SOME SUGGESTIONS FOR TEACHING UNDERGRADUATE BUSINESS STATISTICS COURSES

ABSTRACT. Student anxiety is high in many business statistics courses. Often, students fail in these courses because they rely highly on grades rather than on meaningful learning. Instructors also feel the pressure because their students do not attempt to learn deeply. I taught *Quantitative Methods* courses for a number of years in a large university in Ontario. In this paper, I have critically analyzed some of the challenges that instructors face in teaching these courses and suggested some solutions based on an educational point of view. Continuous assessment, portfolio construction, and improving the efficiency of instructor evaluations are three key suggestions for consideration.

As these challenges are common to any undergraduate course in business statistics, the suggestions would mainly help to raise student motivation, encourage students to learn deeply, and increase instructor efficiency.

Keywords: Business statistics; Statistics anxiety; Attitude toward statistics; Higher education; Teaching statistics

1. INTRODUCTION

Business statistics is usually a compulsory subject in undergraduate commerce programs in many universities. This course has a high failure rate of about 20% (Chua, Foster, McKessock & Smith [1]; Foster, Dewan & Kaplan [2]) compared to Marketing which is one of the other three compulsory subjects in this program. It has a failure rate of about 2% (Chua, Foster, McKessock & Smith [1]). Instructors who teach statistics courses and students who have enrolled in these courses often encounter many challenges (Carmona, Matìnez & Sànchez [3]; Onwegbuzie [4]). Due to these challenges, students attain low performance in examinations (Zanakis & Valenzi [5]). Inability to pass these courses affects the completion of the degree program for some students. On the other hand, teachers sometimes fail to prime their students adequately and experience frustration in doing their work. Zeidner [6] also evidenced this situation and contended that statistics may be one of the most demanding and rigorous courses evoking cognitive and emotional reactions that may inhibit the level of performance of students.

As statistics courses are mandatory in business degree programs, students must take them as part of their coursework. Hence, students who have weak backgrounds in mathematics or statistics sometimes tend to think that they are forced to follow these courses because these courses are mandatory. This is one of the main reasons for some students to have low motivation in these courses. One of the main challenges for instructors is to overcome students' low motivation and lack of positive attitude toward learning. On the other hand, since these courses have high failure rates, instructors are often unpopular among students. Sometimes, instructors receive low evaluations from students not entirely because of the problems of their teaching but because of the students' lack of

interest in the course. Despite this, there are other challenges that instructors have to overcome during their teaching.

I taught Quantitative Methods in Statistics (QMS) courses for a number of years in the School of Business Management at a large Ontario university. In this paper, I will elaborate some of the teaching and other challenges in teaching these courses based on my experience, and suggest some solutions to motivate students in order to make their learning more meaningful. More precisely, my main objective is to examine critically the challenges of teaching and their sources, and suggest some practical solutions that are helpful for any QMS program.

2. LITERATURE REVIEW

The percentage of graduate students experiencing uncomfortable levels of statistics anxiety is between 66% and 80% (Onwuegbuzie & Wilson [7]). Due to this anxiety, some students often have negative views about these courses and they postpone taking these courses until the end of the program (Onwuegbuzie [8]). These negative attitudes and perceptions also influence students' grades in statistics courses (Jordan & Stroup [9]; Swanson, Meinert, & Swanson [10]; Zanakis & Valenzi [5]). For example, a number of studies have shown a negative relationship between test anxiety and statistical performance (Benson [11]; Hembree [12]; Zanakis & Valenzi [5]). This is indeed an unfortunate situation as the ability to do statistical analysis is one of the most valued skills in business (Lane, Mansour & Harpell [13]; Philip & Schulz [14]).

There are a number of reasons for student anxiety in statistics courses. Mathematical ability contributes to the prediction of achievement in statistics as confirmed by many studies (Harlow, Burkholder & Morrow [15]; Johnson & Kuennen [16]; Schutz, Drogosz, White & Distefano [17], Tremblay, Gardner & Heipel [18]). Also, there is a relationship between anxiety toward statistics and achievement in statistics (Onwuegbuzie [19]; Onwuegbuzie & Seaman [20]; Zeidner [6]). Sorge and Schau [21]) examined possible causal relationships among students' previous academic success (i.e. outcomes from prior learning experiences), their attitudes toward statistics, and their achievement in an introductory statistics course. Sorge and Schau [21] found a positive correlation between statistics achievement and previous success, and statistics achievement and attitudes toward statistics as confirmed by previous research (Gal, Ginsburg & Shau [22]; Wisenbacker, Scott & Nasser [23]).

