THE IMPORTANCE OF TEACHING STATISTICS IN A PROFESSIONAL CONTEXT

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This study investigates how the attitudes of marketing and psychology students differ and whether the differences are inherent from the start or develop as they progress through their degree. While statistics is equally useful for careers in marketing and psychology, third year marketing students are shown to have much less positive attitudes towards statistics than their psychology counterparts. It is suggested that this difference may be as a result of differences in the two course structures and that embedding statistics more fully into specific discipline areas improves student' attitudes and helps to prepare them better for the workplace.

INTRODUCTION

Teaching statistics to a group of reluctant students can be an arduous task, but one which is very familiar to those of us who spend most of our time teaching service courses in statistics. There has been a plethora of research over the last thirty years devoted to educating such students, including recommendations such as use of real data (Singer and Willett, 1990), inclusion of projects (MacGillivray, 1998), less reliance on mathematics (Moore, 1992), more simulation (Zhou, Brouwer, Nocente & Martin, 2005), use of multi-media (Lipson, Francis & Kokonis, 2006), using statistical software (Biehler, 1993), and many more. And yet for many of us, motivating these students remains a challenge.

In recent years the authors have been mainly engaged in teaching statistics to students from the psychology and marketing disciplines. We meet these students several times during their three year degree studies. In the first year of their programs they all study the same statistics foundation subject. The psychology students study two more statistics subjects, generally one in their second year and one in their third year, and the marketing students study one more subject, generally taken in their second year. Various modification have been made to the curriculum, pedagogy and assessment of the various subjects over the last ten years, and these have certainly resulted in improved learning outcomes, and overall high rating from students for these subjects. However, many staff members have sensed a difference in attitude to statistics between the two cohorts of students (psychology and marketing). Some evidence for this difference is found in the student feedback survey which is conducted by the university each semester. Until 2007 the survey included the statement "The subject stimulates my curiosity to learn more about this field" to which students were required to respond. The percentages who broadly agree to this statement with regard to the subject indicated are given in Table 1.

Table 1. Percentage of students who broadly agree with the statement
The subject stimulates my curiosity to learn more about this field

	2006	2007
Foundation subject	59%	58%
Second year psychology orientated statistics subject	73%	76%
Second year marketing orientated subject	34%	50%

While this data confirmed the lower level of interest in statistics by the marketing students, it did not help us to determine whether there was a change in interest between the two groups while studying, or whether the difference in interest was inherent in the students from the start. Further understanding the difference between the cohorts of students, and in particular whether the difference could reasonably be explained by their educational experiences, motivated the researchers to undertake this study. To this end we needed to undertake a more thorough investigation of students' attitudes to statistics.

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WORKPLACE RELEVANCE

Before undertaking the research study a comparison of the statistics experiences of the two cohorts was undertaken. The purpose of this was to identify any differences in experiences which might influence attitudes, and hence should be addressed in the study. Since both groups of students are taught statistics by the same staff then no major differences which are attributable to teacher qualities such as attitude, knowledge, experience, or enthusiasm could be expected. Similarly all students were instructed using a data rich curriculum which drew heavily on data and case-studies from their respective disciplines. Assessments in both units required students to use a statistical package to analyse data and write reports in a style appropriate to their discipline. One key difference in assessment is that the psychology statistics subject includes an examination worth 50%, while the marketing statistics subject has a major project assessment, also worth 50%. Given students general dislike of examinations this would seem more likely to alienate psychology students than marketing students.

The main difference between the statistical experience of the marketing and psychology students appeared to be in the extent to which statistics is embedded and applied in the discipline as a whole, over the three years of their degree. The psychology students are required to apply their knowledge of statistics throughout their whole program, needing to be able to both read and interpret psychological research, and also carry out statistical analyses themselves in their laboratory reports. The marketing students however are given little or no opportunity to apply statistical knowledge outside of the statistics subjects. With no opportunity to apply this knowledge in the marketing discipline, it is understandable that they may not view the study of statistics as relevant, and hence they feel less motivated to study the discipline.

Since statistics is not related to their study of marketing throughout their program, it is understandable that students don't see statistics as relevant to their future profession. Is perceived workplace relevance a key to understanding student attitudes? Why do marketing and psychology students study statistics anyway? A study of statistics can be found in most marketing and all psychology programs, and one assumes that this is because this knowledge is important in the conduct of these professions. Stern and Tseng (2002) advocate that all marketing students must understand the concepts of market research in order to "understand the research specialist, to evaluate their work, and to use the information in decision making" (p. 225). Similarly, the Australian Psychological Society requires students in an accredited undergraduate program in psychology to include research design, methods and analysis (APAC Standards, 2007).

