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UNDERGRADUATE STUDENT ATTITUDE AND PERCEPTION TOWARD THE LEARNING OF STATISTICS

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Abstract
The study examined undergraduate study attitude and perception towards learning statistics: a case study of Ignatius Ajuru University Port Harcourt, Nigeria. The study adopted a survey design. The population of the study consisted of all students that study statistics-related courses. The sample of the study was 198 students. Two research questions and two hypotheses guided the study. The instrument for data collection was a researcher-structured instrument titled: Student Attitude and Perception towards Statistics Inventory (APTSI). The instrument was structured using a Likert type of response with Strongly Agree (SA), Agree (A) Disagree (D) and Strongly Disagree (SD) options respectively. The instrument was validated by experts in measurement and evaluation. A reliability of 0.78 was obtained using Cronbach's alpha formula. Data were analyzed using mean and standard deviation. A mean of 2.50 and above was accepted as an indication of agreement while a mean of 2.49 and below indicated disagreement for the section on attitude. The result established among others that the student attitudes and perceptions regarding statistics were positive, both male and female and students did not differ significantly in their attitudes and perceptions towards Statistics. Creating an atmosphere that will make students pay attention in learning and developing in-depth knowledge of mathematics to understand statistics were the identified key strategies that could be adopted to develop student attitudes towards statistics. It was recommended among others that experienced teachers should be employed to teach statistics to debunk the minds of learners from the erroneous belief that statistics is boring.

Keywords: Attitude, Perception, Statistics, Undergraduate, Students

Introduction

Nowadays, most university graduate students have to take at least an introductory statistics research method. It was quite alarming, instead of seeing the class as being significant and functional rather, they held negative attitudes toward it. Many see these statistics courses as non-engaging, uninteresting, tedious, impertinent, unsuitable and difficult. Some drop out or felt indignant after completing the course. Students often see the course as saturated with slang, demanding, and not readily applicable. Statistics lecturers cannot help but marvelled why Introductory Statistics courses have earned such a negative image and what implications this may bring to the teaching and learning of Statistics (Peterson in Dai-Trang et al., 2013). Wentzel and Winfield in Schau (2012) stated that research on educational and cognitive theories established that students' attitudes towards the discipline are crucial course outcomes in that its significance is as knowledge and skills in the discipline. This is perhaps true in statistics, as attitudes towards statistics can be a significant determinant of student performance and their willingness to apply what they learn to their professional lives. Galet al. in Dai-Trang et al. (2013) opines that students who left statistics courses with negative feelings are unlikely to retain and apply what they learned. Therefore, understanding these attitudes and their relationship to learning should become more crucial in developing teaching approaches to enhance students learning experience.

Technology has changed statistics for learning and instruction. According to Moore (1997), using technology in statistics instruction helped to automate many routine operations and as a result, stimulate conceptual learning. In addition, with the use and aid of software, students can actively explore the meaning of statistical concepts through

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the use of computer simulation methods. By using current computing technology, it is possible to supplement standard data analysis assignments by providing students with additional statistical experience. Computer simulations are invaluable in this regard because abstract or hard-to-understand concepts can be illustrated visually using many standard programs such as"ExcelMinitab". This may improve the learning experience, especially for students in introductory statistics courses. Vanhoof et al. (2006) did a study using ATS to investigate students' attitudes toward statistics and the relationship between those attitudes and short-term and long-term statistics examination results. The participants are Flemish students who took an introductory undergraduate statistics course and were enrolled in the Department of Educational Sciences. The researchers administered a Dutch translation of the ATS scale at the beginning of the first and second-year statistics courses. The researchers recorded the students' statistics examination results and dissertation grades to use as measures of statistics performance. The statistics examination results were from the statistics course the students must take during their first three years. During the fourth and fifth years, the students do not take a specific course, but the dissertation included methodology and statistics. For the first-year and second-year statistics courses, there was a statistically significant positive correlation between the ATS Course and the exam results. Only for the first-year statistics course was a difference between the correlations of Course versus Field statistically significant, for the second administration. For the third-year statistics exam results and the fifth-year dissertation, the researchers found no statistically significant correlation with the ATS score. They also found no statistically significant correlation between the short-term and long-term general exam results and the ATS.

