

Understanding Performance of Undergraduate Students in Trigonometry in South-West of Nigeria

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Abstract

Trigonometry is a course that student's first experience with mathematics beyond what they have learnt in the secondary school. It provides critical prerequisite skills for both physical and biological science students. This study investigated the level of performance in trigonometry among undergraduate students in the South-West Universities of Nigeria. The research design used in the study was a descriptive survey type. 150 undergraduate students from faculty of science were randomly selected from three (3) universities in the South-west region of Nigeria. Instrument used to gather data for this study was Trigonometry Achievement Test (TAT) ($r = 0.78$). The data obtained were analysed using descriptive statistics and independent sample t-test at 5% level of significance. The results indicated that the level of performance of majority of the undergraduate students in the trigonometry achievement test was good 94 (62.7%) and 3 (2.0%) perform poorly. There was no significant mean differences in performance based on the type of secondary school (public, private) graduated from ($t_{(148)} = 1.426, p > 0.05$), while there was significant mean difference in performance based on their area of study ($t_{(148)} = 1.576, p < 0.05$). Based on these findings, it is recommended that lecturers teaching trigonometry course should consider all the different areas of study of the undergraduate students that are offering trigonometry course in order to enhance their performance in the course.

Keywords: Performance, Trigonometry, Undergraduates, School type

Introduction

Trigonometry being an inseparable part of Mathematics is one of the required courses that students must pass in their first year in the university. It takes some topics from arithmetic and geometry as sources. It is an essential part of Mathematics; its knowledge plays a very vital role in the development of students' spatial and abstract thinking.

Some problems associated with competency skill in geometry had been identified in some studies Bressoud, 2010; Marchi, 2012, and these problems, can be categorised into two. The first category according to Bressoud, 2010 and Moore, 2012, 2013, are the problems associated with the concept of angle. This sometimes results into students having a negative attitude toward any concept coming from angles due to symbol associated with the concept. According to Moore (2012, 2013) students' difficulties with angles emanated from who taught the students and the way they were taught. The fact is that you cannot give out what you don't have. That is the level of understanding of the teacher matters a lot. In another view, Bressoud (2010) associates difficulties with angles to incompatibilities between the ratio and the unit circle approaches to trigonometry.

The second category are the problems associated with the sine, cosine, and tangent functions (Bressoud, 2010; Marchi, 2012; Moore, 2012). Students find it hard to know some essential formulas which will be needed in solving problems in this concept. In many cases, students approach trigonometry as procedural and rule oriented. This prevents them from experiencing the richness of trigonometry and many approaches that could be used to develop competence skills in trigonometry.

Aside from the trigonometric difficulties parse there are many other causes of poor performance in Mathematics and trigonometry being a topic among students of various educational levels. According to Bakare, (1994) cited in Asikhia, (2010) factors responsible for students' poor academic performance can be grouped into four major areas:

- Causations resident in the child such as basic cognition skills, physical and health factors, psycho-emotional factors, lack of interest in school programme.

- Causations resident in the family such as cognition stimulation/basic intuition during the first two years; type of discipline at home; lack of role model and finance.
- Causations resident in the school such as location and physical buildings; interpersonal relationship among the school personnel.
- Causations resident in the society such as instability of educational policy; under-funding of educational sector; leadership; job losses.

Concepts which students hold about trigonometry determine how they approach the topic. This may likely be linked to the way students were handed at their secondary level of education. This is because students would be introduced to trigonometry at this level and it formed the basis for their performance in trigonometry. A faulty foundation will definitely have negative effects on students' performance. But looking at this from another angle, these students, when seeking admission, would be placed on same parameter and on securing the admission, a level play ground will be provided for them to operate irrespective of their background. As a result of this, the effect of where they are coming from may be neutralised. Even though there are studies such as Mburu 2013 and Joseph 2014 who had established that students from private schools perform better than their counterparts from public schools, but with time, they may all be at the same level.

