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Survey of Attitudes toward Statistics for Business Undergraduates

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Abstract: In business education, statistics course has traditionally been taught at the undergraduate level curriculum to enable them to design, present, analyze, and interpret data in their field and will serve as basis in making decisions. This paper examined to evaluate student's attitudes towards statistics for business using a survey instrument. Several studies has been conducted and found that student's attitude towards statistics can influence their learning process. Students with positive attitude towards the course show an excellent performance in statistics course while a negative attitude will be an impediment in learning the course effectively and started to dislike the course. Analysis shows that students reported positive attitude in affective, cognitive capability, value component, interest and effort while difficulty viewed negative. Relationships between student's performances in mathematics, number of hours studying statistics course, over-all stress level and attitude components has been carried out in this study. Slightly positive relationships were found between student's performance in mathematics and attitude component apart from difficulty. Findings also revealed that student's cognitive capability and difficulty component towards the course were reported slightly significant with overall stress level. A survey form, Survey of Attitudes towards Statistics (SATS) using the posttest version was used to evaluate attitudes of the students towards statistics.
Keywords: attitude, business education, curriculum, posttest, SATS, survey form, undergraduate level.

INTRODUCTION

Business Statistics has been part of the curriculum among undergraduate level and even in secondary level. Business Statistics is designed to provide a set of concepts and techniques that will give student background to engage in statistical descriptions and analysis of the data that are of interest to him. It provides discussion on statistical terms and notations, types of data, measurement scales, collection and presentation of data, descriptive statistics, statistical measurement of data, sampling theory, basic probability, estimation of parameters, test of hypothesis, inferential statistics, simple analysis of variance, and regression and correlation analysis. The integration of statistical software has been included in the course for them to improve and developed their statistical analysis on the course. In business education, statistical methods and analyses will allow them to present and describe business data and information properly, make reliable forecast about a business activity and improve business processes as well.

Most statistics educators are likely to focus and develop on the cognitive factor while students experienced dilemma in learning statistics due to non-cognitive factors like negative attitude towards the course. Many factors may influence learning statistics, such as poor mathematical basis or background [8] misconception in statistics and many more. Mahmud &Zainol[4] and Melad[5] recorded negative attitudes towards statistics such as learning of statistics require a great deal of discipline, it involves massive computations, highly technical and a course not easily learn by most people. Such factors can impede learning of statistics, or hinder the extent to which students will develop useful statistical intuitions and apply what they have learned outside the classroom [3]. To address these issues, it is recommended that students should be given more exposure to the learning and understanding of statistical tools, techniques and concepts [4] rather than exposing them into mathematical formulae and manual computations. Some students believed that statistics was a part of mathematics and so their attitudes towards statistics were merely transferred to statistics[8]. In addition, Mahmud & Zainol[4] recommended that a "Statistical Consulting Service Unit" in which services are provided by statistics experts with a wide range of experience in all forms of statistical analysis and statistical software be created. The use of statistical software like SPSS, phSTAT, MS Excel and many more may increase their positive perception towards the course.

According to Evans [2] instructors generally said that they try to link the material from the statistics courses to real-world problems. According to him, this was the most commonly used technique for generating interest, improving

student's attitudes, and eliminates misconceptions in statistics. To improve attitudes and eliminate such misconceptions, students may gather survey data regarding opinions brand preferences of a particular product. This served as a real-world illustration to facilitate students better and improved understand statistical formations and their real-life applications and measurement of data collection permitted students to utilize their own data for statistical analysis. Meanwhile, to ensure the competency of the students in the course, statistics educators should be able to assess students' standing on non-cognitive factors like interest or motivation for further learning, self-concept or confidence regarding statistical skills, willingness to think statistically in everyday situations, and appreciation for the relevance of statistics in their personal and vocational lives [3].

Enhancing students' perceptions of their mathematics ability is also vital. According to Dempster and McCorry[1] remedial teaching of basic mathematics is required to improve students' maths ability and improve their confidence in approaching the subject of statistics before the statistics curriculum begins. Maybe explicit information about the difference between statistics and mathematics would also help in the formation of more positive attitudes toward statistics at the beginning of the curriculum.