Kristilynn et al.(2013) opined that students' attitudes toward statistics and beliefs about statistics can either help or hurt their learning of the subject. The authors also claimed that attitudes influence how students will develop statistical skills and their abilities to apply their knowledge outside the classroom. Attitudes toward statistics can be defined as a disposition to respond favourably or unfavourably to objects, situations, or people related to statistics learning (Chiesi &Primi, 2009). In the early practice of statistics courses, the instruction was mostly traditional. The focus was on probability theory and specific statistics procedures. Statistics was studied from a mathematical perspective. Students were expected to memorize statistical knowledge and follow rules and procedures in standard contexts (Vanhoof, 2010). In the 1990s, statistics instruction had undergone another revolution primarily as a consequence of the inclusion of computers (Hand in Reeinna, 2014). Statistical software tools enhanced statistical applications and the overemphasis on mathematics in statistics courses. Recently, many changes have been implemented in statistics courses as more technological devices become available for data analysis and simulations. Accordingly, the goal of statistics education tends to emphasize more conceptual understanding and less on mechanics of the mathematical procedures (American Statistical Association, 2010).

Today, statistics courses are compulsory for most students from a broad spectrum of social and natural sciences fields. University students often hold negative attitudes towards mathematics and science courses, including statistics courses, which some students study as a compulsory part of their degree (Mallow, 2010). Statistics is about solving real-world problems. Statistics is a structural method to solve a problem and is frequently used in various fields, including information and communication technology (ICT). The importance of the subject led to making the subject compulsory to be offered by the students in some higher education institutions in Nigeria. Statistics is the study concerned with the analysis of observed facts, which .can be expressed as numbers. It involves a set of procedures for describing, synthesizing, analyzing, and interpreting quantitative and qualitative data. Dodge (2006) describes statistics as the study of the collection, analysis, and interpretation of data as well as the effective communication and presentation of results relying on data. The teaching of statistics as a course in the higher institution had been documented in the curriculum and should be made compulsory. Statistics is taught in universities for some reasons: it is useful for daily life, has an instrumental role in other disciplines, and is important in developing critical reasoning. It helps in the preparation of continuous assessment scores, it enables the classroom teacher to present in an efficient format a precise description and shorthand summary of class test data and to interpret and use such data intelligently. (Ajoku, 2006). Statistics is part of our daily activities, it is useful for collecting data, summarizing them, analyzing them, and making reasonable predictions based on these analyses. Therefore, it enables researchers, teachers, and students to summarize statements more precisely because it saves time and words. It makes research more scientific and objective. (Alieme &Osiesi, 2015)

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Statement of the problem

Experience shows that students' attitude toward statistics lectures is very poor since their lecturers do not teach with the appropriate method or they teach from a mathematical background rather than a statistical point. In some cases, non-specialists may consider statisticians to be a subject of mathematics. Mathematics has failed to treat statistics as an allied but separate discipline from mathematics. They feel unprepared in teaching statistics when their expertise has been teaching trigonometry, algebra, measurement, and calculus. These teachers seem to teach incorrect graphing methods and may well perpetuate the idea that probably relates to dice, coins, and counters. The pedagogical content knowledge for teaching statistics is very different from teaching mathematics. Statistics is an applied science whereas mathematics may be considered to be pure science. Mathematicians and statisticians deal mainly with numbers, both fields work within their field range of theorems to reduce results

Aim and Objectives of the study

The study aimed to explore undergraduate student attitudes and perceptions toward learning statistics. Specifically, the objectives of the study were to:

1. determine the factors responsible for the attitude of undergraduate students towards the learning of statistics?
2. investigate the perceptions of undergraduate students towards the learning of statistics?
3. determine the strategies adopted by teachers to make the learning of statistics interesting?

Research Questions

The following research questions guided the study:

1. What are the factors responsible for the attitude of undergraduate students towards the learning of statistics?
2. What are the perceptions of undergraduate students towards the learning of statistics?
3. What are the strategies adopted by teachers to make the learning of statistics interesting?

Hypotheses

The following hypotheses were tested at a .05 level of significance.

H_{01}: There is no significant difference in the mean ratings of the male and female undergraduate students on their attitudes towards the learning of statistics

H_{02}: There is no significant difference in the mean ratings of the male and female undergraduate students on their perceptions of the learning of statistics

H_{03}: There is no significant difference in the mean ratings of the male and female undergraduate students on teachers' strategies to make the learning of statistics interesting

Materials and Methods

The study adopted an analytic descriptive survey design. The population for the study consisted of 2100 undergraduate students that study statistics-related courses. The sample of the study was 198 students. The study examined undergraduate students' attitudes and perceptions toward statistics at the Ignatius Ajuru University of Education, Port Harcourt. The instrument for data collection was a researcher-structured questionnaire titled: Student Attitude and Perception towards Statistics Inventory (APTSI). The questionnaire was structured using a Likert type of response with Strongly Agree (SA), Agree (A) Disagree (D) and Strongly Disagree (SD) options respectively. The instrument was then administered to the subjects and data were collected. The instrument was validated by experts in measurement and evaluation. The reliability coefficient of 0.78 was obtained using the Cronbach Alpha formula for the attitude scale. The administration of the instrument for the collection of data was done directly by the researchers and copies of APTSI were retrieved on the spot. Thereafter data analysis was done using, mean, standard deviation and z-test. A mean of 2.50 and above was accepted as an indication of agreement while a mean of 2.49 and below indicated disagreement for the section on attitude.