Some courses in commerce programs tend to be survey courses in which much of the emphasis is on information transmission and memorization rather than on relating one knowledge base to another or applying concepts to a variety of situations. Statistics courses are more likely to challenge students to integrate their knowledge of several areas to solve business problems. This integration is difficult for many students. Lounsbury, Sundstrom, Loveland, and Gibson [24]) found that general intelligence determined 16% of the variance in a course grade while other psychosocial factors including work drive accounted for 11% of the variance. This suggests that hard work will have a positive impact on grades, regardless of ability. Lack of hard work due to various reasons is another factor that contributes to students' difficulties.

On the other hand, infrequent or irregular class attendance makes it hard for students to grasp and retain the concepts properly. For example, there is much research showing a positive correlation between class attendance and academic performance (Burdge & Daubenmire [25]; Romer [26]). Devadoss and Foltz [27]) suggested that professors should provide incentives to increase class attendance. Moreover, procrastination is an important predictor of academic achievement (Ferrari, Johnson, & McCown [28]; Jackson, Weiss, Lundquist & Hooper [29]; Schouwenburg [30]; Tice & Baumeister [31]). Students who have already failed the course once or more and others who delayed taking the course until the last moment would often have anxiety issues leading to poor performance. Sebastianelli & Tamimi [32] focused on the suitability of online delivery for quantitative business courses, specifically for business statistics and management science. They used multiple approaches to assess student learning. Their findings suggested that features involving professor–student interaction were the most useful. Features promoting student–student interaction were the least useful, and discussion forums are of limited value in learning quantitative content. The authors also illustrated on how questions embedded in an online final exam can be used to measure desired student learning outcomes.

The above discussion listed a number of reasons for student anxiety in learning statistics. This anxiety has a direct impact on their grades. On the other hand, student anxiety indirectly affects other processes such as teaching. Therefore, instructors who teach these courses are continuously under pressure contemplating whether their students will or will not perform well. In the next section, I will discuss some of the ways to redress student anxiety and make them more comfortable in their learning from an educational point of view. This is important because no meaningful change will occur until we are willing to discuss candidly and openly, the inherent challenges that will obstruct achieving our objectives.

3. A BRIEF DESCRIPTION OF QMS COURSES

In my university, QMS courses are taught in two levels. As a prerequisite to QMS 202, the advanced course, students have to complete QMS 102 (or QMS 204) in their first year of the program. QMS 102 has been structured around a thirteen-week semester, each week with a three-hour contact time, and a final examination at the end of the course. This course contains some preliminary concepts in statistics such as statistical graphs, charts, diagrams, descriptive statistics, basic probability, probability distributions, sampling distributions, and some applications of those concepts. This course will also provide students a quantitative foundation for future courses in finance, economics, accounting, and marketing research. Similarly, QMS 202 is also a thirteen-week course building up on the concepts of QMS 102. The topics covered in QMS 202 are the normal distribution, confidence intervals, hypothesis testing for one sample and two sample tests, one-way ANOVA, chi-square tests, simple linear regression, and multiple regression. It has been recommended to use Casio FX-9750 GII or an equivalent calculator and a statistical software package (Statistical Package for the Social Sciences - SPSS) in this

course. In sum, QMS 102 covers mainly the descriptive aspects of statistics while QMS 202 covers some topics in inferential statistics.

There are two textbooks for the two courses and currently the fourteenth edition of the textbook (Smith & Chua, 2011) is in use. It is a comprehensive guide for students and it contains explanations and applications of the concepts in a suitable manner for business students with limited theory and more practical applications. The book has a comprehensive set of exercises expanding from simple to complex problems at the end of each chapter. The use of technology has been elaborated at the end of each chapter focusing on graphing calculators and SPSS.