Several studies have been conducted in measuring and monitoring student's attitude towards statistics. Such scales have been developed by some researchers are Attitudes towards Statistics (ATS) and Survey of Attitudes towards Statistics (SATS). Most common scale used by many researchers is the SATS which was developed and validated by Schau with assesses student's attitude towards statistics both cognitive and non-cognitive issues. The instrument has six contributing factors to measure such attitudes towards the course. The aim of this study is to evaluate student's attitude towards statistics course for business using the posttest version of SATS to capture the attitude of the students a few weeks before the end of the course. Significant association between student's performances in mathematics, number of hours studying statistics course, over-all stress level and attitude components was also determined. Additionally, profile factor of the participants was considered in this study.

RESEARCH OBJECTIVES

Generally, this study evaluates student's attitude towards statistics course for business using the posttest version of the SATS instrument.

Specifically, this study was surveyed to answer the following statements:

1. What is the profile factor of the respondents in terms of:
    a. Sex
    b. Age
    c. Program
2. What is the student's attitude level towards the course for the following component:
    a. Affective
    b. Cognitive capability
    c. Value
    d. Difficulty
    e. Interest
    f. Effort
3. Is there a significant relationship between the student's performance in mathematics, time allotted in studying the course, overall stress level, and attitude components?

RESEARCH METHODOLOGY

The participants of this study were enrolled in Business Statistics for the second semester school year 2015 – 2016. Participants were students of legal management, marketing management and financial management of Cagayan State University. They were asked to fill up the posttest survey form after a 14-week (out of 18 weeks) study of the course. The use of the posttest survey instrument was permitted by the author, Candace Schau. The number of participants in this study is 255.

To evaluate the attitude level of the participants in this study, a posttest instrument developed and copyrighted by Candace Schau, namely, Surveyed of Attitudes towards Statistics (SATS) has been utilized in this study. SATS[6] measures cognitive and non- cognitive component. There are two versions of SATS, namely SATS 36 and SATS 28. The current version was being utilized in this study and has 36 items on the survey form with six attitude components which are affective(student's feeling regarding statistics), cognitive capability (measures intellectual knowledge and skills when applied to statistics), value (attitudes towards the usefulness, relevant and worth of statistics), difficulty (attitudes towards the difficulty level of the subject), interest(attitudes that assesses the interest to statistics) and effort (the amount of work of the students plan to expand to learn statistics).

Each item in the posttest instrument is assessed by a Likert scale with 1 as strongly disagree, 4 as neutral and 7 as strongly agree. Based from the instructions of the instrument, answers to some of negatively worded items should be reversed (1 replaced by 7, 2 replaced by 6, and so on). Participants were also asked on their demographic profile, student's performances in mathematics, number of hours studying statistics course, over-all stress level and attitude components. A posttest version of the SATS instruments has been utilized to assess their attitude towards statistics a few weeks remaining before the completion of the course.

Descriptive statistics was employed to summarize the profile of the participants. Mean was used to assess participant's feedbacks towards each item in the survey form. A high score means positive attitudes towards statistics.

The interpretation on the participant's attitude towards the course is being interpreted by Zamalia[7] and interpreted as positive if the mean score is 4.50 to 7.00, neutral for 3.51 to 4.49 and negative for 0.00 to 3.50. Pearson's correlation coefficient was used to estimate the strength of association between student's performances in mathematics, number of hours studying statistics course, over-all stress level and attitude components.

SATS showed a good internal consistency of all the six attitude components using Cronbach's alpha. The computed Cronbach's alpha is 0.865. The computed alpha for affective component is0.709, 0.713 for cognitive, 0.737 for value, 0.491 for difficulty, 0.792 for interest and 0.688 for effort factor. Almost the same value had been computed using the pretest version of the instrument.

RESULTS AND DISCUSSION

Table 1: Demographic Information of Respondents

		Frequency	**Percent**
Sex	Female	193	75.7
	Male	62	24.8
Age	16.00	1	.4
	17.00	64	25.1
	18.00	129	50.6
	19.00	45	17.6
	20.00	9	3.5
	21.00	2	.8
	22.00	3	1.2
	24.00	2	.8
	BSBA-FM	114	44.7
Program	BSBA-MM	61	23.9
	BSLM	53	20.8
	BSAT	27	10.6
	TOTAL	**255**	**100.0**

Table 1 presents the profile factor of the respondents, out of 255 respondents, 193 or 75.7% are female while 62 or 24.8% are male. Most of the respondent ages 17-19 years old while the rest are 16 and above 19 years of age with a modal age of 18 since the course is being taught from the second year level. In terms of their program taken, 114 or 44.7% are taking up Bachelor of Science in Business Administration major in Financial Management (BSBA-FM) while 61 or 23.9% are BSBA majoring in Marketing Management. The rest of the respondents are Bachelor of Science in Legal Management (BSLM) with a frequency count of 53 or 20.8% while 27 or 10.6% are Bachelor of Science in Accounting Technology (BSAT). For information, BSAT is a new course of the college.

