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The Effects of Attitude and Self – Efficacy in Statistics to the Performance of BS Mathematics Students

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1. Abstract

This is a study to determine the effects of attitude and self-efficacy to the performance in Statistics of the BS Math Students which includes the perceptions of 60 students taking up the course Bachelor of Science in Mathematics in the second semester of academic year 2016 – 2017 at Surigao del Sur State University. It uses two standardized instruments.

The respondents have a strong attitude to statistics that it will be useful to their profession and they have much confidence to learn how to identify when the mean, median and mode should be used as a measure of central tendency. The study found out that the attitude towards statistics is related to self-efficacy to learn statistics. This study also discovered that there is an effect of attitude and self – efficacy to the performance in Statistics of the BS Math Students.

2. Rationale

Statistics education is focused on improving the cognitive side of instruction, that is, the skills and knowledge that students are expected to develop and little regard has been given to non-cognitive issues such as students' attitudes towards Statistics and self-efficacy to learn Statistics.

Statistics educators routinely mention that many students enter statistics courses with negative views or later develop negative feelings about the domain of statistics. Perney and Ravid (1991)said that statistics courses are viewed by most college students as an obstacle standing in the way of attaining their desired degree. It is not uncommon to see students who delay taking the statistics courses until just before graduation

Phillip (2007) describes attitudes as manners of acting, feeling or thinking that show a person's disposition or opinion and suggested that attitude is more cognitive than emotions and change more slowly than they do. Attitudes may involve positive or negative feelings that resulted from positive or negative experiences over time in learning statistics.

Many students do not come to statistics classes fully ready to embrace and function within a learning environment oriented toward problem solving. Instead, many carry baggage that includes negative or unconstructive beliefs about themselves in relation to the learning of quantitative and mathematical issues, including math anxiety (McLeod 1992)

Self – efficacy is defined as the levels of confidence individuals have in their ability to execute courses of action or attain specific performance outcomes (Bandura, 1977; 1982; 1997) as mentioned in the study of Lane, A. M., et al.Self-efficacy expectations are proposed to influence initiating behavior, how much effort will be applied to attain an

outcome and the level of persistence applied to the task in the face of difficulties and setbacks (Bandura, 1997).

According to Compeau and Higgins, self-efficacy is defined as the belief that one has the capability to perform a particular behavior. This concept refers to beliefs in ones' capabilities to organize and execute the course of action required to produce given attainments (Bandura, 1997) and is thought to result from past accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Individuals' self – efficacy levels influence their ability to acquire skills, their choice of activities, and their willingness to continue in a course of action.

The purpose of this study was to gain more understanding of BS Mathematics' perceptions on selected non– cognitive factors of statistics instruction especially those related to affective reactions and attitudes towards statistics and self – efficacy to learn statistics effectively. The researcher believes that further attention to such factors is necessary as they may contribute to students' difficulties in learning basic concepts in statistics and probability. The research questions were;

1) What is the attitude of the BS Math students towards Statistics?
2) What is the self – efficacy rating of the BS Math students in Statistics?
3) Is there a significant relationship of the attitude andself – efficacy rating?
4) Do attitude and self – efficacy rating have an effect on BS Math students' performance in statistics?

The following were considered as the null hypotheses of this study:

a) There is no significant relationship of the attitude and self – efficacy rating of the BS Math student.
b) There is no significant effect of the attitude and self – efficacy rating on the performance in statistics of the BS Math student.

3. Methodology of the Study

The respondents of this study were 60 BS Mathematics students of the College of Arts and Sciences at Surigao del Sur State University – Main Campus in Tandag City, Surigao del Sur, Philippines on the second semester of the academic year 2016 - 2017. These students have taken the course Stat 101 – Introduction to Statistics during the first semester of the second year of their program of study. The performances of the students in Statistics were taken from their final rating in the course Stat 101.

This study used two standardized instruments. The first instrument is the attitude toward statistics, a questionnaire developed by Wise (1985), is a 29-item, 5-point Likert-format scale measuring the respondents' attitudes toward statistics. The second instrument is a questionnaire developed by Lane et al, is a 15-item, 5-point Likert-format scale measuring the respondents' self-efficacy to learn statistics. This questionnaire contains topics both in descriptive and inferential statistics that the student feels confident in doing the task. On the first week of March, the two instruments were administered to the target respondents.