The evaluation framework for QMS 102 contains two tests, one midterm examination and the final examination. All the questions have a multiple choice format. An online homework system is carried out by the textbook publisher Pearson. Students are expected to do one assignment weekly. For QMS 202, there are two tests and a final examination. All the tests have a multiple choice format. The weekly online homework system is carried out by Pearson. There is also a group project using the statistical software package SPSS. In this project, students are expected to analyze some business data using SPSS, and write a report. One of the objectives of the project is for students to become familiarized with analyzing a mini data set related to a business situation using SPSS.

4. STUDENT EXPECTATIONS

One of the central goals of a business school instructor is to prepare the students to analyze business problems and let them face such problems determinately in the future. To do this, instructors must teach analytical and practical skills that the students will actually use when they become employees in the business sector. In other words, instructors should try to bridge the gap between theory and practice. In other words, this is to impart some practical knowledge and skills to the students. Contrary to this, some students typically have very narrow objectives. They are more eager to discover what will be on the test, or what the instructor is looking for in a given test/assignment. Most often, they want to figure out the easiest way to get a good grade; they want immediate, detailed feedback on any work they do because they are too anxious. This mismatch of objectives between the instructor and the student often leads to problems.

Besides this, some students believe that grades are everything. They are rarely interested in assessing whether they would become good business analysts unless that helps them to get a better grade. In the meantime, they resist confusion, perceived inconsistency, or anything else that detracts them from the most efficient path to a good grade. The pressure to perform well and secure a good grade define their objectives in many critical ways. On the other hand, instructors' objectives are different from this. They must often ask questions from their students that do not have easy answers—questions that require the application of judgment, not just knowledge. In addition, students should not be "spoon-fed" information or taught to the test. As a result, many students become frustrated and, to a certain extent, their comfort level is reduced. However, their learning experience will be much different from a traditional learning style. Ironically, pursuing these objectives could make the instructor truly unpopular among students. The real

challenge for an instructor is to strike the balance between facilitating students to obtain a good grade while at the same time allowing them to learn the concepts deeply.

Grading may really be a disservice to the learning objectives making the educational experience more grade-centric than learning-centric (Kohn [34]). In fact, parents, students, and society focus more on grades than on learning (Weimer [35]). As Kohn [34] argued, we most often hear the same questions or comments from students such as, “Is this going to be on the test?”, “Do we really need to know this?”, “Can I do something for extra credit?” or “I worked really hard on this, I deserve a better grade” which are indications of student concerns about grades than learning. Therefore, grading students for their real abilities is a challenge for the instructor because students are more anxious about their grades than their learning.

5. STUDENTS’ PRE-KNOWLEDGE

As mentioned previously, QMS 202 builds up on QMS 102 and students are expected to have some considerable knowledge of previously learned concepts when learning the second course. Especially, students who repeat the second course more than once have difficulties in recalling the previous concepts. The instructor’s biggest challenge is to impart the required pre-knowledge without seriously affecting the teaching of new concepts. Every lesson in QMS 202 involves some level of hypothesis testing. Therefore, students are expected to have a thorough understanding of the principles of the normal distribution and sampling distributions as a basis for hypothesis testing. On the other hand, students in business courses may have some difficulties in understanding abstract mathematical concepts because they mostly have followed high school applied programs. In my experience, these students are mainly visual learners so that allowing them to explore the concepts visually is more important. Many websites portray visual applications of statistical concepts such as the normal distribution and sampling distributions. Encouraging students to visit those websites and incorporating these websites into lesson notes would be a good practice. In this way, it would refresh students’ pre-knowledge and save valuable time of the instructor when reminding the previous concepts.

One of the main problems that instructors face in teaching QMS 202 courses is the students’ lacklustre approach to learning. In a subject like statistics, students must practice a considerable number of problems in order to get a complete understanding of the concepts. Many students normally realize this when they reach close to an examination. To avoid this situation and to get them involved in continuous practice, it is better to have frequent testing. One of the best ways to do this is to have an online homework assignment every week. As suggested by Chua- Chow, Chauncey and McKessock [36], this will not only improve student performance but also reduce their anxiety level. DiRienzo & Lilly [37] compared student learning outcomes on both a “basic” and “complex” assignment given in the same course using two different delivery methods: face-to-face and online, across five undergraduate business courses taught at Elon University during the summer 2007. The study included over 120 students and, after controlling for other factors known to affect student performance, the results indicated that delivery method had no significant effect in student learning.