To what extent is statistics then explicit in the subsequent professions of marketing and psychology? A convenience sample of 37 relevant positions from job placement websites was analysed, and only those in which a psychology or marketing degree was specifically named were counted in the sample. In total, 18 required a marketing degree, 18 required a psychology degree and 1 required either a psychology or marketing degree.

Analysis of the position descriptions found that 15.8% of both marketing and psychology jobs stated that statistics experience would be required in the role. Furthermore 15.8% of psychology jobs and 26.3% of marketing jobs require expertise in some form of statistical program such as SPSS or Excel. So, overall, a study of statistics was at least equally relevant for positions in both fields.

MEASURING STUDENT ATTITUDES

A validated instrument which has been developed to measure students' attitude to statistics is the Survey of Attitudes Towards Statistics, SATS (Schau, Stephens, Dauphinee and Vechio, 1995). Initially this was a 28 item questionnaire which measured students' attitudes about their intellectual knowledge and skills when applied to statistics (Cognitive Competence), students' attitudes about the difficulty of statistics as a subject (Difficulty), their feelings towards statistics (Affect), and their attitudes about the usefulness, relevance, and worth of statistics in personal and professional life (Value). A second 36 item version of SATS included two more dimensions, the students' level of individual interest in statistics (Interest) and the amount of work the student expends to learn statistics (Effort) (Schau, 2005).

FACTORS THAT INFLUENCE ATTITUDE

Several statistics researcher have investigated factors which affect a student's attitude to statistics (see, for example, Gal & Ginsberg, 1994; Gal & Garfield, 1997). Tempelaar, Loeff and Gijselaers (2007) investigated the relationship between attitude, measured using the SATS scale and reasoning ability, finding only weak relationships between these variables. They concluded that attitudes have a positive effect on reasoning ability only through Value and perceived lack of Difficulty.

In this study we were more interested in how pedagogy and course design can affect attitude rather than the influence of factors inherent in the student. In an earlier study Lo and Stevenson (1991) suggested that attitude is affected by perceived usefulness, with students who can see the relevance of statistics, particularly those who are undertaking post-graduate study and who are beginning to read research articles, recording more positive attitudes to statistics than undergraduate students. Lantos (1997) conjectured a relationship between the attitude of students and the attitude of the teaching staff, with more positive attitudes attributed to students of highly motivated staff. In her study of the attitude of psychology students to statistics Wiberg (2009) concluded that a combination of data-driven problems, experiential learning, and particularly continually relating the subject to a specific psychology problem, contributed to an increase in student motivation.

THE STUDY

Two groups of students were used in the study; those completing a third year marketing subject and those completing either of two third year psychology subjects offered in the second semester of 2009. The questionnaires were distributed in either the lecture or the tutorial of week 3, at the discretion of the subject convenors. For the marketing subject, and one of the psychology subjects, students were given time to complete the questionnaire in class, and response rates were very high with almost all students present in the class completing the questionnaire. For the second psychology unit where students were asked to complete the questionnaire after class only 4 additional questionnaires were received. However, many students are enrolled in both third year psychology subjects and had already completed the questionnaire. In total, data was obtained from 68 of the 106 marketing students and 29 of the 68 psychology students.

Some of these students had also participated in an earlier study, conducted in 2006 and 2007, measuring their attitudes towards statistics before they commenced the foundation first year statistics course. Unfortunately many of the marketing students either had an exemption from the first year subject in statistics or completed it in 2008 when data was not collected. In consequence, complete information from both time periods was only available for 21 marketing students and 22 psychology students.

The students' attitudes towards statistics were measured using a slightly reduced version of Schau's 36 item SATS scale (Schau, 2005). Only 5 of the 6 subscales were used. Items in the subscale measuring the amount of effort the student expended to learn statistics were not relevant to third year students, who were not currently enrolled in any statistics subjects. The five scales used were Affect, Cognitive Competence, Value, Difficulty and Interest. All scales take values from 1 to 7. One of the additional items from SATS was also used: "In the field in which you hope to be employed when you finish university, how much will you use statistics?" which takes values from 1 (not at all) to 7 (a great deal).

RESULTS

Table 2 gives the mean scores for each group (psychology and marketing) separately for the five dimensions of attitude measured during third year. That is, after each group had studied two statistics subjects, a common foundation subject, and then discipline specific subjects in second year.