Table 2: Mean scores and standard deviations for Affective component

Affective Attitude Component	Mean	SD
s3. I like statistics.	5.34	1.08
s4*. I feel insecure when I have to do statistics problems.	4.39	1.40
s15*. I get frustrated going over statistics test in class.	4.45	1.48
s18*. I am under stress during statistics class.	4.74	1.41
s19. I enjoy taking statistics courses.	4.82	1.27
s28*. I am scared by statistics.	5.24	1.64

*negative statement but transformed to positive wordings when scoring (1 becomes 7, 2 becomes 6, etc.)

Table 2 shows the average score for each item under affective component towards statistics. Respondents have shown positive attitude for items s3 (mean = 5.34, s.d=1.08), s18 (mean = 4.74, s.d = 1.41), s19(mean = 4.82, s.d = 1.27) and s28(mean = 5.24, s.d = 1.64). Neutral response was found for items s4(mean = 4.39, s.d = 1.40) and s15(mean = 4.45, s.d = 1.48). No negative responses were recorded by the students in this component.

Table 3:Mean scores and standard deviations for Cognitive capability attitude component

Cognitive Capability Attitude Component	Mean	SD
s5*. I have a problem in understanding statistics because of how I think.	4.51	1.47
s11*. I have no idea of what's going on in this statistics course.	5.44	1.40
s26*. I make a lot of math errors in statistics.	4.44	1.41
s31. I can learn statistics.	6.09	1.00
s32. I understand statistics equations.	5.29	1.00
s35*. I find it difficult to understand statistical concepts.	4.11	1.51

*negative statement but transformed to positive wordings when scoring (1 becomes 7, 2 becomes 6, etc.)

Based on table 3 regarding cognitive capability attitude component, the respondents marked a high positive responses towards item s31(mean = 6.06, s.d = 1.0), s32(mean = 5.29, s.d = 1.0), s11(mean = 5.44, s.d = 1.40) and s5(mean = 4.51, s.d = 1.47). A neutral response was displayed for items s26 (mean = 4.44, s.d = 1.41) and s35 (mean = 4.11, s.d = 1.51).

Table 4: Mean scores and standard deviations for Value component

Value Attitude Component	Mean	SD
s7*. Statistics is worthless.	5.83	1.49
s9. Statistics should be a required part of my professional training.	5.04	1.33
s10. Statistical skills will make me more employable.	5.25	1.22
s13*. Statistics is not useful to the typical professional.	5.48	1.43
s16*. Statistical thinking is not applicable in my future profession.	5.34	1.49
s17. I use statistics in my everyday life.	4.85	1.50
s21*. Statistics conclusions are rarely presented in everyday life.	3.71	1.47
s25*. I will have no application for statistics in my profession.	5.20	1.46
s33*. Statistics is irrelevant in my life.	4.89	1.40

*negative statement but transformed to positive wordings when scoring (1 becomes 7, 2 becomes 6, etc.)

Table 4 illustrates the mean score for each item of student's value towards statistics course. They have given a high positive response towards all items s7(mean = 5.83, s.d = 1.49), s9(mean = 5.04,s.d = 1.33), s10(mean = 5.25, s.d = 1.22), s13(mean = 5.48, s.d = 1.43), s16(mean = 5.34, s.d = 1.49), s17(mean = 4.85, s.d = 1.5), s25(mean = 5.20, s.d = 1.46) and s33(mean = 4.89, s.d = 1.40) except for item s21(mean = 3.71, s.d = 1.47) which shows a neutral response towards statistics. This shows that respondents viewed that the course is uncommonly applicable is their everyday life.

Table 5: Mean scores and standard deviations for Difficulty component

Difficulty Attitude Component	Mean	SD
s6. Statistics formulae are easy to understand.	4.52	1.29
s8*. Statistics is a complicated subject.	4.02	1.60
s22. Statistics is a subject quickly learned by most people.	4.35	1.30
s24*. Learning statistics requires a great deal of discipline.	2.33	1.16
s30*. Statistics involves massive computations.	2.81	1.23
s34*. Statistics is highly technical.	3.21	1.13
s36*. Most people have to learn a new way of thinking to do statistics.	2.75	1.20

*negative statement but transformed to positive wordings when scoring (1 becomes 7, 2 becomes 6, etc.)