Trigonometry being a course that provides critical prerequisite skills for both physical and biological Science students, and for many, they represent a barrier to success in their programs, it is of paramount importance to investigate the pattern of students performance in this course considering the established fact that trigonometry is one of the areas of Mathematics where students showed dislike especially at their pre-university stage (Secondary School Level). This study therefore established their level of performance vis a vis the secondary school they graduated from as well as the type of course they are studying in the university.

Statement of the Problem

The vast and broad knowledge of trigonometry serves as fundamental knowledge to perform credibly well in mathematics as a course. This

knowledge is best acquired at the early years of schooling, where students are expected to have a solid foundation in fundamental operations in Mathematics. Though, findings have shown that most of the time, students in the private schools perform better than their counterparts in the public schools, does this still hold when they get to higher institution? It is therefore considered necessary to establish the empirical fact as regards level of performance in trigonometry among undergraduate students in the South-west Universities in Nigeria vis-à-vis the type of secondary school they graduated from as well as their course of study. This will inform both the teachers and the students the pattern and level of achievement in trigonometry and as a result they will be able to plan for the instructional method to be adopted in order to enhance the students' performance in the course (trigonometry).

Research Questions

This work was guided by the following research questions:

1. What is the level of performance of the undergraduate students in trigonometry?

Hypotheses

1. There will be no significance secondary school type difference in students' performance in Trigonometry.
2. There will be no significance difference in students' performance in Trigonometry based on area of study.

Methodology

The descriptive survey research design was used in this study. The stages of the research process that was used are shown below.

