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Research Article

Students' Attitude and Anxiety Towards Statistics : A Descriptive Analysis

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Abstract

Statistical knowledge is important to students as they will need to apply it on their research or projects. Basically, every major specially major in education offered research methodology courses that will covered basic knowledge on statistics in terms of computation and statistical application. The purpose of this study is to determine the students' attitude towards statistics and statiscal anxiety among postgraduate students in faculty of education. There are 199 respondents involved in this study which consists of 45 males and 154 females students. Two sets of questionnaire, Survey of Attitude toward Statistics-36 (SATS-36) and Statistical Anxiety Rating Scale (STARS) were distributed among the students. Each of the questionnaire consists of 42 and 51 items respectively. Based on the findings, students' attitude and statistical anxiety were both at a moderate level. Addressing students' attitude and statistical anxiety is really necessary in promoting better learning and understanding in statistical literacy.

Key Words

Statistical anxiety • Attitude toward statistics • Graduate students

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The world we live in now revolving with collection of numeric and digitalised data. We have been exposed to the media of how importance statistical literacy without our concern. For instance, in order to make the news make sense to us, we must equipped ourselves with basic statistical knowledge. It will help in determining the economic growth, the weather forecast, predicting the spreadness of a disease, the election polling and medical studies. Statistics acts as code breaker for the encrypted data and to understand it, ones must possess statistical knowledge (Watson, 2006). Thus, statistics is important as it keep us alert from fraud or get cheated (Slootmaeckers, 2012).

That is why early exposure on statistical literacy is necessary. It will help the students to develop their ability to read or write critically and improved their numeric skills (Watson, 2006). In New Zealand, the new curriculum designed to make sure that grade 10 student can make inference of population thorugh the sample obtained (Arnold, Pfannkuch, Wild, Regan, & Budgett, 2011). Watson (2006) that literacy skills should be thought during the middle years, grade 7 and 9 to enhance their reasoning skills and applying in the social context.

The graduate students are not exempted on taking statistics courses as they will need it to imply statistics in their research as a requirement to finish studies (Koh & Mohd Khairi, 2014). Meanwhile, it is also compulsory for the students to take statistics courses in order to graduate (Reeinna, 2014). Schau (2003) explained that the real purpose of the statistics education is to make sure the students can think statistically in the real life. However, problems rised as the students are not valued statistics seriously and tend to demotivate them in learning statistics.

Onwuegbuzie (2004) had reported that 80% of the students struggled with statistics anxiety while Maat, Zakaria, and Rosli (2016) found that the students' statistical anxiety was at a medium level. However, the truth is that the students responses in the survey are differ from the reality of their struggling (Schau, 2003). The students anxiety can affect their attitude towards certain subjects (Marzita, 2002).

The students attitude and anxiety toward statistics may be affected by their math competence (Lai, Tanner, & Stevens, 2011). Koh and Zawi (2014) added that the students math competence can be 'rusty' since they were not using mathematics for a while before furthering their studies.

The objectives of this study are :

a) To determine students' level of attitude towards statistics among postgraduate students
b) To determine students' level of statistical anxiety among postgraduate students
c) To determine the relationship between students' attitude and statistical anxiety

Method

Research Design

This study used survey as research design. Creswell (2012) stated that research design is used to describe attitude opinion, behavior or any characteristics in population. In this study, students' attitudes toward statistics and statistical anxiety will be identified. Thus, the survey design is the suitable for this study as it involved multiple variables (Maat, 2011). While, Nik Pa (2014) agreed that if large number of samples involved, survey design can saves time and cost when collecting data.

Sampling

A total 199 respondents participated in this study which 77.4% of them are female students and remainder of male students as shown in Table 1. All of the students were taking the research methodology course that the faculty offered. It is compulsory for the students to take this course offered in order to graduate.