There are other reasons that will bring better results from frequent testing. An increased number of tests will allow weak students to get more practice to reduce their anxiety and perform better. More frequent testing may also provide weak students with a more realistic view of their ability because a limited number of concepts are tested frequently allowing them to focus on a particular unit or two at a time. Above all, frequent testing increases the motivation to attend classes and that it reduces the opportunity for procrastination. Dunn, Richardson, McDonald, & Oprescu [38] suggested to use classroom response systems (CRS) and the use of them which has been associated with positive educational outcomes by fostering student engagement and by allowing immediate feedback to both students and instructors. Their study explored the use of a low-cost CRS (VotApedia) from an instructor perspective. The use of VotApedia enabled first-year students to become anonymously engaged in a large-class environment by using their mobile phones to vote on multiple-choice questions in first-year undergraduate statistics classes at three Australian universities. The results indicated a significant impact on student learning based on instructors' views and challenges therein.

6. SPSS PROJECT

Students in QMS 202 are expected to finish a small group project using SPSS toward the end of the semester as one of the evaluation requirements. During the course, students can get used to SPSS in two ways. They can follow the instructions given in the textbook or follow the examples that the instructor demonstrates in class. However, during the classroom tests, students are not expected to use SPSS and obtain results. Instead, they get relevant SPSS outputs on the test paper for interpretation. Due to this approach, students do not pay much attention to learn SPSS thoroughly during the course. They often forget the step-by-step instructions to get the correct output because of their lack of exposure to the software. Students at their discretion can form groups of four or five for the project. Normally, what happens in a group is that the students in the group divide the workload of the project among themselves. Usually, those who are familiar with SPSS will volunteer to obtain the outputs. For this reason, some students do not get familiarized with the statistical package at all. This may drastically affect achieving some of the course objectives. Alternatively, a series of individual lab exercises instead of the project will solve this problem to a certain extent. This approach will undermine the objectives of a group project. However, it will increase students' familiarity with the software allowing them to use it independently.

To avoid the "shotgun approach" of finishing the project in the last minute, we can implement a different procedure. In this method, the project will expand during the whole semester. Student groups can make their submissions in four stages. This approach would allow students to reflect upon their previous stages and take corrective actions if necessary. The students should be given the opportunity to select their own project topic, so long as it was relevant to the course coverage and intentions. In stage 1, they had to decide on a topic and send it to the instructor describing it briefly in a couple of paragraphs. This is due in the second week of class. Stage 2 is a bullet-point outline, due in a week or two later. This will give the instructor the opportunity to provide feedback

and the projects which do not have the required quality have to go through another iteration. Stage 3 is the rough draft, which is due about two or three weeks before the end of the term. The instructor can comment on the depth of investigation, citations, clarity/organization, adequacy etc. in the draft report at this stage. The last stage is the completed report due in the last day of the course. By making students pay attention to the final project at stages throughout the term, we can eliminate most of the "last-minute rush" and because of the detailed feedback given at each stage, quality of these projects would be much better. Also, the students can obtain a complete understanding of all the aspects of the project including the software package, SPSS in this way.

7. PORTFOLIO APPROACH

As instructors, one of our major goals is to increase students' intrinsic motivation and allow them to learn deeply. To achieve this goal and to overcome some of the previously mentioned difficulties, we can encourage students to prepare an individual portfolio to see whether this facilitates their learning. The students can start the process from the beginning of the second class and can finish it in the last week. In the portfolio, they could integrate material from the text, class lectures, and other sources that are relevant to the course. Specific Instructions should be provided to them on how to construct a portfolio such as a list of required topics (all the topics in the course outline), guidelines for the number of pages, page restrictions on each topic, inclusion of materials from other sources, copyright laws, penalties for plagiarism and so on. These guidelines would make them evaluate the material to be included before simply including them.

The portfolio approach will provide answers to some of the challenges and problems that were discussed earlier in this paper. Students could start each section of the portfolio with some pre-concepts that will give them easy access to new concepts. Some parts of the portfolio would contain websites that have animations of statistical concepts. Most important are the step-by-step procedures for SPSS analysis and the details on how to obtain and read SPSS outputs. One of the greatest advantages of the portfolio is that students can use their portfolios in the tests (the tests are open-book) instead of using crib sheets as reference materials. Students can have personal satisfaction of their work and can keep those materials for future reference. They would also have the intrinsic motivation to study advance courses in statistics because of the experience gained in this work.