Table 5 demonstrates the mean scores for each item under student's difficulty towards the course. Students exhibited a positive response on item s6(mean = 4.52, s.d = 1.29) while neutral response was recorded on item s8(mean = 4.02, s.d = 1.60) and s22(mean = 4.35, s.d = 1.30). The rest of the items were given a negative response towards which are s24(mean = 2.33,s.d = 1.16), s30(mean = 2.81, s.d = 1.23), s34(mean = 3.21, s.d = 1.13) and s36(mean = 2.75, s.d = 1.20).

Table 6: Mean scores and standard deviations for Interest component

Interest Attitude Component	Mean	SD
s12. I am interested to communicate statistical information to others.	5.13	1.11
s20. I am interested in using statistics.	5.07	1.31
s23. I am interested in understanding statistical information.	5.38	1.15
s29. I am interested in learning statistics.	5.84	1.13

Table 6 shows the mean scores for each item under student's interest towards the course. Respondents marked positive response in all items which are s12 (mean = 5.13, s.d = 1.11), s20(mean = 5.07, s.d = 1.31), s23(mean = 5.38, s.d = 1.15) and s29(mean = 5.84, s.d = 1.13). This illustrates that student shows interest on the course.

Table 7:Mean scores and standard deviations for Effort component

Effort Attitude Component	Mean	SD
s1. I tried to complete all of my statistics assignment	5.91	1.02
s2. I worked hard in my statistics course.	5.80	.85
s14. I tried to study hard for every statistics test.	5.65	1.04
s27. I tried to attend every statistics class session.	5.85	1.37

Table 7 explains the average scores of the students under effort attitude factor. Students marked high positive response in all items (s1, mean = 5.91, s.d = 1.02; s2, mean = 5.80, s.d = 0.85; s14, mean = 5.65, s.d = 1.04; s27, mean = 5.85, s.d = 1.37).

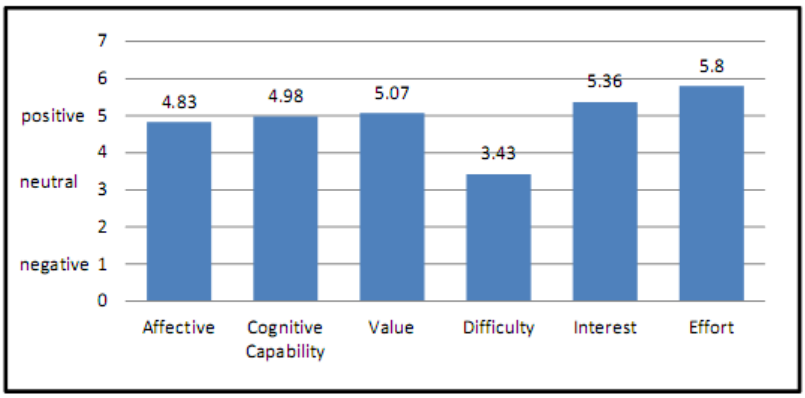

Fig-1: Mean Score of Each Attitude Component

Table 8: Mean Score for Each Attitude Component

Attitude Factor	*Mean*	*Interpretation*
Affective	4.83	positive
Cognitive Capability	4.98	positive
Value	5.07	positive
Difficulty	3.43	*negative*
Interest	5.36	positive
Effort	5.80	positive

Figure 2 confirms the mean summary score of the six attitude components towards statistics course. The figures indicate a positive attitude towards affective, cognitive component, value, interest and effort with a mean of 4.83, 4.98, 5.07, 5.36 and 5.80 respectively. Meanwhile, a negative attitude was revealed for difficulty component with a mean of 3.43.

Student's feeling towards statistics is slightly positive like enjoyable and desirable towards the course, stress, and worry while insecurities and frustrations towards the course were labeled neutral. Student's intellectual knowledge and skills are more likely positive means that they are confident to learn statistics because they understand statistics; they know statistics well and understand statistics equations but less on statistical concepts.

In addition on value factor, students marked a highly positive in terms of the usefulness, relevance and worth of statistics in their personal life and future career. Since they considered statistics is vital especially in their profession as

business students hence statistics should be a part of their professional training and they added that the statistical skills they will acquire will make them more employable.