Table 1

The Frequency of Respondent

Gender	Frequency	Percentage (%)
Male	45	22.6
Female	154	77.4
Total	199	100

Two sets of questionnaires were used, there are Survey of Attitude toward Statistics-36 (SATS-36) and Statistical Anxiety Rating Scale (STARS). SATS-36 was developed by Schau (2003) consists of 42 items with six construct that measured by 5-point Likert Scale same as Estrada, Batanero, and Lancaster (2011). 6 out ouf 42 items are the additional item that not included in the six construct given. The six constructs are Affective, Difficulty, Cognitive Competence, Value, Effort and Interest. Affective will measured the student affection, emotion and feeling towards statistics, difficulty components will access the students' attitude regarding to the difficulty about statistics and cognitive competence will measured the students' attitude about their ability, knowledge and skill when facing statistics. Value will measured the students' view on the importance statistics in their personal life and field of work or study, interest items will access the students' level of individual interest in statistics while effort will view that students' amount of work in learning and understanding statistics.

Meanwhile, STARS was developed by Cruise, Cash, and Bolton (1985) but in this study we used the revised version of STARS by Hanna, Shevlin, and Dempster (2008). STARS also consist of 6 constructs which are Test and Class Anxiety, Interpretation Anxiety, Worth of Statistics, Fear of Asking for Help, Fear of Statistics Teacher and Computational Self-Concept. Test and class anxiety are refer to the students' experience when taking a statstics class and examination, interpretation anxiety will measured the students' anxiety when dealing with statistics and worth of statistics used to access the students' perceptions on usefulness and relevance of statistics in real life or field of study. Fear of asking help is refer to the anxiety experience faced when the students' asking for help regarding statistics, fear of statistics teacher is the perception of the students towards statistics teacher and computational self-concept will measured the students' attitude towards statistics.

Students' attitude and anxiety are based on the total score of the data and divided into three category; low, moderate and high. High score of attitude indicate the positive attitude of the students while low score expressed the negative attitude toward statistics. Furthermore, high score of anxiety resembles the students' high level of anxiety toward statistics and low score exhibits the low level of students anxiety toward statistics.

Pilot study has been conducted to ensure the instruments are valid and reliable. This instruments has obtained validity from experts and the reliability value of Alpha Cronbach for the overall items in the insturments are high (Pallant, 2013) which is 0.936 for SATS-36 while 0.963 for STARS.

Data Analysis

Quantitative method. Data was analysed using the Statistical Package for Social Science (SPSS) and AMOS version 22. Descriptive analysis was used to describe the level of students' attitude toward statistics and statistical anxiety while correlation model was used to determine the relationship between attitude and anxiety.

Results

The Level of Attitude Towards Statistics among Postgraduate Students

According to the result obtained, the mean, standard deviation, minimum and maximum are as table below. It is recorded in Table 2 that the mean is 125.06, standard deviation of 20.72 with minimum of 59 and 68 as maximum.

Table 2

The Mean, Standard Deviation, Minimum and Maximum Value of the Attitude Toward Statistics

Descriptive Statistics	Value
Mean	125.06
Standard Deviation	20.72
Minimum	59.0
Maximum	68.0

The total score is classified based on the range score. Three level of attitude is defined as low, moderate and high (Norman & Money, 2011) as shown in Table 3

Table 3

The Classification of the Attitude's Total Score

Level	Range Score
Low	36 – 84
Moderste	85 – 132
High	133 - 180

Result in Table 4 showed that overall the level of students' attitude toward statistics are in moderate level. Majority of them which is 121 students out of 199 exhibits their neutral in feeling toward statistics. While only 74 (37.2%) and 4 (2%) students expressed positive and negative attitude respectively.

Table 4

The Level Of Attitude of the Students

Category	Frequency	Percentage (%)
Low	4	2.0
Moderste	121	60.8
High	74	37.2
Total	199	100.0

The only construct that reflect the negative attitude of the students is difficulty. Most of the students (53.3%) has a negative attitude while remainder of 46.7% has neutral affection toward statistics. However, students shows positive attitude toward effort construct. 90.5% of the students has a positive attitude towards effort in statistics and only 0.5% shows negative attitude. There are moderate level of students' attitude in affective, cognitive competence, value and interest components.