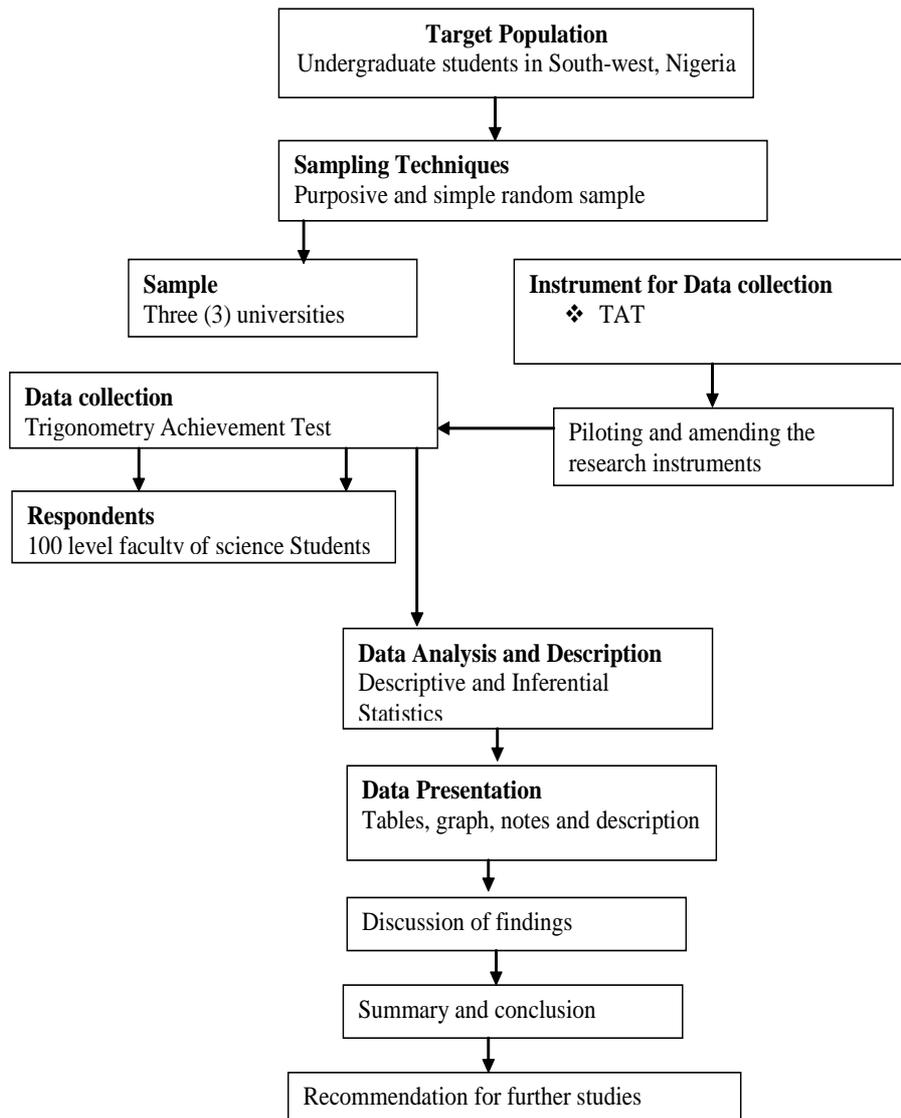


Figure 1: Study process

Source: Adapted and modified from (Cohen and Manion, 1994: 89)

Figure 1 shows the target population from which 3 universities were picked. Shown in the figure also are the methods of sampling that were used. Instruments that was used for data collection is the Trigonometry Achievement Test (TAT). After the construction of the instrument, a pilot testing was conducted and proper amendment of the research instrument was done after which data was collected on TAT with respondents been 100 Level Faculty of science students. The data collected was analysed using frequency count and Independent T-test. Results of the findings were discussed; then summary, conclusion and recommendation were made for further studies.

The target population for this research were the 100Level undergraduate students in Universities in the South-west region of Nigeria. Purposive sampling techniques was used in selecting the Universities, Faculty of science students were used in each of the universities while simple random sampling was used in selecting the students that took part in this research. 50 students from each school constituted the sample. At the end, a total of 150 students were sampled.

Instrument that was used in this research work was the Trigonometry Achievement Test (TAT) The objective of the test was to determine the level of performance in trigonometry among 100 level undergraduate students. The course outline of the selected universities were collected and test blueprint of 50 test items were constructed covering the commonality in content area of the three universities: trigonometry functions and exponential/logarithmic function, circular measure, inverse of trigonometry functions, trigonometry formulae and general solution of trigonometric equations, a mathematics lecturer and an expert in test construction helped validated the questions. A similar sample population was administered with the test items and was coded on the SPSS for marking and computed the total score for each student, the difficulty, discriminating index and point bi-serial correlation was calculated on the Microsoft Excel sheet. Selection of good and bad items was determined based on meeting at least two of the following criteria.

- Difficulty indices ranged between 0.3 and 0.7 (i.e. $0.3 < p < 0.7$)
- Discrimination indices ranged between 0.3 and above (i.e. $D.I > 0.3$)
- Point bi-serial correlation .3 or above ($r > 0.3$)

In conclusion, a total of twenty (20) items were selected from the initial pool items of fifty (50) based on meeting the conditions of difficulty, discrimination indices and point bi-serial correlation. The surviving items were tagged good and therefore chosen. The reliability of the test was done using Kuder-Richardson 20(KR-20) formula to generate a raw reliability coefficient of 0.779

The trigonometry achievement test blueprint was developed using Blooms Taxonomy of Learning Objective, which was broken-down to Knowledge (K), Comprehension (C) and Higher Reasoning (HR) and it was given to mathematics lecturer who is an expert in test construction to establish the content validity after which it was pilot tested having a reliability index of 0.779.

Descriptive analysis was used to analyse students' performance in trigonometry while Inferential analysis was used to analyse the significance difference in students' performance based on type of school they graduated from and area of study.

Results

Research Question 1: What is the level of performance of the undergraduate students in trigonometry?

Table 2: Distribution of level of performance of the undergraduate students in trigonometry

| Level of Performance (Score)(%) | Frequency | Percentage |
|---------------------------------|-----------|------------|
| Poor (0-5)0-29 | 3 | 2 |
| Fair (6-10)30-49 | 34 | 23 |
| Good (11-15)50-79 | 94 | 62 |
| Excellent (16-20)80-100 | 19 | 13 |
| Total | 150 | 100 |

