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AN ASSESSMENT OF TEACHERS KNOWLEDGE, ATTITUDE TO AND PERCEPTION OF STATISTICS IN OYO STATE PRIMARY SCHOOLS, NIGERIA

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ABSTRACT: *This study ascertained the knowledge content, perception and attitude of primary school teachers towards the statistics component of the Nigerian primary school mathematics curriculum. The study population consisted of all primary school teachers in Oyo State, Nigeria and the sample comprised of 127 teachers who responded to the three questionnaires that were developed, pilot tested and validated by the researchers and adopted in collecting data for the study. They are: Teacher Statistics Content Knowledge Questionnaire (TSCKQ) with Cronbach Alpha reliability coefficient index of 0.81, Teacher Attitude to Statistics Teaching Questionnaire (TASTQ) with Cronbach Alpha reliability coefficient of 0.69, Teacher Perception of Statistics Questionnaire (TPSQ) with Cronbach Alpha reliability coefficient of 0.72. Multi-stage sampling technique was used in selecting the required number of respondents for the study. First, purposive sampling was used in selecting the sample State (Oyo State). Simple random sampling was adopted in selecting three local government areas in the State. Purposive sampling was used to select ten public primary schools in the local government areas and purposive sampling was also used in choosing mathematics teachers from the selected schools. The data collected were analysed using descriptive and correlation statistics at 0.05 level of significance. Findings show that mathematics teachers' possesses the adequate content knowledge of statistics needed for teaching the statistics related topics in the primary school mathematics curriculum; that they possess a positive attitude in the teaching of statistics and the right perception of statistics. More so, there is a negative relationship among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics; there is a moderate positive correlation between teachers' attitude to teaching statistics and their perception of statistics. It is thus recommended that teachers at the primary level of education be continually updated with the current statistical knowledge, perception and attitude; so as to foster better teaching and learning of statistics cum mathematics at the level.*

KEYWORDS: Teacher Statistics Knowledge, Teacher perception, Teacher attitude, primary school.

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INTRODUCTION

In recent times, we seem to be enclosed by statistical data/information that is presented through statistical graphs, tables and charts. The relevance of statistics along with its applications in man's daily undertakings is immense. Statistics can be referred to as the science of data; needed to make sense of societal happenings such as crime rates, the spread of diseases, population growth, employment rates, educational achievement and assessing chance based situations such as insurance policies; to mention but a few. The knowledge of how to use and communicate statistics is therefore necessary if teachers and pupils' are to become statistics compliant through which they become capable of making critical and informed decisions (Wallman, 1993). Statistics is one of the scopes of primary mathematics, the others being Number, Shape and Space, Measures, and Algebra. The learning prospect of statistics teaching and learning process are to enable pupils' to understand the elementary concepts and representations of statistics. The purpose for including statistics teaching in schools have been repeatedly highlighted over the past 20 years (Franklin *et al.*, 2005; Girard, 2005): usefulness of statistics for daily life, its instrumental role in other disciplines, the need for a basic knowledge of statistics in many professions and the important role of statistics in developing critical reasoning. Moreover, to be statistically knowledgeable, it is essential for today's citizens (teachers and learners included) to be critical with available information at their disposal, to understand how the information is generated as well as to be able to make personal, social, economic, educational and political decisions. Consequently, there is a need for primary school mathematics teachers, who are responsible for teaching statistics at this level to be grounded with the right attitude, perception and content knowledge of statistics for a functional and qualitative mathematics teaching and learning process.