4. Results and Discussion

Table 1 presents the attitude of the BS Mathematics students. It can be noted that the respondents strongly agreed on the item "I feel that statistics will be useful to me in my profession" and "A good researcher must have training in statistics". These are positive

attitudes with a tied mean of 4.684. This is followed by the item “My statistical training will help me better understand the research being done in my field of study” with a mean of 4.316 and the item “One becomes a more effective "consumer" of research findings if one has some training in statistics” with a mean of 4.289. This means that the respondents of this study are looking forward to their future as researcher. They can use the knowledge of statistics in their researches someday.

Table 1. Respondents’ Attitude towards statistics

Item	Mean	Description
I feel that statistics will be useful to me in my profession.	4.684	Strongly Agree
A good researcher must have training in statistics.	4.684	Strongly Agree
My statistical training will help me better understand the research being done in my field of study.	4.316	Strongly Agree
One becomes a more effective "consumer" of research findings if one has some training in statistics.	4.289	Strongly Agree
Training in statistics makes for a more well-rounded professional experience.	4.237	Strongly Agree
Statistical thinking can play a useful role in everyday life.	4.211	Strongly Agree
Most people would benefit from taking a statistics course.	4.184	Agree
Statistics is a worthwhile part of my professional training.	4.184	Agree
Statistics will be useful to me in comparing the relative merits of different objects, methods, programs, etc.	4.105	Agree
Statistical training is relevant to my performance in my field of study.	4.053	Agree
I feel that statistics should be required early in one's professional training.	3.921	Agree
Statistics is an inseparable aspect of scientific research.	3.816	Agree
I am excited at the prospect of actually using statistics in my job.	3.816	Agree
Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.	3.658	Agree
I would like to continue my statistical training in an advanced course.	3.579	Agree
Statistics is too math oriented to be of much use to me in the future.	4.079	Agree
Statistics seems very mysterious to me.	3.474	Agree
I have difficulty seeing how statistics relates to my field of study.	2.921	Undecided
The thought of being enrolled in a statistics course makes me nervous.	2.737	Undecided
I feel intimidated when I have to deal with mathematical formulas.	2.711	Undecided
Statistics is too complicated for me to use effectively.	2.658	Undecided
Statistical analysis is best left to the "experts" and should not be part of a lay professional's job.	2.632	Undecided
I get upset at the thought of enrolling in another statistics course.	2.500	Disagree
Dealing with numbers makes me uneasy.	2.447	Disagree
I see being enrolled in a statistics course as a very unpleasant experience.	2.342	Disagree
Statistical training is not really useful for most professionals.	2.000	Disagree
Statistics is not really very useful because it tells us what we already know anyway.	1.974	Disagree
I wish that I could have avoided taking my statistics course.	1.947	Disagree
Studying statistics is a waste of time.	1.553	Disagree
Over All Mean	3.369	Agree

The respondents agreed on the items “Most people would benefit from taking a statistics course” and that it is a worthwhile part of his professional training. These two items have tied means of 4.184. The item “I am excited at the prospect of actually using statistics in my job” with a mean of 3.816 and the item “I would like to continue my statistical training in an advanced course” obtained a mean of 3.579. These items were still agreed by the respondents as a positive attitude towards statistics.

The respondents are undecided on the items "The thought of being enrolled in a statistics course makes me nervous" with a mean of 3.737. This is followed by "I feel intimidated when I have to deal with mathematical formulas" with a mean of 2.711.

The item "I get upset at the thought of enrolling in another statistics course" with mean of 2.5 and "I see being enrolled in a statistics course as a very unpleasant experience" with mean of 2.342 are negative attitudes. These are being disagreed by the respondents.