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Results

Research question 1: What are the factors responsible for the attitude of undergraduate students towards the learning of statistics?

Table 1: Mean ratings of respondents on factors responsible for the attitude of undergraduate students towards the learning of statistics

		Male, n=116		Female, n=82	
SN	**Item: Attitudes**	**Mean**	**SD**	**Mean**	**SD**
1	I feel delighted in solving statistics	3.14	0.88	3.00	0.70
2	Statistics is important for major	2.89	1.08	2.75	0.80
3	I am nervous about learning statistics	2.87	0.50	3.00	0.78
4	It has some complex formulas	3.00	0.49	2.98	0.70
5	Statistics is important to future career	3.30	0.91	3.08	0.79
6	The student liked the course	3.08	0.79	2.80	1.02
7	I normally make mistakes solving statistics	3.08	0.52	3.10	0.87
8	Statistics is not very different from mathematics	3.19	0.82	3.00	0.50
9	The students were indifferent to statistics	2.78	0.97	3.19	0.83
10	Statistics is a compulsory course	2.86	1.03	2.75	0.80
	Grand mean	**3.02**	**0.80**	**2.97**	**0.78**

Table 1 revealed that all the items with their means and also with corresponding standard deviations respectively were accepted by the male and female students as factors responsible for the attitude of undergraduate students towards the learning of statistics. The acceptance of the students was indicated by their mean scores for items 1-10 being higher than the criterion mean of 2.50.

Research Question 2: What are the perceptions of undergraduate students towards the learning of statistics?

Table 2: Mean ratings of responses on the perception of undergraduate students toward the learning of statistics

		Male, n=116		Female, n=82	
SN	**Item: Perceptions**	**Mean**	**SD**	**Mean**	**SD**
11	Difficulty in communicating the statistical results	3.19	0.82	3.00	0.5
12	Statistics problems are difficult to solve	2.85	1.30	2.83	1.29
13	Learning statistics is boring	3.02	0.98	3.20	1.02
14	I am motivated to learn statistics	3.30	1.08	3.00	1.03
15	Students enjoy mathematics	2.88	0.96	2.81	5.6
16	The students are not good at mathematics.	2.72	1.39	2.80	0.92
17	Statistics is challenging and frustrating	2.80	0.96	2.72	0.72
	Grand mean	**2.97**	**1.07**	**2.91**	**1.58**

Concerning Table 2, it is obvious that the mean ratings of male and female students scored above the criterion reference mean of 2.50. These indicated the perceptions of undergraduate students toward the learning of statistics.

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Research Question 3: What are the strategies adopted by teachers to make the learning of statistics interesting?

Table 3: Strategies adopted by teachers for making the learning of statistics interesting

		Male, n=116		Female, n=82	
SN	Item: strategies adopted	**Mean**	**SD**	**Mean**	**SD**
1	Practising can make statistics to be imaginative and interesting.	2.83	0.96	2.79	0.90
2	Students ask questions when they don't understand	2.78	1.08	2.80	0.92
3	Students need strong mathematics background to do well in statistics	2.80	0.92	2.72	1.39
4	In-depth knowledge of mathematics spurs them to understand statistics.	3.25	1.07	3.00	1.03
5	Create an atmosphere that will make them pay attention	3.19	0.82	3.00	0.50
6	Do all the assignments and then look for interesting questions	2.78	1.08	2.75	0.80
7	Develop an interest in statistics	2.78	1.08	2.75	0.80
8	Develop a probabilistic mindset	2.85	1.30	2.98	1.02
	Grand mean	**2.91**	**1.04**	**2.85**	**0.92**

Table 3 revealed the notion that all the items with their means and also with corresponding standard deviations respectively were accepted by the male and female students as strategies adopted by teachers to make the learning of statistics interesting. The acceptance of students was indicated by their mean scores for items 1-8 being higher than the criterion mean of 2.50.This is an indication that they are strategies adopted by teachers to make the learning of statistics interesting