Teachers are a vital ingredient in the educational setting. Their input and output into the educational system portrays the standard and quality of the system. Factors such as teachers' knowledge of statistics, attitude and perception of statistics can influence the learning of statistics or the extent to which teachers will apply what they have learnt inside and outside the classroom (Gal and Ginsburg, 1994). Studies such as those by Estrada *et al.* (2005) and Lancaster (2007) restated that teachers acknowledge the practical importance of statistics, are willing to learn more and spend more time teaching statistics. At the same time, teachers feel their students experience greater difficulties in statistics classes than in other mathematical topics and they consider themselves not well prepared to help their students face these difficulties. Even if teachers have been trained for mathematics teaching, they need more qualifications to teach statistics since they have difficulties in solving statistical questions and explaining statistical concepts to students (Arnold, 2008). It is very important for teachers to be competent in developing statistical literacy in pupils and this requires that teachers have the capacity to critically examine and reason about real-world data with the help of their statistics. These teachers should be able to: recognize what concepts can be addressed through a particular data set and implement effective learning in the classroom with the data. Teachers possessing adequate knowledge of statistics could go a long way in determining his or her attitude and perception to statistics. For the teaching of statistics in primary schools to be enhanced, it will depend on the extent to which teachers are convinced that statistics is one of the most useful themes for their students. Teachers' especially at the primary level of education should possess the right perception of statistics.

Teachers' statistical perceptions deserve attention as mathematics teachers' thinking or imagination is the key factor in any movement towards changing mathematics teaching and determines both the knowledge and beliefs of pupils concerning mathematics and hence statistics (Batanero & Díaz, 2010). Teachers perception of statistics are the mental images or thoughts teachers have about statistics. These are formed and shaped by the teachers' background knowledge and life experiences. It can be experiences stemming from their family history or tradition, education, work, culture, or community. The ways a teacher perceives statistics can undermine his interest, attitude, content knowledge of statistics and his pedagogy in teaching statistics. These on the long run, do affect his general teaching performance and output. Teachers perception of statistics, if rightly and positively tailored, causes the same teacher to have the right attitude to statistics.

Teacher attitude to teaching statistics is paramount for a proficient lesson delivery in the area. Attitudes of teachers' towards statistics play a significant role in assuring success in implementing any new statistical curriculum. Philipp (2007) described attitude as a manner of acting, feeling or thinking that show a person's disposition or opinion towards a topic. They are relatively stable, comprise a larger cognitive component and less emotional intensity than emotions, develop as repeated positive or negative emotional responses and are automatized over time. Teachers' positive attitudes towards a topic would help them to understand that the topic is useful in their students' professional and personal lives and that their students can be trained to understand this theme (Schau, 2003). Estrada (2002) compared the attitudes towards statistics of in-service primary school teachers and future primary school teachers and related these attitudes to gender, number of previous statistics courses, specialty (topic in which the future teachers were specialising or topic that the teachers taught) and number of years of teaching experience in mathematics (for in-service teachers). The analysis of the specific items indicated that, when possible, senior teachers tended to exclude statistics from their classes, because they found statistics more difficult than younger teachers did. This study also showed that senior teachers had a greater tendency to suppress statistics when possible and found statistics more difficult than younger teachers. Participants' perception of the difficulty of statistics was unrelated to their statistical knowledge, although attitude and its components in general tended to improve with increased knowledge. Begg and Edwards (1999) used interviews, an unspecified survey scale, and concept maps to study attitudes in a sample of 22 in-service and 12 prospective primary teachers. Results showed negative attitudes in the affective component. Teacher attitude to statistics would determine the quantum of knowledge of statistics teachers are to have for an improved learner's outcome

Moreover, most teachers have little or no prior experience with using statistical investigation/knowledge in teaching statistics in schools. Thus, they may have difficulty implementing statistical investigation (Stohl, 2005). With respect to interpreting graphs, pre-service primary school teachers in Espinel's (2007) research lacked the experience to interpret graphs, made errors involving symmetry, outliers and cumulative frequencies. They struggled with mean and median and thought mainly in terms of qualitative variables, thereby confusing histograms with bar graphs. They incorrectly identified the relevant variable and failed to interpret

the data distribution as a whole, focusing instead on specific aspects, such as the average or an outlier. Estrada *et al.* (2005) found a worrying percentage in the sample of pre-service teachers that did not take into account outliers when computing averages, confused correlation with causality, did not relate the mean to the total, were insensitive to sample bias or believed that estimation was not possible because of random fluctuation in sampling.