There are 6 additional items known as single global attitude items. It measured the math cognitive competence (B37), career value (B38 and B40), statistics cognitive competence (B39), statistics interest (B41) and course difficulty (B42). We combined scale 1 with 2 and scale 4 with 5. While scale 3 is remained as neutral response.

Table 5

The Level of Attitude Based on the Single Global Items

Item	Statement of Item	Percentage (%)				
		1	2	3	4	5
B37	How good at mathematics are you?	5.5	10.1	35.2	43.7	5.5
B38	In the field in which you hope to be employed when you finish school, how much will you use statistics?	5.5	23.6	47.2	18.6	5.0
B39	How confident are you that you have mastered introductory statistics material?	3.5	15.1	50.8	28.6	2.0
B40	As you complete the remainder of your degree program, how much will you use statistics?	4.0	10.6	39.7	35.2	10.6
B41	If you could, how likely is it that you would choose to take another course in statistics?	14.6	15.6	28.6	27.6	13.6
B42	How difficult for you is the material currently being covered in this course?	1.0	4.0	39.7	40.7	14.6

Overall, most of the students (49.2%) believed that they are pretty good in mathematics while only 15.6% of them still coping and struggling in it. However, 55.3% of them admitted that statistics is very difficult based on statement B42. Majority of the students (47.2%) have a neutral affection towards the application of statistical value in their future career life while only 23.6% perceived the usefulness of statistics in their future career value.

50.8% of the students did not sure of their confidence level in mastering statistics materials and 18.6% reacted negatively which convinced that they are not well mastered in the introductory statistics. However. Most of them (45.8%) found that they will use a lot of statistics in finishing their study programs.

When talking about the students' interest on pursuing further statistics courses, 41.2% of the students' recorded to be interested in taking further statistics courses followed by the students that were not interested at all.

The Level of Statistical Anxiety among Postgraduate Students

The result in Table 6 showed the mean obtained from STARS are 161.38 with standard deviation on 32.3. The minimum and maximum are 68 and 255 respectively.

Table 6

The Mean, Standard Deviation, Minimum and Maximum Value of the Statistical Anxiety

Descriptive Statistics	Value
Mean	161.38
Standard Deviation	32.3
Minimum	68.0
Maximum	255.0

The range score obtained is the same as the attitude range score above (refer to Table 7). Low total score indicate low level of anxiety, moderate total score indicate medium level of anxiety and high total score exhibit the high level of anxiety.

Table 7

The Classification of the Anxiety's Total Score

Level	Range Score
Low	51 - 119
Moderste	120 - 187
High	188 - 255

Table 8 showed that the result of overall students level of statistical anxiety. A total of 138 students which made up of 69.3% of the sample exhibit the medium level of anxiety. Followed by 39 students (19.6%) that have a high level of statistical anxiety and 22 of them have low level of statistical anxiety.

Table 8

The Level of Statistical Anxiety of the Students

Category	Frequency	Percentage (%)
Low	22	11.1
Moderste	138	69.3
High	39	19.6
Total	199	100.0

Of all six constructs in STARS, only one of them showed a high level of statistical anxiety which is test and class anxiety while remainder of the constructs are in moderate level of anxiety. A total of 111 students (55.8%) indicate high level of anxiety in class and test followed by 37.2% showed a moderate anxiety level and only 7% have a low anxiety level in test and class.

The Relationship between Students' Attitude and Statistical Anxiety

We used path analysis in AMOS to interpet the correlation between students' attitude and statistical anxiety. Based on the result in Table 9, the relationship between attitude and anxiety is significant and negative with the correlation coefficient of -.650. The critical region value is less than 1.96 (β=-.650, t=-6.820, *p*<.05).

