The Evaluation of Student Attitudes toward MC2G

Gulsah Basol-Gocmen, Ohio University
Gibbs Y. Kanyongo, Ohio University
Lydia Blankson, Ohio University

The purpose of this paper is to evaluate the use of MC2G program to teach certain topics in statistics education. MC2G is a program written in Pascal Delphi by Gordon Brooks of Ohio University based on Monte Carlo studies. MC2G provides students opportunity to practice important topics in an introductory statistics course, such as power, Type I error, t test, and effect size through the use of. So far, this software is used by Gordon Brooks, its writer, in his introductory statistics course to teach power, Type I error, t-test, and effect size. There is a need for a study on the student attitudes toward the use of this software to teach statistics. Students' perceptions may provide an understanding on the use of the software. The current study proposes an understanding to this gap through a survey study. The results indicated that students have positive perceptions toward the use of MC2G in teaching power, Type I error, t-test, and effect size topics. It was expected to gather student perceptions regarding the effectiveness of the MC2G in teaching power, Type I error, t-test, and effect size topics in statistics. Only problem with the software is appeared to be its difficulty in application. According to the students, it works best when it is used along the instruction.

Key Words:MC2G, student attitudes, Monte Carlo studies.

This paper presented at the 2002 annual meeting of the Mid-Western Educational Research Association, Columbus, OH

Correspondence: Assist. Prof. Gulsah Basol, Gaziosmanpasa University, Faculty of Education, Department of Educational Sciences, Tokat/TURKEY +90 356 2521616 ext. 3412 or by email basol@gop.edu.tr

Introduction

The purpose of this paper is to evaluate the use of MC2G program to teach certain topics in statistics education. MC2G is a program written in Pascal Delphi by Gordon Brooks of Ohio University and it offers a learning experience in selected topics such as power, Type I error, t test, and effect size through the use of Monte Carlo studies. So far, this software is used by Gordon Brooks, its writer, in his introductory statistics course to teach power, Type I error, t-test, and effect size. However, there has not been any study on the student attitudes toward the use of this software to teach statistics. Students' perceptions need to be examined in order to have an understanding of flexibility and the

use of MC2G software from the viewpoint of actual users. The current study proposes an understanding to this gap through a survey study. It was expected to gather student perceptions regarding the effectiveness of the MC2G in teaching power, Type I error, t-test, and effect size topics in statistics.

Review of Related Literature

Statistics and students attitudes towards statistics

Statistics is the science of collecting, organizing, and interpreting data, and it is important in the work of many professions. Statistics is a powerful intellectual method that is applied in many contexts and most disciplines. The training in the science of statistics is therefore, valuable for preparing students for a variety of careers.

Realizing the significance of statistics for a sound education, most colleges and universities require students in the various fields of study to take at least one statistics course before graduation. To be successful at statistics students must learn how to read data, comprehend, and provide valid conclusions to important questions.

Although statistics is viewed as very important, most students lack a strong background in it. It is well known from experience that many students from non-statistics backgrounds find the task of taking an introductory statistics scary. For most students statistics is a hurdle, which they need to overcome in order to obtain their degrees. They thus have a phobia for statistics and tend to keep putting it off till they get to a point where they are no longer able to postpone taking a statistics course (Potter, 1995). Then when they do finally take the statistics course, most students go through the course with high anxiety, especially during testing periods (Onwuegbuzie, 2000). Having high anxiety towards statistics is a dangerous phenomenon since research trends show a positive relationship between students' attitude towards statistics and student achievement (Robert & Saxe, 1982, Robert & Reese, 1987).

