn and Sacco 2007; Russell, Fisher, Fisher, and Premo 2003). Even though the difference is not statistically significant students scored highest on the reverse order version. This suggests a recency effect where students more readily recall information presented most recently in class. Successful completion of these initial items may provide confidence to better address the remaining test items on the exam.

In this study student performance varied significantly based on general academic achievement. Intuitively this makes sense given that academically stronger students are more likely to be the best prepared for exams regardless of version and therefore are least sensitive to test item order. Moreover, weaker students are also not as likely to be affected by question sequencing given their overall difficulty with objective exams.

Student performance also varied significantly based on marketing academic achievement. This is a more relevant finding given that general academic achievement is a reflection of student performance in a variety of courses from a number of disciplines. However marketing academic achievement is based on similar course content and therefore provides a more applicable result. Taken together, the two measures for academic achievement suggest that test item order is not a significant differentiator of student performance compared to the influence of past performance in other courses and current performance in other assessments in the Principles of Marketing course.

When looking at student grouping based on cumulative GPA and multiple choice exam score it is clear to see that students in the highest third scored lowest on the random version, students in the middle third scored lowest on the forward version, and students in the lowest third scored most poorly on the reverse version. This is interesting because these respective versions for each group represent the first exam students took in the course. Given that the overall average for all students was lowest on the first exam this finding may be due to students not being familiar with the instructor's testing style or the type of content that appears on multiple choice exams.

The results of this study and those of previous research (Canlar and Jackson 1991) suggest that students in the middle third are the most susceptible to the influence of test item order given the highest third view exams as easy and the lowest third view them as challenging

TABLE 2
STUDENT PERFORMANCE AND MARKETING ACADEMIC ACHIEVEMENT

Marketing Academic Achievement	Test Item Order			
	Forward	Random	Reverse	Overall
Highest Third (17)	77.4	78.8	80.0	78.8 [a]
Middle Third (17)	69.9	73.1	72.1	71.7
Lowest Third (16)	74.1	73.5	78.5	75.3
Overall (50)	73.8	75.2	76.8	75.3

[a] Highest third is significantly different than middle third ($p = .02$)

regardless of familiarity with the instructor's approach to testing or the order in which test items appear on the exams.

When students were grouped based on marketing academic achievement students in the lowest third actually performed better than those in the middle third on all three exam versions, particularly those in forward and reverse test item order. Although the difference was not statistically significant, this result does raise an interesting point. Students in the lowest third based on marketing academic achievement likely do not retain comprehensive data as effectively and do not have writing skills as strong as those in the other two thirds who perform better on short answer questions. Perhaps the students in the lowest third are better able to recall related information represented by multiple choice questions formatted in sequential order, whether in forward or reverse order. Thus, multiple choice questions in forward or reverse order, as opposed to short answer questions, tend to favor the poorest academic achievers while not significantly disadvantaging the highest academic achievers.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The results derived from this study should be viewed as suggestions rather than definitive conclusions given that the research was conducted at one institution with one instructor. Although the students in this study are representative of students at many institutions, there is likely to be differences based on institutional size and selectivity. Also, no consideration was given to student test anxiety or attitude toward marketing as a field of study or career. Perhaps those students who wish to pursue further coursework in marketing better prepare for exams than those who take the course simply to fulfill the requirement for the Business Management major. The findings by Petit, Baker, and Davis (1986) showed that marketing majors perform better than non-majors on multiple choice exams. However that type of analysis was not possible since the marketing major is not offered at the institution in this study.

Rather than matching general academic achievement groups with a particular test item order version from the outset, some students from each group should be administered a forward test item version, some a random test item version, and some a reverse test item version on each of the three exams. This will mitigate the influence of maturation particularly on the first exam. However, each student should still be exposed to each test item order version once so that the influence of test item order and academic achievement on student performance can still be analyzed. This approach is also most fair for students so that their grades in the course are not needlessly influenced by the test item order on one exam.

Test items used in this study were all categorized as moderately difficult so no consideration was given to the order of test items and their level of difficulty. Students completed the exams in this study within the time given, but it would be interesting to see if there is any change in the influence of the factors listed above with significant time constraints placed on the exam administration. Time limitation is quite relevant to the study given the myriad of situations that students will face after graduation when time is of the essence in making effective business decisions.

The influence of test item order may have been reduced in this study given the limited number of multiple choice questions included in each exam (24, 20, and 20) and by the fact that the two sections did not have the exact same questions on their exams. Perhaps increasing the number of multiple choice items and administering exams with identical questions to multiple sections in a future study might highlight the possible differences that were not perceptible given the brevity of the multiple choice portion of the exams in this study. Increasing the number of students and including marketing majors is worthy of consideration.

The marketing academic achievement variable could be expanded to include student performance on other measures of assessment in the Principles of Marketing course such as written case analyses, group presentations, and quizzes. This would better illuminate any differences between the general academic achievement measure based on cumulative GPA and the marketing academic achievement based on performance solely in Principles of Marketing. Allowing for student anonymity in short answer responses may reduce grading bias. Moreover, having more than one instructor grading subjective aspects of the course, including the short answer exam questions could further reduce bias in grading. Future studies could also consider the influence of text anxiety, time constraints, student major, or volume of material, as measured by the number of chapters covered, on student performance on multiple choice exams in the Principles of Marketing course.

CONCLUSION

Student performance was not affected by test item order rather academic achievement in prior courses as well as the Principles of Marketing course played a more significant role. Therefore, marketing educators should not hesitate to utilize the randomizing function of testing software that scrambles the order of questions to make several versions using the same questions for a selected multiple choice exam. This is an efficient and fair approach which serves as an effective deterrent to student cheating. Alternatively one would need a seating chart and statistical software to detect answer patterns between

students seated in close proximity (Nath and Lovaglia 2008). It may also be a more accurate measure of student learning given the absence of cues from preceding or following questions in the random version. The random version does not favor any student group based on academic achievement and it better represents how knowledge is used in business practice when related information is not readily available.

Educators with larger sections should not hesitate to use multiple choice questions instead of short answer questions on exams. As demonstrated in this study, students who perform well on questions in short answer format are just as likely to excel at multiple choice questions. This will reduce the time marketing professors have to spend on grading without compromising a student's ability to excel in the course. This is particularly true when students are also given the opportunity to demonstrate their learning via written assignments such as case analyses, critiques, or marketing plans.

However, educators may want to consider using the reverse test item order on the first multiple choice exam in a given course since the benefits of the recency effect may mitigate the detriments of student unfamiliarity with the professor's approach to testing. This may also encourage students who might otherwise do poorly on the first exam to not withdraw from the course prematurely. Professors should also consider lowering the weight of the first exam or administer several exams in the course to reduce the influence of initial student unfamiliarity with the professor's testing style. Given the pervasiveness of multiple choice exams administered in Principles of Marketing courses continued research in test item order or multiple choice question formats (Brodowsky and Taylor 2009) should enhance marketing pedagogy and student learning.

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