Table 2. Respondents' Self-Efficacy to learn statistics

Item	Mean	Description
Identify when the mean, median and mode should be used as a measure of central tendency.	4.079	Much Confidence
Compute the value of a test statistics from a data.	4.000	Much Confidence
Explain the difference between a sampling distribution and a population distribution.	3.974	Much Confidence
Explain what the value of the standard deviation means in terms of the variable being measured.	3.868	Much Confidence
Select the correct statistical procedure to be used to answer a research question.	3.842	Much Confidence
Explain the meaning of a 95% confidence interval.	3.816	Much Confidence
Identify the scale of measurement for a variable.	3.763	Much Confidence
Distinguish between a population parameter and a sample statistic.	3.737	Much Confidence
Interpret the results of a statistical procedure in terms of the research question.	3.605	Much Confidence
Distinguish between the objectives of descriptive versus inferential statistical procedures.	3.579	Much Confidence
Interpret the probability value (p-value) from a statistical procedure.	3.526	Much Confidence
Distinguish between a Type I error and a Type II error in hypothesis testing.	3.526	Much Confidence
Distinguish between the information given by the three measures of central tendency.	3.474	Much Confidence
Identify if a distribution is skewed when given the values of three measures of central tendency.	3.447	Much Confidence
Distinguish between a parametric test and a Non – parametric test.	3.368	Much Confidence
Over All Mean	3.707	Much Confidence

The respondents self – efficacy to learn statistics is presented in table 2. It can be observed that these are the different tasks in descriptive and inferential statistics that a student has to do. The respondents have much confidence to identify when the mean, median and mode should be used as a measure of central tendency with a mean of 4.079. The respondents said that to compute the value of a test statistics from a data with a mean of 4.0 and to select the correct statistical procedure to be used to answer a research question with a mean of 3.482.

The respondents have also much confidence of interpreting the results of a statistical procedure in terms of the research question. This item obtained a mean of 3.605

and the item "Distinguish between a Type I error and a Type II error in hypothesis testing" has a mean of 3.526.

Table 3. Relationship between the attitudes towards statistics and the self – efficacy to learn statistics

Component	Mean	r – value		Decision on Ho	Conclusion
		Computed value	Critical value@ 1%		
Attitude	3.7545	0.399	0.325	Reject	Significant
Self-Efficacy	3.8505				

To determine if a relationship between the attitude towards statistics and the self – efficacy to learn statistics exists, Pearson correlation was applied and the result of the test was presented in table 3. It can be noted that the computed value of 0.399 is greater than the critical value of 0.325. Thus, the hypothesis rejected. This implies that the two variables, attitude and self – efficacy have a relationship. This would implyfurther that the more positive the attitude of the respondent is, the higher is his or her confidence to learn statistics.

Table 4. Effect of attitude on the performance of BS Math student in statistics

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.084	19	.636	6.880E+32	.000
Within Groups	.000	40	.000		
Total	12.084	59			

Table 4 presents the effect of attitude on the performance of BS Math student in statistics using analysis of variance. It is shown in this table that the analysis yields an f value of6.880E+32 which is significant. This result implies that the null hypothesis of no effect is rejected meaning "there is an effect of the attitude on the performance of the respondent in Statistics".

Table 5. Effect of self – efficacy to learn statistics on the performance of BS Math student in statistics

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.075	16	.505	5.412	.000
Within Groups	4.009	43	.093		
Total	12.084	59			

It is also shown in table 5 that the effect of self – efficacy rating to the performance of the respondents is statistically significant with an f value of 5.412. This would mean that the confidence of the respondents to learn statistics has something to do with his or her performance in Statistics.

5. Conclusions

In this study, the following conclusions were drawn;

1. BS Mathematics students have positive attitudes towards statistics. On the average, they agree on the items with an overall mean of 3.369.
2. BS Mathematics students have self confidence in performing the different task in statistics. On the average, they have much confidence on the items with an overall mean of 3.707.
3. The relationship between the attitudes towards statistics and the self – efficacy to learn statistics of the BS Mathematics students is statistically significant.
4. There is an effect of the attitude and self – efficacy rating on the performance of the respondents in Statistics.

6. Recommendations

The following recommendations were made;

1. The statistics anxiety of the students as an independent variable can also be integrated in the study.
2. Other profile variables such as socio – economic status of the family and others can also be used in an off shoot studies.
3. This study can be replicated such that the respondents will be from the other programs or all the students of the College of Arts and Sciences or to the students of other colleges and universities.

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