

## Inductive Approach of Students' Mathematics Value Scale Development

Flourish Isaac-Oloniyo<sup>1</sup>, Promise N. Okpala<sup>1</sup>, Joshua Oluwatoyin Adeleke<sup>1</sup>

<sup>1</sup>International Centre for Educational Evaluation (ICEE), Institute of Education, University of Ibadan, Nigeria.

---

### Abstract

**Background:** There are numerous skills which have been ascribed to the learning of Mathematics. Such skills becomes Mathematics values when developed in the students while learning Mathematics. These may let the students that have acquired them valuable to the society and the world at large. But, some students are not performing up to expectation in their examinations, which may be because of their views or orientation towards Mathematics. Much studies have not been done in the area of the students' Mathematics value or orientation. Qualitative research is useful when trying to understand how individuals interpret information or think about a particular subject. It focuses on generating detailed information. Its research data cannot be directly linked to a numerical value but, may help to explore and discover indicators that will enable the latent (unobservable) variables to be studied. Such approach complements quantitative research type when developing an instrument which may measure students' rate of skills students are really deriving from learning Mathematics. Such useful skills are the ones that may make them valuable in future or improve their efficiency in Mathematics.

**Method and Materials:** Inductive approach or qualitative research type was used through interview techniques. Recorder was used as allied-instrument during the interviews which were guided by six open-ended items.

**Results:** Inductive approach or qualitative research type was used to explore and obtain indicators which were used to complement the development of the Students' Mathematics Value Scale (SMaV scale).

**Conclusion:** Qualitative approach was used to obtain the proposed indicators, which were used to complement the development of SMaV scale.

**Key word:** Inductive Approach, Qualitative research, Interview, Mathematics Value, Scale Development.

---

Date of Submission: 26-05-2020

Date of Acceptance: 13-06-2020

---

### I. Introduction

Mathematics as a fundamental element of numerous fields of life is a valuable means of daily transactions in various forms of human endeavors. Mathematics is used in numerous ways like buying and selling, in planning and execution of the planning, in formal and informal teaching and learning processes, in communication and for orderliness. There is an innate tendency of Mathematics in everyone and everything in existence. Mathematics and people are co-dependent to aid each other's growth (Sravan, 2017). Mathematics teaches students the techniques on distance, quantity, weight, estimating, approximately that will eventually be needed one day or even every day (Teachnology, 2019). Although Mathematics is challenging, it is a fun and rewarding, (Johnson, 2019) because numerous values are embedded in mathematics.

Although, value means to regard highly and make worth of seeking or achieving, there are different definitions of value by the educationists. Sociologically, values means something directly attached or ascribed to the preferred or desirable objects; whereas philosophically, values are standards or ideals with which actions, people, things or situation can be evaluated. Values may be seen as absolutes which are inherent in objects and present within man (Thome 2015). There are different values like economic vales, social values, philosophical values and mathematics values.

These are the derivatives of learning Mathematics. These are the skills that have been attached or ascribed to the study of Mathematics within the context of the general values of Education in Nigeria (NPE, 2013). Such Mathematics value maybe derived when the students learn the Mathematics skills like thinking, reasoning, intelligence, problem solving and time management. The skills are inherent and present in the students. These may be developed and make the students valuable when they learn Mathematics. Values can be expressed through individual person's behaviors.

By experience, students Mathematics value orientation have been expressed by their behaviors; through attendance in Mathematics lessons and mode of responses to class works and assignments. Some students' expression in sure ways are low, while some students as well have high expressions. The students' mathematics values are in two forms: Potential skills in the students which when developed by learning Mathematics can result into how valuable such students may be in future and Orientation of the students on what learning

mathematics can make them become in future or students' belief about who they can become in future by learning mathematics.

Since the mathematics values and mathematics value orientation are inherent and present in the students, the only means of expressing them by the students' are by their behaviors. Such behaviours are measurable. So, the measurement of the degree or extent of the constructs in the students is also possible by measuring the students' behaviours. Measuring the students' behaviours may reflect the students' mathematics values. The two constructs may be measured using a properly developed scale.

The scale development processes require the two distinct approaches which are inductive and deductive. They are the best practices of scale development with regards to self-reporting scales. The inductive approach that is of the qualitative research has been utilized to complement the drafting of SMaV scale development. The scale development processes require the two distinct approaches which are inductive and deductive. They are the best practices of scale development with regards to self-reporting scales (Tay and Jebb, 2017).