Meanwhile, student's interest towards statistics is highly positive. This illustrates that studentsshow interest in learning statistics, understand statistical information, they use statistics and communicate statistical information to their fellow students. Moreover, student gives enough effort towards the course like they tried to complete their statistics assignment, they worked hard toward the course, and they also give much effort in reading or studying hard for every statistics test and tried to attend every statistics class session.

On the other hand, students experienced difficulties and responded negative attitude towards statistics like the course is highly technical, it involves massive computations and learning course requires a great deal of discipline. This indicates that the majority of the students disagreed that statistics was an easy subject to handle.Nevertheless, they understand statistics equations (cognitive capability) hence they viewed positively that statistics formulae are easy to understand. For this reasons, to avoid negative attitude towards statistics, educators should limit their students in doing massive computations but to introduce some statistical software and methods to construct graphs that give statistical results like summary and inferential statistics.

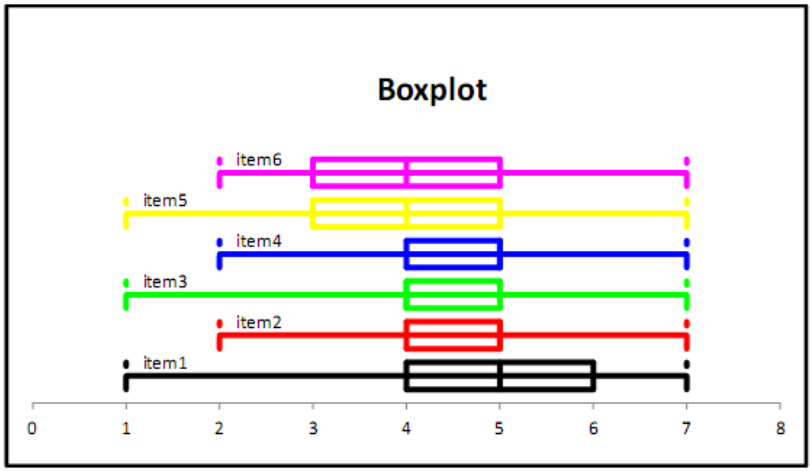

Fig-2: Summary on additional information using boxplot

Table 9: Summary Statistics for Item 1 to Item 6

Five-Number Summary	Item1	Item2	Item3	Item4	Item5	Item6
Minimum	1	2	1	2	1	2
First Quartile	4	4	4	4	3	3
Median	5	5	4	5	4	4
Third Quartile	6	5	5	5	5	5
Maximum	7	7	7	7	7	7

Figure 2 illustrates additional information with regards to math achievements of the students. For item 1students were asked, "How good are you in mathematics?", possible response would be 1 as very poor and 7 as very good. It can be viewed from the boxplot figure that the median response is 5 which shows that their performance in mathematics is quietly positive. In terms of the significance or relevance of statistics in the future career when they get employed, students marked a positive response (item 2 and item 5) with a median of 5 (1 as not a great deal while 7 as great deal). For item 3, students marked neutral response with a median of 4 when they asked on their confidence in mastering statistics materials. It can also be concluded from item 6 that students feel difficulty from the course materials covered with a median value of 5 as more likely difficult. Furthermore, students responded neutral (1 as not all likely and 7 as very likely)with a median of 4 when they ask if they like to take another statistics course.

Table 10: Correlations of performance in mathematics, number of hours studying statistics, over-all stress level and attitude component

Attitude component	Performance in mathematics		Number of hours studying statistics course		Over-all stress level	
	r-value	*p-value*	*r-value*	*p-value*	*r-value*	*p-value*
Affective	.271**	.000	.043	.495	-.085	.175
Cognitive ability	.333**	.000	-.003	.967	-.169**	.007
Value	.237**	.000	-.037	.552	-.010	.870
Difficulty	-.086	.171	.097	.121	-.190**	.002
Interest	.378**	.000	.073	.243	-.121	.053
Effort	.186**	.003	.104	.097	-.029	.648

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

Table 10 illustrates the relationship between performance in mathematics, number of hours studying statistics, over-all stress level and attitude component. It can be viewed from the table that performance of students in mathematics is somewhat moderately positive related to all attitude components excluding difficulty. This clarifies that the better performance in mathematics the more positive attitude towards statistics. Additionally, this shows that their mathematics' performance is a significant factor in determining the attitude level of the students in statistics. The same result was found from the pretest version of SATS conducted by the researcher in this study. Meanwhile, the number of hours allotted for them to study statistics is not related to all attitude components. This explains that attitude of students towards the course does not rely on the amount of time allotted in studying the course. Furthermore, there is moderate association between cognitive ability component and over-all stress level of students (r-value = - 0.169, p-value < 0.01), this means that the more positive on cognitive ability component the less amount of stress experienced by the students. In addition, difficulty towards the course is highly significantly related with over-all stress level (r –value = -0.190, p-value < 0.01) which means that the negative attitude on difficulty component towards the course the greater amount of stress level experienced by the students.

