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### RESEARCH ARTICLE

#### COMPARATIVE STUDY OF THE ATTITUDES OF SCIENCE AND NON-SCIENCE STUDENTS TOWARDS STATISTICS

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#### Abstract

The current study was conducted to determine whether there would be a difference between science and non-science student's attitudes towards statistics. Two hundred and eight undergraduates were pooled from three public tertiary institutions in the Kogi State of Nigeria as the study participants. A cross-sectional survey design was adopted. The participants completed a self-report measure of Survey of Attitude toward Statistics (SATS-36), originally developed by Schau (2003). An independent t-test performed on the data established a statistically significant difference in the attitudes of the science and non-science students towards statistics at MD = 0.77 (95% CI, 0.57 to 0.77),  $t(206) = 12.747$ ,  $p = .001$ . It was concluded that there is variation between the attitude of science students and non-science students towards the teaching and learning of statistics. The study recommends that robust attitude change strategies be adopted to reshape the attitudes of the non-science students towards statistics.

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#### Introduction: -

Statistics is an exciting topic in modern-day society (Eichler & Zapata-Cardona, 2016). The field of statistics denotes the science of learning from data (Lieten, 2005). Statistical methods are crucial to the quality and rigor of any scientific endeavour (Annapurna, 2017; Olivier & Bell, 2018). It has emerged as a distinct discipline in recent years (Garfield & Ben-Zvi, 2007; Groth, 2015; Jose, 2017). Statistics play a crucial role in society and the workplace and have received increased attention from scholars (Ben-Zvi & Garfield, 2008; Chew & Dillon, 2014; Sharma, 2017). Perhaps, attention has been directed to the method of teaching and learning statistics in many countries (Fioravanti et al., 2019; Veloo et al., 2018). The importance of statistics has been widely highlighted (Frost, 2017; Gupta & V., 2020; Wiberg, 2009). For example, researchers have emphasized the relevance of statistics in psychology (Verma & Verma, 2019), health research (Coggon, 2015), national development (Shangodoyin & Lasisi, 2011), biophysical context (Tamm, 2019), data mining (Ribeiro et al., 2017). Statistics is an essential component in scientific discoveries, decision making, and predictions based on data (Lieten, 2005). There are many common misapprehensions about statistics (Currey et al., 2009). Statistics has been widely perceived as a challenging course, and this has presented a significant challenge for higher education students and is consequently associated with anxiety, which further inhibits performance (Sandoz et al., 2017). Research has attested that student commonly have negative perceptions of learning statistics (Gopal et al., 2020).

In the Nigerian tertiary education system, statistics is usually thought of as a service course to students in non-science departments such as management and social sciences. Basic statistical knowledge such as data

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representation, data distribution, probability, sampling, and statistical inferences is required to study most courses, including science, engineering, business, humanities, education, and others. Consequently, most students enrolled in non-science classes do not necessarily have a solid mathematical background (Dempster & McCorry, 2009). (Lavldas et al., 2020) had reported the effect of perceived competence in mathematics on students' performance in the statistics course. The unsatisfactory perception of students in statistics is well documented (Field, 2002; Murtonen & Lehtinen, 2003), and the trend is experienced globally. Many non-statistics students most often do not see the relevance of statistics within their discipline (Bilgin et al., 2020).

It is observed that most undergraduates in Nigeria tertiary institutions experience anxiety in response to statistics. However, the situation is pervasive among year one students. Perhaps, the fresh undergraduates approach the course with preconceived thoughts and attitudes, increasing or decreasing their anxiety towards statistics (Koh & Zawi, 2014). However, student's statistical anxieties have attracted broad investigation in recent years (Cui et al., 2019; Faber & Drexler, 2019; Huang, 2018; Malik, 2015; Najmi et al., 2018; Onwuegbuzie, 2004; Siew et al., 2019; Smith & Capuzzi, 2019; Tonsing, 2018; Vahedi et al., 2012; Walsh & Ugumba-Agwunobi, 2002; Williams, 2010). This study is concerned with the variation in attitude to statistics in undergraduates from science and non-science backgrounds.

Attitude is a learned disposition to behave in a consistent evaluative manner towards any aspect of the socio-world. Attitude denotes positive or negative evaluation of attitude objects. Thus, attitude, when acquired, can influence individual's responses to their environments. Students with a positive attitude tend to be more diligent in learning, whereas a negative attitude is characterized by a reduced commitment (Kurniawan et al., 2019). Over the years, attitude towards statistics has received increased attention, especially as it relates to performance (Arumugam, 2014; Ashaari et al., 2011; Budé et al., 2012; Gerald & Allan, 2018; Gómez et al., 2012; Judi et al., 2011; Koparan & Güven, 2008; Mustam et al., 2020; Nguyen et al., 2016; Saidi & Siew, 2018). Performance in statistics assessments is clearly shown to be related to students' attitudes toward statistics (Dempster & McCorry, 2009; Rosli & Maat, 2017).