Researches assessing the pedagogical content knowledge required for teaching statistics and the way teachers use their statistical knowledge when teaching statistics has shown that the knowledge teachers have in statistics is often weak. In González and Pinto's (2008) qualitative research pre-service secondary school mathematics teachers had a scant knowledge of graphical representation, no training in matters related to the curriculum and the processes of learning and teaching; specifically they knew nothing about stem and leaf graphs. They did not perceive the different cognitive levels associated with graphs (Friel *et al.*, 2001) or the various components and processes linked to their interpretation (Monteiro and Ainley, 2006). Consequently, teachers' statistical knowledge plays a significant role in the quality of their teaching since teachers' instructional decisions in the statistics classroom are dependent on this knowledge (Batanero & Díaz, 2010). For a teacher to be proficient in teaching statistics, especially at the primary level; he/she should be grounded in data awareness, the ability to understand statistical concepts and the ability to analyse, interpret and evaluate statistical information, the ability to communicate statistical information and understandings. They should possess in-depth knowledge of statistics to gain the ability to criticize, produce, and analyze statistics. This entails that teacher knowledge of statistics, their attitude to statistics and perception about it can determine pupils' attitude and achievement towards statistics related topics in the mathematics curriculum.

If Pupils' are to master the methods of data collection; finding frequencies, mode, median, mean, variance and standard deviation of an array of data; learn to construct and read simple statistical graphs; to mention but a few, teachers especially at the primary level of education should possess the necessary knowledge, attitude and perception towards statistics. With the help of these, pupils' can apply the knowledge obtained and methods learnt to solve simple and practical problems as they emerge and to draw necessary conclusions as the need arises. These prompted the study; as it aimed at ascertaining primary school teachers' statistics content knowledge as imbedded in the mathematics curriculum, teachers attitude to the statistics related topics and their perception towards statistics.

Statement of the Problem

Learners' learning outcomes in statistics, a component of the primary school mathematics curriculum is a function of the mathematics teacher teaching it. Mathematics teachers who teach the statistics related topics in the mathematics curriculum may or may not possess the right, necessary and adequate statistical knowledge, attitude and perception in teaching it. Therefore, this study assessed the quantum and nature of the statistics content knowledge, attitude and perception these practicing primary school mathematics teachers have in mathematics teaching and learning processes.

Research Questions

1. What is the profile of Oyo state primary school teachers in respect to their attitude, perception and knowledge of statistics?

2. What is the relationship among teachers' knowledge of statistics, attitude to teaching statistics and perception of statistics?

RESEARCH METHODOLOGY

(i) Research type

The study is an expost facto research design. The research type was employed because the researcher had no direct control of the dependent and the independent variables as they had already occurred.

(ii) Population, Sampling Technique and Sample

The population for the study comprised of all public primary schools teachers in Oyo State, Nigeria. The public primary schools were chosen to ensure homogeneity of the sample with respect to school type and curriculum content used. Multi-stage sampling technique was used in selecting the required number of respondents for the study. First, purposive sampling was used in selecting the sample State (Oyo State). Simple random sampling was adopted in selecting three local government areas in the State. Purposive sampling was used to select ten public primary schools in the local government areas and purposive sampling was also used in choosing mathematics teachers from the selected schools. In all, 127 teachers were used as the study sample.

(iii) Instrumentation

Three instruments were developed, pilot tested and validated by the researchers and adopted in collecting data for the study: Teacher Statistics Content Knowledge Questionnaire (TSCKQ) with Cronbach Alpha reliability coefficient index of 0.81, Teacher Attitude to Statistics Teaching Questionnaire (TASTQ) with Cronbach Alpha reliability coefficient of 0.69, Teacher Perception of Statistics Questionnaire (TPSQ) with Cronbach Alpha reliability coefficient of 0.72.

The Teacher Statistics Content Knowledge Questionnaire (TSCKQ) consisted of ten items. The contents of TSCKQ consist of items measuring the content knowledge of statistics the mathematics teachers possessed. The items were placed on a dichotomous Likert Scale of Agree (1) and Disagree (2). The Teacher Attitude to Statistics Teaching Questionnaire (TASTQ) contained two sections (A & B). Section A was used to capture the demographic data of the respondents (teachers) with respect to gender, year of teaching experience and qualification of the teachers. Section B contained items designed to measure the attitude of teachers towards statistics. It consisted of 7 items which was also placed on a dichotomous Likert Scale of Agree (1) and Disagree (2). The Teacher Perception of Statistics Questionnaire (TPSQ) contained items measuring teachers' perception of statistics. It consisted of 7 items which was placed on a dichotomous Likert Scale of Agree (1) and Disagree (2).