CONCLUSION

Positive attitude towards statistics was revealed in all items under interest and effort component which shows that students give importance and endeavor in learning the course. Most of the item in value, affective and cognitive capability component viewed positively. Students confirmed negative attitude in most of the item towards difficulty component nevertheless they give much effort and interest in learning the course. The following items were reported positive:

1. I like statistics.
2. I am not under stress during statistics class.
3. I enjoy taking statistics courses.
4. I am not scared of taking statistics.
5. I have no problem in understanding statistics because of how I think.
6. I have some idea of what's going on in this statistics course.
7. I can learn statistics.
8. I understand statistics equations.
9. Statistics is valuable.
10. Statistics should be required as part of my professional training.
11. Statistical skills will make me more employable.
12. Statistics is useful to the typical professional.
13. Statistical thinking is applicable in my future profession.
14. I use statistics in everyday life.
15. I have an application for statistics in my profession.
16. Statistics is relevant in my life.
17. Statistics formulae are easy to understand.
18. I am interested to communicate statistical information to others.
19. I am interested in using statistics.
20. I am interested in understanding statistical information.
21. I am interested in learning statistics.
22. I tried to complete all of my statistics assignment.
23. I worked hard in my statistics course.

24. I tried to study hard for every statistics test.
25. I tried to attend every statistics class session.

The following items were reportedly neutral by the students:

1. I don't feel insecure when I have to do statistics problems.
2. I don't get frustrated going over statistics test in class.
3. I don't make a lot of math errors in statistics.
4. I find it easy to understand statistical concepts.
5. Statistics conclusions are presented in everyday life.
6. Statistics is not a complicated subject.
7. Statistics is a subject not quickly learned by most people.

Negative attitude towards statistics was reported in most of the items under difficulty component. The following are negative responses:

1. Learning statistics does not require a great deal of discipline.
2. Statistics do not involve massive computations.
3. Statistics is not highly technical.
4. Most people do not have to learn a new way of thinking to do statistics.

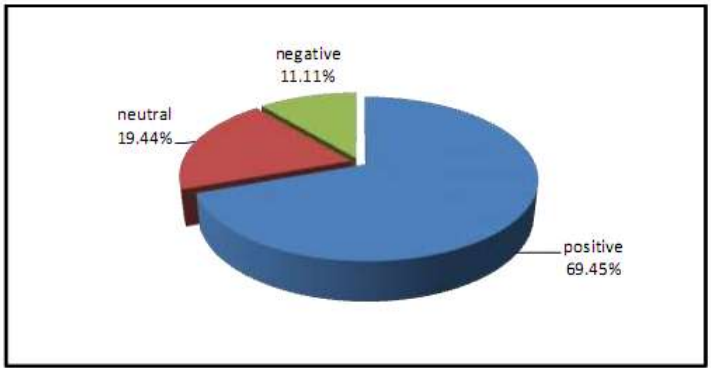

Fig-3: Student's category according to attitude towards statistics

There are three groups of students in this study, namely, students with positive attitude, neutral and negative (see figure 3). In can be viewed from the figure that most of the students are in the positive group (69.45%), followed by neutral (19.44%) and negative attitude (11.11%). The result shows that group of students with positive attitude marked highest scores in all components while negative attitude have the lowest scores in all components. Neutral attitude marked scores in between the two groups.

RECOMMENDATIONS

To avoid negative attitude towards statistics, instructors should introduce some statistical software in order to facilitate computations and delimit highly mathematical equations used in the computations for them to develop their statistical analysis towards the course. It is highly recommended also that to encourage students to learn and apply statistics especially in business, instructors should focus on the direct application and importance of statistics in business and economics. Instructors should also evaluate their course materials, instruction and outcomes. Researcher may also utilize other instruments in assessing students' attitude towards statistics like the ATS, SATS28 version and the like.

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