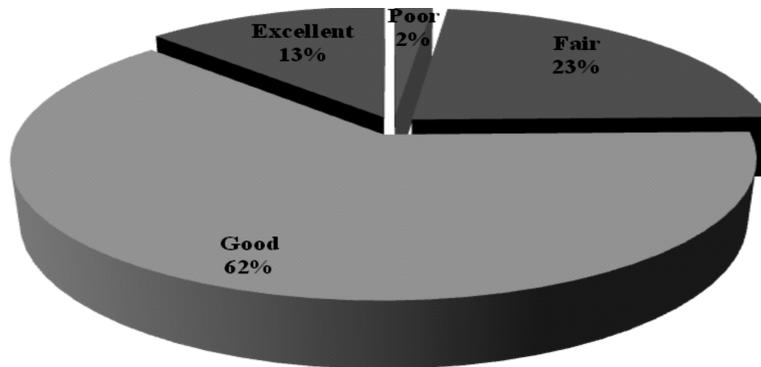


Figure 2: Distribution of level of performance of the undergraduate students in trigonometry.

Table 2 and Figure 2 shows the level of performance of the undergraduate students in trigonometry. The results reveal that 3(2%) of the undergraduate students performed poorly, 34(23%) performed fairly, 94(62%) had good performance while 19 (3%) of the undergraduate students' performed excellently in the trigonometry achievement test. This implies that the level of performance in trigonometry is quite impressive.

Hypothesis I. There will be no significance secondary school type difference in students' performance in Trigonometry.

Table 3: Difference in undergraduate students' performance in trigonometry based on the type of school graduated from

| Type of secondary school graduated from | N | Mean | Std. deviation | Df | T | Sig | P | Remark |
|---|----|------|----------------|-----|-------|------|-------------|-----------------|
| Public | 93 | 2.35 | .503 | 148 | 1.426 | .078 | 0.05 | Not significant |
| Private | 57 | 2.23 | .567 | | | | | |

$p < 0.05$

Independent sample t-test was used to compare mean difference in undergraduate students performance in trigonometry based on the type of school graduated from. Table 3 shows that there was no significant mean differences in the type of school graduated from, $t_{(148)} = 1.426$, $p > 0.05$). The table further revealed that mean score of students who graduated from public secondary school ($\bar{x} = 2.35$, S.D=0.503) was higher than students who graduated from private secondary school ($\bar{x} = 2.23$, S.D=0.567), but the difference was not statistically significant. Therefore, from the result of the analysis there is no statistical reason to conclude that there is significant difference in the performance of students who graduated from public and private secondary school.

Hypothesis 2 There will be no significance difference in students' performance in Trigonometry based on area of study

Table 4. Difference in area of study in undergraduate students' performance in trigonometry.

| Area of study | N | Mean | Std. deviation | Df | t | Sig | P | Remark |
|---------------------|----|------|----------------|-----|--------|------|-------------|-------------|
| Biological Sciences | 62 | 2.24 | 0.432 | 148 | -1.257 | .000 | 0.05 | significant |
| Physical Science | 88 | 2.35 | 0.588 | | | | | |

$p < 0.05$

Table 4 shows that an independent sample t-test was used to compare mean difference in undergraduate students' performance in trigonometry based on the area of study. There was a significant mean differences in students' performance based on the area of study that was $t_{(148)} = -1.257$, $p < 0.05$). The table revealed that the mean score of students in physical science ($\bar{x} = 2.35$, S.D=0.588) is higher than that of their counterparts in biological sciences = ($\bar{x} = 2.24$, S.D=0.432). The difference was found to be statistically significant. Therefore, from the result of the analysis there is statistical reason to conclude that there

was significant difference in the trigonometry performance of students offering physical science courses and those offering biological sciences courses.