Statistics teachers are therefore, faced with the task of designing courses that are interesting, decrease students' perceptions of statistics being a difficult subject, and that enable students to understand the necessary statistical concepts. In trying to do so most teachers focus on improving cognitive aspects of statistics instruction. Very little attention is paid to non-cognitive issues, such as, students' feelings, attitudes, beliefs, interests, and perceptions' towards statistics (Onwuegbuzie, 2000). Since Faghihi &

Rakow have shown that attitudes and beliefs about a medium may affect learning (1995), statistics teachers need to also consider areas these non-cognitive areas in order to make the students' "statistics experience" a less-anxious and enjoyable one. Therefore, as one of the less favorite courses, statistics welcome the software programs that help learning through drill and practice in the classroom environment.

The role of computers in statistical education

It has been accepted that computers significantly contribute in the learning process. The use of computers in classrooms is no longer a novelty. In today's world, students perceive computers to be crucial or essential commodities in their education. The computer is often characterized as an impartial tutor, providing a risk-free learning partner. It is also known as an interactive environment for creative and independent learning (Payne & Sachs, 1994). Some reports have also suggested that computers and other educational technologies have beneficial effect on student achievement (Bialo & Sivin, 1991, Roblyer, Castine, & King, 1988). Computers in classrooms enrich both the teaching and learning experience, let teachers keep pace with individual needs of students, prepare students for 'real world' jobs, and help teachers make positive, fundamental changes in how they teach (Oblinger, D., 1992). Also, educators view computers as instruments through which they can achieve much greater success in reaching their basic goal of educating students (Bennett, 1997).

The computer has become a very important tool for the statistician as well. Personal computers, spreadsheets, professional statistical packages, and other information technologies are now ever-present in statistical data analysis. Without using these tools, the statistician cannot perform any realistic statistical data analysis on large data (Arsham, 2002). According to Bratton (1999), students should have some experience with computer statistical packages or at the very minimum, have experience interpreting the outcomes from statistical software.

The center of it all is whether using computers as instructional tools influences students' attitudes toward statistics. Leite (1994) investigated students' attitudes to the use of computers in statistics courses. He sampled 143 undergraduate students at a private mid-western university, and the results of the study revealed that students did have positive attitudes toward the use of computers in statistical courses.

Using computer software in teaching statistics

It must be acknowledged that students understand a topic more when they are provided with an illustration of the concept under study. This notion applies also to statistics. Statistics generally comprise of two components: statistical techniques and tools. Tools are essential complements of statistical techniques. Much confusion may be created when the techniques are taught without illustration (Tabatabai & Gamble, 1997). Illustrations are usually done using computer software.

Computer software is specifically written and used to teach, and provide training or information to increase the user's cognitive base in a particular academic, vocational, or skill area. Such software has benefits over some of the more traditional skill-building methods by accommodating different learning skills, and thus motivating students to participate actively in learning (Payne & Sachs, 1994).

A survey research conducted by Bartz & Sabolik (2001) in which 203 colleges and universities were sampled indicated that the most used statistical software package in most colleges and universities was SPSS (59% of the 73 departments that indicated the use of computers used this package). Webster (1997) studied statistical software used in Business statistics courses, and observed that Minitab and Mystat programs were the most used. Webster's study also showed that statistical topics were enhanced when appropriate software were used. Tabatabai & Gamble, in their study on business statistical software, found out certain software such as, Minitab and SAS were frequently used in statistical courses. High (1998) examined the use of computer software in college classrooms in teaching mathematics and statistics. A survey instrument was designed and distributed to teachers of mathematics and statistics at several four-year colleges in Long Island, New York. The survey also measured the opinions and attitudes of the faculty towards the use of software to supplement their teaching. The study concluded that majority of professors teaching statistics utilized statistical packages to supplement their teaching, and required students to learn and use the software for the course. One criticism though was that it took to long to teach the student how to use the software.

Though, there is not complete agreement that computer software should be used in statistics courses (Dillon, 1999), a discussion on the impact of technology on instruction and curriculum have indicated that computer software make teaching more

interesting because then faculty can focus on teaching topics better (Bratz & Sabolik, 2001). Also, changing job markets are now requiring students to have at least a minimum competency of statistical software. Not only is it important that the student is able to use computer software, it is also important that the student is able to interpret outcomes obtained from using the software. Faghihi & Rakow' s study has shown that attitudes and beliefs about a medium may affect learning (1995) and therefore, there is a need to examine the effect of statistical software on students' attitudes.

Methods

Twenty surveys were administered to students of an introductory statistics course at Ohio University, College of Education during the summer session of the 2002-2003 school-year. The subjects were 20 graduate students enrolled in an introductory statistics course. The survey was focused on four topics: power, Type I error, t-test, and effect size because MC2G was used during the time that these topics were covered.

The experiment lasted two class sessions. Every student had his/her own computer to work with during each session. First, a theoretical explanation of power, Type I error, t- test, and effect size was delivered to the class by the instructor and the following session an illustration of software was offered in relation to power, Type I error, t-test, and effect size. In the next session, students practiced with MC2G in the guidance of the instructor. At the end of the session, they were informed about the survey on which their preference of MC2G use on teaching certain topics in statistics could be indicated. Participation was stated as voluntary and there was not any requirement to complete the survey once it had been started. Also a written instruction related to the nature and purpose of the survey is provided. After the instructor left the classroom, students were given the survey by one of the authors of this paper and the confidential returns were collected in an envelope. The questions were concerned more with the practical effectiveness of the software rather than its facial features as in usual software evaluation forms. All students completed the survey and a content analysis was conducted to see the result of this survey.

Findings

Twenty surveys are collected from 20 students – a response rate of 100%. Of the respondents, 16 were female and 4 were male. Students were coming from different

fields of study, such as, Higher Education, Audiology, Telecommunications, Biological Sciences, Counseling, Cultural Studies, and Curriculum and Instruction. Half of the students reported that this class was their first statistics course and the other half reported that they took a statistics course before coming to this class.

The survey questioned students' perceptions of MC2G use by asking whether they thought MC2G software was helpful in understanding power, Type-I error, t-test and effect size topics. There was one yes/no question for each topic and another question to provide an explanation for the answers. The proportions of students who answered "yes" to these questions were presented in Table 1.

Table 1- Proportion of students answering "yes" to each question

Topics	Proportions
Power	1.00
Type I error	.75
t-test	.90
Effect size	.79

Overall, results indicated that all respondents favored MC2G use in teaching power. Meanwhile, other topics were also given considerably high scores. While all 20 students reported that MC2G helped them to understand power, the large majority of the students indicated that MC2G was also useful in understanding t-test, Type I error and effect size (15 students out of 20 for Type I error, 18 students out of 20 for t-test, 15 students out of 19 for effect size). The most often given explanation to the "yes" answers were a preference for visual learning, ability to manipulate numbers and ability to see varying results and their effects, and the usefulness of practical examples. The explanation to the "no" answers were the difficulty of software and the need for more practice. Some students indicated that they were not sure how MC2G worked and how to relate the concepts, such as, power, t-test, effect size to each other. There were a few students saying that lecture was enough to understand the topics without the use of MC2G. Furthermore, although some students favored MC2G, they also concluded that without the help of instructor they would be lost. A few students suggested that MC2G

should include a help menu to make it easier to understand and apply without the help of instructor.

Almost all students (19 out of 20) reported MC2G as user-friendly. Furthermore, all 20 students concluded that overall MC2G helped them to understand power, Type I error, t-test, and effect size. All 20 students recommended the use of MC2G in introductory statistics courses, while 11 of these students reported that lecturing was enough for them to understand the above topics.

Finally, students were asked to rate their understanding with the help of MC2G and without the use of MC2G on a 1 to 10 scale. The number of students in each level is provided in Table 2 and Table 3.

Table 2- Number of student rates in each level on a 1 to 10 scale before being introduced to software

Rate	Number of students
4	1
5	2
6	8
7	5
8	4

Table 3- Number of student rates in each level on a 1 to 10 scale after being introduced to software

Rate	Number of students
5	2
6	1
7	5
8	10
9	2

Before being introduced to MC2G, 4 students rated their understanding as 8, 5 students rated as 7, 8 students rated as 6 and 2 students rated as 5 and 1 student rated as 4.