8. EVALUATION OF INSTRUCTORS

It is obvious that the instructors play an active role in student success. Therefore, instructors also should be assessed in a constant basis allowing them to deliver quality instruction. Evaluation of instructors is another challenging aspect associated with student low achievement. In a university system, instructor success is determined usually by two methods: student evaluations of the instructor and faculty evaluations. One problem with student evaluations is that the students sometimes have inherent biases and misleading information in measuring the effectiveness of an instructor. While student evaluations can provide objective information about whether the instructor is on time,

treats all the students fairly, appears to be organized, and so on, the question is whether student evaluations are equipped to evaluate the teaching skills of the instructor objectively.

Wachtel [39] questioned whether students have the capacity to evaluate teaching effectiveness. Heckert, Latier, Ringwald-Burton and Drazen [40] found that students who had an extended effort in studies, learned more, and were subsequently rewarded, rated instructors more highly than expected. The role of the scale used and question sequencing used on the rating have significant effects on the accuracy or reliability of student evaluations (Sedlmeier [41]). Diehl (in German) cited in Sedlmeier [41] expressed that more formal topics such as research methods and statistics seem to receive systematically lower ratings. Cognitive Dissonance Theory provides an explanation for the unreliability of student evaluations. The theory suggests that students who expect poor grades rate instructors poorly to minimize psychological, or ego threat (Maurer [42]). None of this means that student evaluations are useless. My point is that such biases of evaluation must be eliminated whenever possible and alternative methods should be used to validate student evaluations. We have to equip students properly to assess their instructors' teaching skills not with a subjective "I" but with an objective eye. In my opinion, students should be allowed to evaluate their instructors on two occasions, one at the mid-term and the other toward the end of the course in order to obtain more reliable evaluations. This will provide a better comparison of the performance of the instructor in pre- and post- mid-term sessions. The evaluation schedule should be simple and that it should have more focus on obtaining qualitative information on teaching. Among other items, students can provide a description of what the instructor should eliminate from his/her current practice, should continue with, and should change in the future.

The peer evaluation of instructors and the departmental evaluation during the semester are two good methods of improving instructor efficiency. There must be room for lengthy feedback to the instructor in the evaluation schedule. The evaluation should be conducted in a proper manner in order to help the instructor by giving feedback rather than performing the evaluation merely for auditing and administrative requirements. Instructors are entitled to receive lengthy qualitative feedback on their teaching and that this whole process should be perceived in an educational point of view before considering those evaluations for administrative purposes. A one-to-one discussion between the instructor and the evaluator is the best method to clarify issues and to provide feedback.

9. CONCLUSION

In this paper, I have listed a number of challenges related to teaching quantitative methods courses and suggested some practical solutions for these problems. Most of these challenges may be common to any statistics course at this level and that discussing these problems openly would make way to bring them to a common platform in finding solutions. The main challenge of teaching those courses is to raise student motivation and decrease their anxiety level. Also, students' extreme desire for pursuing grades is a great obstacle to meaningful learning. Instructors who strive hard motivating their students to

learn deeply are truly unpopular among students, and these instructors tend to receive low evaluations from students.

The challenges identified in this paper will have either direct or indirect influence on student learning. In order to raise motivation levels, students should be given continuous feedback about their learning by assessing them frequently. Weekly online assignments or other methods would help in this end. Encouraging students to prepare an individual portfolio is an efficient method for them to understand the concepts deeply and reflect upon their learning. Instructor evaluation is another area that needs to be addressed in an efficient manner to provide constructive feedback to them rather than using the evaluation merely for administrative purposes. This will improve instructor confidence and efficiency that will lead to effective teaching.

Any great teaching effort by instructors would not flourish unless the students have intrinsic motivation to learn the subject. Kilpatrick, Swafford and Findell [43] divided mathematical proficiency into five interwoven and interdependent strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Productive disposition is "the habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy" (Kilpatrick et al., [43], p. 116). The above strands closely related to statistical proficiency too as a subject in the family of mathematics. What it simply says is that fluency in a subject depends on many important factors. Productive disposition toward the subject is one of them among others. We can make it happen by adjusting our routine programs and leaving room for some positive changes to occur.

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