(iv) Procedure for Data Collection

Three teachers from each school (non mathematics teachers) were trained for two days as research assistants by the researchers. The researchers and the research assistants administered the instruments to the teachers in the selected schools. Data were collected for three weeks.

(v) Data Analysis

The data collected were analysed using descriptive (frequencies, mean and Std. Dev) and inferential statistics (correlation) at 0.5% level of significance.

RESULTS

Research Questions 1: What is the profile of Oyo state primary school teachers in respect to their attitude, perception and knowledge of statistics?

Table 1: Teachers Content Knowledge of Statistics

S/No	Statements	Agree Freq (%)	Disagree Freq (%)	Mean	Std. Deviation
1,	I can draw a frequency distribution table	122 (97)	5 (4)	1.04	.195
2.	I know how to find the mode from a set of numbers	127 (100)	0 (0)	1.00	.000
3.	I know how to find the median from a set of numbers	127 (100)	0 (0)	1.00	.000
4.	I know how to find the mean from a set of numbers	124 (98)	3 (2)	1.02	.152
5.	I can calculate variance from a set of numbers	84 (70)	43 (30)	1.34	.475
6.	I can calculate standard deviation from a set of numbers	50 (35)	77 (65)	1.39	.491
7.	I can draw a Histogram	99 (80)	28 (20)	1.22	.416
8.	I can draw a Bar chart	93 (76)	34 (24)	1.27	.445
9.	I can draw a Pie chart	41 (29)	86 (72)	1.32	.469
10.	I can draw a Histogram Polygon (Ogive)	14 (10)	113 (90)	1.43	.496

NB: Average Mean=1.20, Mean score ≥1.00 = Adequate teacher content knowledge of statistics, Mean score ≤ 1.00 = Inadequate teacher content knowledge of statistics.

Table 1 shows that the aggregate mean score of the teachers on their content knowledge of statistics is 1.20, which is indicative of adequate teachers' content knowledge of statistics. Thus, mathematics teachers in Oyo State primary schools do possess the adequate content knowledge of statistics needed for teaching the statistics related topics in the primary school mathematics curriculum. However, a numbers of teachers may be having issues with topics like: finding standard deviation of a set of numbers, drawing of pie charts and drawing of frequency polygon.

Table 2: Attitude of teachers to teaching Statistics

S/No	Statements	Agree Freq (%)	Disagree Freq (%)	Mean	Std. Deviation
1.	I hate teaching Statistics related topics in the Mathematics curriculum	29 (31)	98 (69)	1.77	.421
2.	It's difficult teaching Statistics related topics in the Mathematics curriculum	49 (45)	78 (55)	1.61	.489
3.	I do not understand Statistics related topics in the Mathematics curriculum	41 (40)	86 (61)	1.68	.469
4.	I avoid teaching Statistics related topics in the Mathematics curriculum	47 (44)	80 (56)	1.63	.485
5.	I love Statistics related topics in the Mathematics curriculum	86 (71)	41 (29)	1.32	.469
6.	I like expressing my knowledge of Statistics	54 (49)	73 (51)	1.57	.496
7.	I do not require Statistics knowledge in teaching Mathematics	10 (17)	117 (83)	1.92	.270

NB: Average Mean=1.64, Mean score ≥1.30 = Positive attitude of teachers to teaching Statistics, Mean score ≤ 1.00 = Negative attitude of teachers to teaching Statistics.

Table 2 shows that the aggregate mean score of the teachers' attitude to the teaching of statistics is 1.64, which is indicative of a positive attitude of teachers in teaching statistics in their schools. Therefore, mathematics teachers in Oyo State primary school have a positive attitude in the teaching of statistics in their schools. However, many of teachers agreed to the statement that they do not require the knowledge of statistics in teaching mathematics.