Hypothesis 1 : There is no significant difference in the mean ratings of the male and female undergraduate students on their attitudes towards the learning of statistics

Table 4: Summary of z-test on the difference in the mean ratings of the male and female undergraduate students on their attitudes towards the learning of statistics

Gender	**Mean**	**SD**	**N**	**df**	**z-cal**	**z-crit**	**Decision**
Male	3.02	0.80	116	196	0.44	1.96	Retain H_{01}
Female	2.97	0.78	82				

From the Table 4, it is obvious that the calculated z-test (0.44) is less than the critical value of z from tables (z critical= 1.96) at a 0.05 level of significance and 196 degrees of freedom. Hence, we retain the null hypothesis of no significant difference. This means that there is no significant difference in the mean responses of the male and female undergraduate students on their attitudes towards the learning of statistics.

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Hypothesis 2: There is no significant difference in the mean ratings of the male and female undergraduate students on their perceptions of the learning of statistics

Table 5: Summary of z-test on difference in the mean ratings of the male and female undergraduate students on their perceptions of the learning of statistics

Gender	Mean	SD	N	df	z-cal	z-crit	Decision
Male	2.97	1.07	116	196	0.32	1.96	Retain H_{02}
Female	2.91	1.58	82				

Concerning Table 5 the calculated z–value (z cal =0.32) is less than the critical value of z from the table (z critical=1.96). Based on this, we retain the null hypothesis of no significant difference. This means that there is no significant difference in the mean ratings of the male and female undergraduate students on their perceptions of the learning of statistics.

Hypothesis 3: There is no significant difference in the mean ratings of the male and female undergraduate students on teachers' strategies to make the learning of statistics interesting

Table 6: Summary of z-test on the difference in the mean ratings of the male and female undergraduate students on teachers' strategies to make the learning of statistics interesting

Gender	Mean	SD	N	df	z-cal	z-critical	Decision
Male	2.91	1.04	116	196	0.41	1.96	Retain H_{03}
Female	2.85	0.92	82				

Table 6 revealed that the z calculated (0.41) is less than z critical (1.96) at a 0.05 level of significance i.e.zcal $\leq$ z critical. Based on this; we uphold the null hypothesis of no significant difference. This means that there is no significant difference in the mean ratings of the male and female undergraduate students on teachers' strategies to make the learning of statistics interesting.

Discussion of findings

The findings in Table 1 revealed the factors responsible for the attitude of undergraduate students toward the learning of statistics. This finding is in agreement with Hendrikus and Jitu (2020) who found that the factors responsible for the attitude of undergraduate students toward learning statistics include: feeling delighted in solving statistics, being nervous in learning statistics and the complexity of the formulas among others. Moreover, z test of hypothesis one showed no significant difference in the mean ratings of the male and female undergraduate studentson their attitudes towards the learning of statistics.

Concerning research question two, from Table 2, it is obvious that the findings from table two revealed the perceptions of undergraduate students towards statistics include: difficulty in communicating results, poor motivation to study statistics, and the boring nature of the course among others. The z-test showed that there is no significant difference in the mean ratings of the male and female undergraduate students on their perceptions of the learning of statistics. These findings support earlier findings by Hendrikus and Jitu (2020) who reported that when students have a positive perception of their learning it may result in success. However, when they have bad perceptions, it leads to failure.

The results from Table 3 showed that the strategies adopted by teachers to make statistics interesting at the university level are the creation of an atmosphere that could make students pay attention, in-depth knowledge of mathematics spur them to understand statistics and practising can make statistics interesting among others. However, the z-test of hypothesis three, showed that there is no significant difference in the mean ratings of the male and female undergraduate students on teachers' strategies to make the learning of statistics interesting.

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Conclusion

Based on the findings, it can be concluded that most of the students stated that they agreed with all the statements dealing with attitude. This implies their overall attitude towards statistics was positive. Also, the majority of the students showed positive perceptions concerning the statistics. They are motivated to learn statistics and they enjoy mathematics. However, they also expressed their feelings regarding the complexity of the statistics problems. The strategies adopted to make the course interesting: creating an atmosphere to make the students pay attention and have in-depth knowledge of the course may increase student understanding of statistics among other strategies.

Recommendations

1. Experienced teachers should be employed to teach statistics to debunk the minds of learners from the erroneous belief that statistics is uninteresting.
2. Teachers should be able to change students' attitudes and perceptions toward statistics and strategies to improve the learning of statistics should be taught
3. Teachers should be trained and exposed to different methods of teaching statistics to capture the attention of learners.

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