Discussion

The result of the findings indicated that the level of performance of majority of the undergraduate students in the trigonometry achievement test was good, suffice to say that majority of the undergraduate students have an average knowledge of trigonometry. Comparing the significant difference on the performance of students in trigonometry based on the type of secondary school graduated from. The result revealed that there was no significant mean difference in the type of secondary school which the students graduated from. This indicates that regardless of the type of secondary school graduated from, the performance is almost even at university level. This may likely be attributed to the fact that the students would have been tested before given admission. That is irrespective of the type of secondary school they graduated from; offer of admission was based on their performance in the entrance examination (UTME or Post UTME) they sat for. The simple implication of this is that students of the same performance were likely to be offered admission. This buttressed the point made from the study of Bello and Ariyo 2014 who established that there was a very low correlation (not statistically significant) between the knowledge of Mathematics in secondary school and the knowledge of Physics in the university introductory course. This simply implies that the knowledge a student is bringing in may not be sole determinant of students performance, this is to say that there are other factors associated with students performance. This study was in line with the work of Philiias and Wanjobi 2011 that the type of schools which the students attended has effect on their academic performance in Mathematics. This was contrary to the finding of Ýnan, (2013), that there was significant different in the achievement levels of trigonometry students conducted between the two schools that he used for his experimental work. More so, on the students' performance in trigonometry based on their area of study, it was revealed that there was a significant mean difference in their performance.

Conclusion

Based on the results of the study, the following conclusions were made: that the undergraduate students performed creditably well and that the type of secondary school the undergraduate students graduated from does not affect their performances in trigonometry and that those undergraduate students from physical sciences performed well than their colleagues from the biological sciences.

Recommendations

It is therefore recommended that:

1. lecturers taking the trigonometry course should consider all the different area of study of the undergraduate students that are offering trigonometry course to make them perform well.
2. appropriate teaching approach that will suit various background should be explored.

References

- Asikhia, O. (2010) Students and Teachers' Perception of the Causes of Poor Academic Performance in Ogun State Secondary Schools [Nigeria]: Implications for Counselling for National Development. *European Journal for Social Sciences*, 13, 229-242
- Bakare C.G.M (1994). Mass failure in public examination: Some Psychological Perspectives psychological Monograph, Department of guidance and counselling, University of Ibadan, Ibadan
- Bello, T.O & Ariyo, B.D. (2014) Secondary School Mathematics as Determinant of Academic Performance in University Introductory Physics *Journal of Education and Practice* ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) 5 (39) retrieved from www.iiste.org on 15th June 2018
- Bressoud, D.M. (2010). Historical reflections on teaching trigonometry. *Mathematics Teacher*, 104(2), 106-112.
- Cohen, L and Manion, L. (1994). *Research Methods in Education* (4th Ed). London: Routledge.
- Ýnan, C. (2013). Influence of the constructivist learning approach on students' levels of learning trigonometry and on their attitudes towards mathematics. *Hacettepe Üniversitesi Eđitim Fakóltesi Dergisi [Hacettepe University Journal of Education]*, 28(3), 219-234.

- Joseph, E.U. (2014), "School variables and mathematics performance among students in Akwa Ibom State", *International Journal of Development and Sustainability*. 3 (7), 1558-1568.
- Marchi, D. J. (2012). *A Study of Student Understanding of the Sine Function through Representations and the Process and Object Perspectives* (Unpublished doctoral dissertation). The Ohio State University, USA.
- Mburu, D.N.P 2013 Effects of the Type of School Attended on Students Academic Performance in Kericho and Kipkelion Districts, Kenya. *International Journal of Humanities and Social Science* 3 (4) 79 – 90
- Moore K.C, (2012). An investigation into pre-calculus students' conceptions of angle measure. In twelfth annual special interest group of mathematical association of America on research in undergraduate mathematics education (SIGMAA on RUME) Conference, Ralleigh, NC: North Carolina State University.
- Moore, K.C. (2012). Coherence, quantitative reasoning, and the trigonometry of students, in Mayes, R., Bonillia, R., Hatfield, L. L., and Belbase, S. (eds.), *Quantitative reasoning and Mathematical modelling: A driver for STEM Integrated Education and Teaching in Context. WISDOM Monographs*, volume 2, University of Wyoming Press, Laramie, WY.
- Moore, K.C. (2013). Making sense by measuring arcs: A teaching experiment in angle measure. *Educational Studies in Mathematics*, 83(2), 225-245.
- Philius, O.Y., & Wanjobi, W.C (2011). Performance Determinants of Kenya Certificate of Secondary Education (KCSE) in Mathematics of Secondary in Nyamaiya Division, Kenya. *Asian Social Science*, 7(2) 107-112.