Table 3: Teachers Perception of Statistics

S/No	Statements	Agree Freq (%)	Disagree Freq (%)	Mean	Std. Deviation
1.	Statistics is highly related to mathematics	57 (51)	70 (49)	1.05	.213
2.	Teachers knowledge of statistics is needed in teaching mathematics	121 (96)	6 (4)	1.05	.213
3.	I am not trained to teach statistics from my NCE/B.ED institutions	57 (51)	70 (49)	1.55	.499
4.	Teachers knowledge of statistics can predict their mathematics attitude and teaching performance	88 (74)	39 (26)	1.31	.463
5.	Statistics education has not been given the accorded attention in mathematics teaching and learning	83 (69)	44 (31)	1.35	.478
6.	I would love to have more knowledge of statistics to teach the statistics related topics in the mathematics curriculum	53 (49)	74 (51)	1.58	.495
7.	Knowledge of statistics is not important in my mathematics teaching	18 (24)	109 (76)	1.86	.350

NB: Average Mean=1.40, Mean score ≥1.00 = Right teachers perception of statistics, Mean score ≤ 1.00 = Wrong teachers perception of statistics.

Research Question 2: What is the relationship among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics?

Table 4: Relationship among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics

Correlation		Teachers content knowledge of statistics	Teacher attitude to teaching statistics	Teachers perception of statistics
Teachers content knowledge of statistics	Pearson Correlation	1	-.482**	-.166
	Sig. (2-tailed)		.000	.063
Teacher attitude to teaching statistics	Pearson Correlation	-.482**	1	.422**
	Sig. (2-tailed)	.000		.000
Teachers perception of statistics	Pearson Correlation	-.166	.422**	1
	Sig. (2-tailed)	.063	.000	
	Number of Teachers	127	127	127

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

Table 3 shows that the aggregate mean score of the teachers' perception of statistics is 1.40, which is indicative of teachers possessing the right perception of statistics. Hence, mathematics teachers in Oyo State primary school have a positive attitude in the teaching of statistics in their schools. However, many of the teachers agreed to the statement that they do not require the knowledge of statistics in teaching mathematics.

Table 4 presents the Pearson product moment correlation result showing the relationships among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics. As revealed from the table, there is a negative relationship among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics. There is a moderate correlation between teachers' attitude to teaching statistics and their perception of statistics.

DISCUSSION

It was observed from the findings in this study that mathematics teachers in Oyo State primary schools do possess the adequate content knowledge of statistics needed for teaching the statistics related topics in the primary school mathematics curriculum; they possess a positive attitude in the teaching of statistics and the right perception of statistics. This findings disagrees with those of Onwuegbuzie, (1998); Begg and Edwards (1999) that teachers possesses a negative attitude to statistics. The findings of the study also negated the finding of Arnold (2008) who was of the opinion that teachers' need more qualifications to teach statistics since they have difficulties in solving statistical questions and explaining statistical concepts to learners. The same is true with the finding of Espinel's (2007) research lacked the experience to interpret graphs, made errors involving symmetry, outliers and cumulative frequencies. They struggled with mean and median and thought mainly in terms of qualitative variables, thereby confusing histograms with bar graphs. Moreover, the finding

also reveals that there is a negative relationship among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics. Also, there is a moderate correlation between teachers' attitude to teaching statistics and their perception of statistics.

CONCLUSION AND RECOMMENDATION

This study sought to examine Nigerian primary school teachers' statistics content knowledge as imbedded in the mathematics curriculum, their attitude to the statistics related topics in the mathematics curriculum/textbooks and their perception towards statistics in general. Findings show that mathematics teachers' possesses the adequate content knowledge of statistics needed for teaching the statistics related topics in the primary school mathematics curriculum; that they possess a positive attitude in the teaching of statistics and the right perception of statistics. More so, there is a negative relationship among teachers' knowledge of statistics, their attitude to teaching statistics and perception of statistics; there is a moderate positive correlation between teachers' attitude to teaching statistics and their perception of statistics. It is thus recommended that teachers at the primary level of education be continually updated with the current statistical knowledge, perception and attitude; so as to foster better teaching and learning of statistics cum mathematics at the level.

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