An analysis of the results of the SATS questionnaire administered to third year students showed quite dramatic differences between the attitudes of psychology students and marketing students. From the table it can be seen that the psychology students had more positive feelings about statistics than marketing students ($M = 4.0$ compared to $M = 3.7$), and more confidence in their ability to deal with statistics than marketing students ($M = 4.9$ compared to $M = 4.5$), but the differences are quite small. However, psychology students valued statistics much more highly than

marketing students (M = 5.2 compared to M = 3.8), and expressed much more interest in using statistics than marketing students (M = 4.7 compared M = 3.2). The perceived level of difficulty was almost the same for both groups (M = 3.4 for psychology students, M = 3.3 for marketing students).

Table 2. Mean attitude scores for students in third year

	Psychology			Marketing		
Component	Mean	SD	N	Mean	SD	N
Affect	4.0	1.3	29	3.7	1.2	69
Cognitive Competence	4.9	1.1	28	4.5	1.2	66
Value	5.2	0.8	29	3.8	1.0	69
Lack of Difficulty*	3.4	0.7	28	3.3	1.0	67
Interest	4.7	1.4	29	3.2	1.4	69

*a higher score means that students perceive the subject as less difficult

How do the perceptions of the usefulness of statistics to their discipline differ? The boxplots in Figure 1 compare the level of agreement to the statement "In the field in which you hope to be employed when you finish university, how much will you use statistics?" for each group. The boxplots show a marked difference between the two groups. The distribution for the marketing students is positively skewed, with 50% of students indicating a level of agreement of 3 or less. These students see little application for statistics in their eventual careers. In contrast, 50% of psychology students indicated a level of agreement of 5 or more. For this group of students, statistics has a place in their upcoming career.

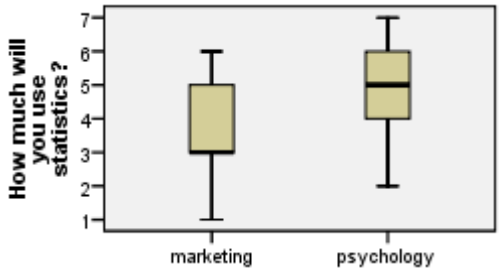

Figure 1. Level of agreement with the statement *How much will you use statistics?*

Do these results just reflect differences in attitudes between psychology and marketing students before they encounter any statistics units, or have there been changes in attitude which might have occurred as a result of their studies? Attitudes before commencing any studies in statistics were compared to attitudes at the start of third year for both marketing and psychology students. Figure 2 gives the mean scores for each of the variables Affect, Cognitive Competence, Value, Interest, and Difficulty.

From Figure 2 it can be seen that marketing students actually start out with a more positive feelings about statistics and more confidence in their ability to deal with statistics than psychology students, but by the third year of their programs this relationship has reversed. Marketing students see only modest value in statistics at the start of their program, and unfortunately this worsens over time, while psychology students see statistics as more valuable from the start, and increase this view over their program. Both groups of students start out with almost the same level of interest in statistics but again this reduces markedly for the marketing students while level of interest increases for the psychology students. Psychology students' perception of the level of difficulty of statistics stays relatively constant during their program. While Marketing students see statistics as less difficult at the outset than psychology students, for them statistics becomes more difficult over their course of study.

Thus, overall it can be said that marketing students' attitudes deteriorate while psychology students' attitudes improve as they undertake their studies in statistics, alongside their studies in their major discipline.