Table 9

The Correlation between Students' Attitude and Statistical Anxiety

Path	Estimate	Standard Error	Critical Region	*p*
Statistical anxiety $\leftrightarrow$ attitude	-.650	.602	-6.820	0.05

Discussion

The Level of Attitude Towards Statistics among Postgraduate Students

This study found that the graduate students' attitude is neutral. It means that the students are not too negative and too positive. It consistent with Mira Khalisa and Siti Mistima (2017) using the SATS-28 version and also Noraidah, Hairulliza, Hazura, and Tengku Meriam (2011). Noraidah et al. (2011) did a study on faculty of science and information technology first year students and found that their level of attitude towards statistics is neutral . However, Hairulliza, Noraidah, Hazura, and Tengku Meriam (2011) found positive attitude towards attitude on majority of the students.

This study also found that students' attitude were only positive in the effort construct. It is consistent with the study of Reeinna (2014), Noraidah et al. (2011) and Li (2012). Eventhough the setudents' attitude are at modest, they realize that if they work hard, they will get the best results. However, Millar and Schau (2010) proved that high efforts were still unable to influence their achievement. This is because students' effort with the right learning technique affects student achievement. Students need to work harder to overcome difficulties in statistical courses as 55.3% of respondents in this study find that statistics are a difficult and challenging course. They also have to find the efficient way to learn statistics and overcome barriers while learning it. That is why study smartly is vital rather that study hard.

The Level of Statistical Anxiety among Postgraduate Students

Result showed that the students' level of anxiety are at moderate. It confirmed the study of Siti Mistima et al. (2016) using the Statistical Anxiety Questionnaire (SAQ) instrument. While Koh and Mohd Khairi (2014) stated that students did not show their anxiety as a whole, however, a high degree of anxiety was noted in statistical classes.

The findings of this study showed a lot of concern about class and test. It is consistent with Koh and Mohd Khairi (2014) study findings. These undergraduate students are exposed to the negative perceptions from their friends who have taken GB 6023 course in the previous semester. Although, lecturers have been innovating their way of statistical teaching and learning in forder to form a positive attitude towards statistics, still, it is difficult to get rid of the negative perceptions that have been embedded before they were taking GB 6023 course.

The Relationship between Students' Attitude and Statistical Anxiety

This study proved that there is a significant negative correlation between attitude toward statistics and statistical anxiety. This study is consistent with Baloğlu, Kocak, and Zelhart (2007) that use ATS instruments to measure attitudes towards statistics. Similarly, Khavenson, Orel, and Tryakshina (2012) which uses SATS-36 adaptations found a significant but weak correlation between attitude toward statistics and statistical anxiety. Negative relationship means that when a student's attitude is positive, the anxiety of the student will be decreasing.

Attitude and anxiety have a relationship with each other. Positive attitudes will reduce student concerns over statistics as students master the knowledge and statistical content. Similarly, this relationship can be seen in the study Sesé et al. (2015) and Devaney (2010) which have a negative relationship to statistical attitudes and concerns.

The study of Chiesi and Primi (2010) found that statistical anxiety can influence the student's attitude towards the course. The higher level of anxiety will result in lower levels of student competence thus, resulting in lower achievement and their stance on statistics is negative. It is applicable in both directions because lower level of anxiety will result in increasing student competence levels by increasing their statistical knowledge and achieving good results. Furthermore, it will lead to a positive change in student attitudes.

Conclusion

Studies related to statistical education issues are aimed to increase the statistical literacy rate of students. Overall, the level of student attitudes towards the statistics and anxiety of students in the study was moderate. It is consistent with Noraidah et al. (2011) who use undergraduate students from UKM's Faculty of Technology and Information Sciences (FTSM). Meanwhile, Schau (2003) states that this data still does not adequately describe the realities of students in statistical education. Therefore, researchers should measure students using different methods and perspectives in collecting information. This is because there is a difference in the students' answers in answering the questionnaires and written responses.

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