Undergraduates from different academic disciplines have a different perception of statistics as a course. Perhaps, science-oriented students could have a more positive attitude towards statistics when compared to their counterparts in non-science fields. The study's main objective is to investigate the attitudinal variation between students admitted in science courses and students enrolled in non-sciences courses in relation to statistic education. Thus, it is expected that science students would show a more positive attitude towards statistics than non-science students.

### Method: -

A survey research design was adopted in the study. The population of the current study included undergraduate students from tertiary institutions in the Kogi State of Nigeria. Two hundred and eight ( $n = 208$ ) students were recruited from three public tertiary institutions in Kogi State as the research participants. The students were mainly pooled from the year one class and comprised males and females in the science and non-science departments. With permission from the school authorities, the students were approached in their classes and hostels. Those who passed the study criteria were asked to take part in the study intended to understand the attitude towards statistics better. Thus, only those who consented to participate were given the study instruments.

### Measures: -

Attitude towards statistics was measured using the Survey of Attitude toward Statistics (SATS-36) originally developed by Schau (2003). The 36 items, Linkert-type scale is scored in a 7- point format ranging from (1) strongly disagree to (7) strongly agree. Items in the scale were modified to suit the present context. Cronbach alpha .78 was recorded in this study.

### Result: -

**Table 1:** -Table showing the mean and standard deviation score of the science and non-science student attitude towards statistics.

Students discipline	N	Mean	SD
Science students	105	0.86	0.36
Non-science students	103	0.19	0.39
Total	208	0.53	0.51

The above table shows that a mean score of ( $M = 0.86$ ) and standard deviation score of ( $SD = 0.36$ ) was recorded for the science students, while a mean score of ( $M = 0.19$ ) and standard deviation score of ( $SD = 0.39$ ) was obtained for the non-science students. This score indicates that the science students showed a more positive attitude towards statistics when compared to their non-science counterparts.

**Table 2:** -Table showing t-test comparison of the difference between science and non-science students on attitude towards statistics.

Source of Variation	Mean	SD	df	t	Sig
Science students	0.86	0.36			
Non-science students	0.19	0.39	206	12.747	000

An independent-samples t-test was conducted to determine if there were differences between science students and non-science students on attitude towards statistics. The positive attitude of the science students was found to increase ( $0.86 \pm 0.36$ ) compared to the non-science students ( $0.19 \pm 0.39$ ), a statistically significant difference of  $MD = 0.77$  (95% CI, 0.57 to 0.77),  $t(206) = 12.747$ ,  $p = .001$ .

### Discussion: -

The current study was conducted to determine whether there would be a difference between science and non-science student's attitudes towards statistics. It was expected that the science students would have a more positive attitude towards statistics than the non-science students. Indeed, the result of the independent t-test conducted on the data established a statistically significant difference in the attitudes of the science and non-science students towards statistics at  $MD = 0.77$  (95% CI, 0.57 to 0.77),  $t(206) = 12.747$ ,  $p = .001$ . This means that the expectation of the study was realized. The study results indicate that the students who are enrolled in the science courses such as engineering, health sciences, natural and physical sciences are more likely to perform better in statistics than those in non-science departments such as management and social sciences. The finding is aligned with a previous study (Cahyawati et al., 2018; Griffith et al., 2012). For instance, (Cahyawati et al., 2018) reported a higher mean score for science field students and a lower mean score for social field students on attitude towards statistics. The observed variation in attitude to statistics between the science and non-science students could be explained in relation to academic background. In that, science students are more exposed to calculation courses and analytical concepts. Science disciplines are more demanding of mathematical skills than the non-science fields. But not that the non-science students do not undertake similar skilled related subjects. However, (Kurniawan et al., 2019) noted that science propels curiosity, critical thinking, open thinking, the desire to solve problems, and a sensitive attitude towards the environment.

Furthermore, the study provides insight into the differential attitude of science and non-science undergraduates towards the teaching and learning of statistics in the tertiary institutions in Nigeria. Therefore, the study results indicate that the anxieties occasioned by statistical education could be more prevalent among the non-science students. Thus, it becomes imperative that action be taken not only to improve statistical performance but also to ease anxiety.

### Conclusion: -

The present study established a statistically significant difference between the attitudes of science and non-science students in relation to statistics in the tertiary institutions. Hence, it is concluded that there is variation between the attitude of science students and non-science students towards the teaching and learning of statistics. The study contributes to the statistics literature by revealing the differential attitudes attributed to academic discipline relating to statistics. Nevertheless, the study encountered certain limitation that needs to be stated. For instance, the sample size was small and may not be dependable for generalization. Also, the design of the study did not allow for cause-effect determination. Future researchers are advised to include more representative samples and adopt pure experimentation to ascertain cause-effect relationships. However, we recommend that robust attitude change strategies be adopted in the non-science settings and the use of teachers with pedagogical expertise in the statistics classroom.

**Ethical consideration**

The researchers ensured that the study procedures involving human participants were done following the institution's ethical standard.

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