The inductive approach that is of the qualitative research has been utilized to complement the drafting of SMaV scale development through the components gathered. Qualitative research was used in this work to seek for the stakeholders' It is a type of research that is useful when trying to understand how individuals interpret information or think about a particular subject (Kellinger & Lee, 2000). It is concerned with the opinions, experiences and feelings of individuals producing subjective data.

Qualitative sampling techniques are concerned with seeking information from specific groups and subgroups in the population (Falaye, 2018). Phenomenological design is normally used in qualitative researcher. Such design allows the researcher to start a research process with an unstructured interview which may end up with a structured interview schedule (Sambo, 2011). Interview is a technique of collecting data in qualitative research. It is a face-to-face interpersonal role situation through a large amounts of information may be extracted from people. Data collected may help to explore and discover indicators that will enable latent (unobservable) variables to be studied (Kellinger & Lee, 2000).

Having a large enough sample size to uncover a variety of opinions, but to limit the sample size at the point of saturation should be the goal for every qualitative study. Therefore, an arbitrary number must not be blindly accepted when carrying out a qualitative research. Rather, some conditions are very important to be considered for the sample size determination. These are quality over quantity, an appropriate study design selection, the Principle of Saturation. In some cases, it is generally recommended for in-depth interviews to have a sample size of 20-30, when building similar segments within the population; while a minimum of 10 is acceptable – assuming the population integrity in recruiting (Shetty, 2018).

The factors responsible for students' disparity in behavior towards Mathematics may be numerous. Some of these are teacher traits, student anxiety level, school geographical location, school type, gender, age and parents' or guardians' educational qualification. Such factors are also responsible for the students' unsatisfactory performance in Mathematics in Nigeria as revealed by the chief examiners' report of 2018. In 2016 (52.97%), in 2017 (59.22%), but in 2018 (49.98%). This shows that there is still need for improvement in the students' performance. Students' Mathematics value and value orientation have not been studied to know whether these may be means for students' improvement in Mathematics.

Although there have been tools to measure features of Mathematics teaching and learning, but there is yet to be an instrument by which the extent or degree of students' Mathematics value may be measured. So, this study utilized inductive approach for the preparedness of Students' Mathematics Value Scale (SMaV Scale) development. The study specifically, discovered some means of learning Mathematics; explored the derivatives of learning Mathematics and detected the views or orientation of Mathematics Stakeholders towards Mathematics.

## **II. Material and Methods**

This inductive approach (or qualitative research) study was carried on some Mathematics Stakeholders of Nigeria from February to August, 2019. A total of 15 respondents (both male and females) were used for this study.

**Study Design:** The study adopted phenomenology design of the survey type of research through interview techniques. An interview guide containing a six open-ended items was used for the exploratory study for the development of the SMaV Scale.

**Study Location:** The South West geo-political zone from the existing six geo-political zones in Nigeria was selected for study.

**Study Duration:** January 2019 to April 2019.

**Sample size:** Fifteen respondents.

**Sample size calculation:** 30 respondents were approached to take part in the interview study. Only 20 agreed and 18 were interviewed before data saturation, but only 15 (eight male and seven female) were available for analysis.

**Subjects & Selection Method:** The study population consisted all Mathematics Lecturers, teachers and students in Nigeria. A multi-stage sampling technique at two stages was used: at the first stage, one geo-political zone was randomly selected from already existing six geo-political zones in the country. At the second stage, three states were selected purposively from the six states in the zone. One Federal University lecturer, One Federal University of Technology Lecturer, One State University lecturer, Two Public Secondary school teachers, Two Private secondary school teachers and eight students of four different secondary schools were selected using a purposive sampling technique. The data collected from a total of 15 out of the total respondents interviewed were analyzed.

### **Procedure Methodology**

The written consent was obtained. Thereafter, three research questions were raised to guide the study. They are: (1) What are the means of learning Mathematics? (2) What views and orientation do Mathematics Stakeholders have towards Mathematics? (3) What Mathematics values can be derived from learning Mathematics? Through the research questions, a well-designed Mathematics Stakeholders' Interview Guide (MSIG) containing six open ended items was prepared to guide the study. Items one and two were used under the research question one. