ASSESSMENT OF STUDENTS' KNOWLEDGE AND SKILLS IN LEARNING STATISTICS IN THE 21ST CENTURY

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This paper investigated the ways on how students understood the various topic areas in statistics in order to have better learning experiences in gaining knowledge and skills in statistics. The relationship between the students' attitudes to statistics; their abilities and learning outcome were also examined. Results showed that students whose biases and misconceptions were being corrected tend to have excellent grades. Also, students who agreed that they like statistics were likely to have very good and excellent grades. Several activities that improved awareness, developed talents and potential, enhanced quality of life and contributed to the realization of dreams and aspirations in the field of statistics in the 21st century were also presented. The students agreed that they were encouraged to ask questions, to experiment and to formulate their own plan of action. In addition, they were also taught to use statistical software in their respective classes.

INTRODUCTION

Evaluation is essential to the education process (Gardner, 2002). Teaching can be more effective if the desired goals at the end of the class is properly set and determined by the educators (Garfield, 1994). Assessment must be integrated into the learning process so that teachers and students can verify whether the learning goals are being met. This way, shortcomings could be resolved before the course is over. Assessment upholds the goals of lifelong learning, including higher levels of student achievement, greater equity of student outcomes, and improved learning to learn skills. These are used to evaluate what students have learned at the end of a course, to ensure they have met required standards while earning certification for school completion, or while joining the work force, or as a method for selecting students for entry into graduate education.

Statistics is found to be important in research on various disciplines. The University of the Philippines Cebu offers statistics courses for students of other disciplines such as Political Science, Computer Science, Biology, Management, Psychology, Mass Communications and Mathematics. A survey of 146 students who took statistics course from these programs was conducted to assess the various ways on how students learn statistics at the post secondary level. It also determined the relationship between the attitude of the students on statistics and their performance in class.

RESULTS AND DISCUSSION

Statisticians are engaged in various industries such as in agriculture, telecommunications, pharmaceuticals, weather forecasting, strategic planning, marketing, computing, and data mining.

Several statisticians today are teaching in a college classroom setting or conducting trainings in an industrial setting. One of the major concerns in teaching statistics is how to ensure that students understand the statistical ideas and are able to apply what they learned. Hence this paper attempts to investigate the variety of ways of how students understand various topic areas in statistics.

To assess the variety of ways on how the respondents understood the various topics in statistics, they were asked to indicate their level of agreement to the following statements on a scale of 1 to 5 with 1-Strongly disagree, 2-disgaree, 3-neutral, 4-agree and 5-strongly agree: 1) I have learned and understood new concepts of statistics in this class; 2) My past misconceptions, stereotypes and biases on the concepts of statistics are corrected in this class; 3) I learned to apply statistical concepts in real life situations because of the real-life applications tackled in this class; 4) I learned how to connect my new learning with my past experiences; 5) I was enthusiastic to learn new things in this class because the lessons challenged me to rethink my own ideas; 6) I learned to formulate my own plan of action in this class by looking for concepts and answers in various references/sources, and asking questions; 7) I was encouraged to ask questions, to experiment, and to formulate my own plan of action; 8) I learned to ask questions which helped me understand the

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lessons; 9) I learned to develop my confidence and properly guided to perform tasks; and 10) I learned to use statistical software (i.e., data analysis in Microsoft excel, SPSS) in this class.

More than 50 percent of the respondents agreed that: they had learned and understood new concepts of statistics in their classes; that their past misconceptions and biases on the concepts of statistics were corrected; and they learned to apply statistical concepts to real-life situations. Further, 36 percent of the respondents agreed that: they were encouraged to ask questions, to experiment, and to formulate their own plan of action. Moreover, 45 percent of the respondents agreed, and 28 percent strongly agreed that they learned to use statistical software (i.e., data analysis in Microsoft Excel, IBM SPSS) in their respective classes.

In measuring students' attitudes about the value of learning statistics and the use of statistics in his or her chosen field of study, 37.67 percent of the students agreed that they like statistics; 32.19 percent disagreed that they felt insecure when they did statistics problems; 31.51 percent agreed that they got frustrated going over statistics tests in class; and 32.19 percent agreed that they were under stress during statistics class. Meanwhile, 30.14 percent agreed that they enjoyed taking statistics courses; 34.25 percent disagreed that they were scared by statistics; 37.67 percent disagreed that they were having trouble understanding statistics because of how they think; 50 percent disagreed that they did not have any idea of what's going on in this statistics course; 31.51 percent agreed and disagreed that they made a lot of math errors in statistics. Further, 52.04 percent disagreed that they learned statistics; 34.93 percent disagreed that they found it difficult to understand statistical concepts; 30.14 percent agreed that Statistics formulas were easy to understand; 39.04 percent agreed that Statistics is a complicated subject; 32.19 percent disagreed that statistics is a subject quickly learned by most people; 58.22 percent agreed that learning statistics requires a great deal of discipline; 47.95 percent agreed that statistics involves massive computations; 51.37 percent agreed that statistics is highly technical; and 45.21 percent agreed that most people have to learn a new way of thinking to do statistics. Results also revealed that 41.78 percent agreed that they were interested in being able to communicate statistical information to others; 45.21 percent agreed that they are interested in using statistics; 51.37 percent agreed that they are interested in understanding statistical information; 52.74 percent agreed that they are interested in learning statistics; 47.95 percent agreed that they worked hard in the statistics course; 42.47 percent agreed that they studied hard for every statistics test; and 43.15 percent agreed that they attended every statistical session.

The grades of the respondents were found to be related with the degree of agreement if their past misconceptions, stereotypes and biases on the concepts of statistics were corrected in their class, and if they liked statistics. Further, 83 percent of those who strongly disagreed that their misconceptions in statistics were corrected in their class had grades ranging from 2.51- 5.00. On the other hand, 58.3 percent of those who strongly agreed have grades ranging from 1.00-2.00. Further, 83.3 percent of those who strongly disagreed that they like statistics have grades ranging from 2.51-3.00. Meanwhile, 67 percent of those who strongly agreed that they like statistics have grades ranging from 1.00-2.00.

CONCLUSION

It is important that misconceptions and biases of the students regarding statistics should be addressed in the classroom. It is found that there was a relationship between the grades of the students with the degree of agreement if their past misconceptions, stereotypes and biases on the concepts of statistics are corrected in their class, and if they like statistics. The grades of the students were affected by their attitude towards statistics. Thus, in order to make the learning of statistics in the 21st century less frustrating, less fearful, and more effective, not only among college students but also at the earlier stages, statistics educators should focus on the attitudes and experiences students bring to statistics education; how they developed and changed during their educational experiences, and the impact of these experiences on students' achievement, persistence, and eventual application of their new knowledge and skills.

REFERENCES

Carless, D. (2005). Prospects for the Implementation of Assessment for Learning. *Assessment in Education Principles Policy and Practice, 12*(1), 39-54.

Chambers, R.L., & Skinner, C.J. (2003). *Analysis of Survey Data.* Chichester, UK: Wiley.

Glasson, T. (2008). Improving Student Achievement through Assessment for Learning. *Curriculum & Leadership Journal. 6*(31).

Gal, I., Ginsburg L., & Schau C. (1997). Monitoring Attitudes and Beliefs in Statistics Education. In I. Gal and J. Garfield (Eds.), *The assessment challenge in statistics education* (pp. 37-51). Amsterdam: IOS Press.

Garfield, J (1994). *How Students Learn Statistics.* Retrieved from http://www.dartmouth.edu/~chance/teaching_aids/books_articles/isi/isi.html

Gardner, J. (2002). *Assessment Reform Group. Assessment for Learning: 10 Principals*. London: British Educational Research Association (BERA).

Garfield, J. (1994). *How Students Learn Statistics.* Retrieved from http://www.dartmouth.edu/~chance/teaching_aids/books_articles/isi/isi.html