After using MC2G, 2 students rated their understanding of the topics as 9, 10 students rated as 8, 5 students rated as 7 and 1 student rated as 6 and 2 students rated as 5. As seen in Table 2 and Table 3, the more students gave higher rates regarding their understanding of the topics after the use of MC2G.

Discussion and Conclusion

In summary, it appears that students have positive perceptions towards the use of MC2G software in teaching power, Type I error, t-test, and effect size topics. The present study clearly shows the advantage of using MC2G in teaching mostly power, and also teaching Type I error, t-test, and effect size topics. MC2G provides a chance for learning through visual demonstration. Through the help of Monte Carlo methods, students also get an understanding of how parameters are affected when the certain changes are made.

Difficulty of its application appears to be one major weakness of MC2G from the results of the present study. A number of students indicated that MC2G works best with the help of instructor when it is used along with instruction.

References

Arsham, H., University of Baltimore. (n.d.) Professor Arsham's Web page. Retrieved September 18, 2002 from http://ubmail.ubalt.edu/~harsham/stat-data/opre330SPSSSAS.htm#rintrocomo.

Bartz, A.E., & Sabolik, M.A. (2001). Computer and software use in teaching the beginning statistics course. *Teaching Psychology*, *28*(2), 147-149.

Bennet, F. (1997). *Computers as tutors*. Retrieved September 18, 2002 from http://www.firstmonday.dk/issues/issue6/intro/

Bialo, E., & Sivin, J. (1991) *Microcomputers*. A Research Review complied for Software Publishers Association.

Bratton, G.N. (1999). The role of technology in introductory statistics courses. *The Mathematics Teacher, 92*(8), 666-668.

Dillon, K.M. (1999). I am 95% confident that the earth is round: An interview about statistics with Chris Spatz. *Teaching Psychology, 26*, 232-234.

Faghihi, F., & Rakow, E.A. (1995). *The relationship between instructional methods with students' responses to the survey of attitudes toward statistics.* A paper presented at the annual meeting of the mid-south educational research association.

High, R.V. (1998). The use of computer software in the teaching of college mathematics and statistics. *School of Business Report*, Adelphi University.

Leite, P. (1994, June). College students' attitudes towards computers. *Division of Business and Technology Report.* Butler County Community College.

Oblinger, D. (1992). Teaching and learning with computers. *Institute for Academic Technology*. North Carolina University at Chapel Hill.

Onwuegbuzie, A.J. (2000). Attitudes toward statistics assessments. *Assessment and Evaluation in Higher Education, 25*(4), 321-339.

Payne, M.D., & Sachs, R. (1994). Educational software and adaptive technology for students with learning disabilities. *Health Resource Center Guide: American Council on Education.*

Potter, A.M. (1995). Statistics for sociologist: Teaching techniques that work. *Teaching Sociology,* 23, 259-263.

Robert, D.M., & Reese, C.M. (1987). A comparison of two scales measuring attitudes toward statistics. *Educational and Psychological Measurement, 47*(3), 759-764.

Robert, D.M., & Saxe, J.E. (1982). Validity of a statistics attitudes survey: A follow-up study. *Educational and Psychological Measurement, 42*(3), 907-912.

Roblyer, M., Castine, W., & King, F. (1988). The effectiveness of computer applications for instruction: A Review and Synthesis of Recent Research Findings. The Haworth Press: New York.

Tabatabai, M., & Gamble, R. (1997). Business statistics education: Content and software in undergraduate business and statistics courses. *Journal of Education for Business, 73*(1), 48-54.

Webster, E. (1997). Evaluation of computer software for teaching statistics. *Journal of Mathematics and Science Teaching, 11*(314), 377-391.