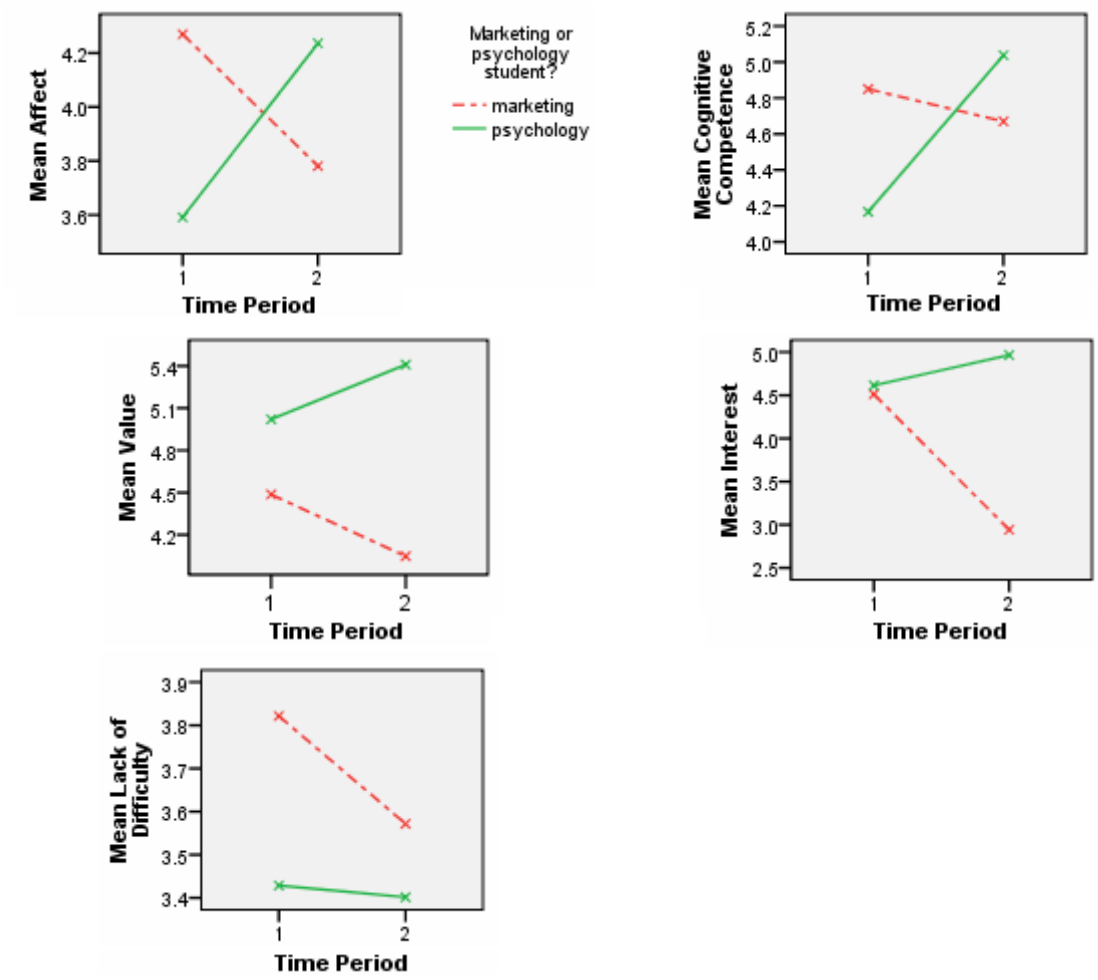

Figure 2. Comparison of the mean scores in each variable before any study of statistics, and in their final year of their course, for psychology and marketing students

DISCUSSION

In this study it has been established that towards the end of their three year degree marketing students feel less enthusiastic about statistics, see it as less valuable and relevant in their personal and professional lives, and are actually less intrinsically interested in statistics, than psychology students. The marketing students also indicated that they see statistics of little use to them in their future employment, and it is reasonable to consider that the student perception of applicability of statistical knowledge to their discipline mediates their attitude to the subject.

If the study of statistics is equally important for marketing and statistics students, why do marketing students see statistics as far less relevant? It is our conjecture that this might be attributable to the extent to which statistics is embedded in their whole program, which in turn may depend upon the attitude, experience, or knowledge of those involved in teaching in this area. In a study of the effect of teacher attitude and teacher knowledge on student learning in economics Dills (2008) found that that teacher knowledge had a positive effect on student learning, whereas teacher attitude had little or no effect. However, when statistics is a service discipline, the attitudes towards statistics of teachers in the students' core discipline (marketing or psychology) are likely to affect the extent to which statistics is included in the teaching of that core discipline.

Thus we conclude that it is not enough to consider statistics study in isolation, or even to use examples and case studies from the profession; statistics needs to be embedded in discipline study. Concepts and techniques learned in the statistics subjects must be included in both the curriculum and assessment of the core discipline for students to have a positive view of and value this knowledge.

In a recent review of the marketing discipline in out faculty, a new subject entitled Strategic Business Research has been included, for commencement in 2010. The intention of this

unit is to build on the statistical techniques which have already been taught and relate them to the real world role of the marketing professional. The unit provides training in the use and interpretation of actual data generated from important areas of contemporary business research. A future study for the authors will include the measurement of marketing students' attitude to statistics after they have studied this subject. Since they will now have an opportunity to see statistical analyses underpinning the decision making strategies of the marketing discipline, there is a good chance that more positive attitudes to statistics will result.

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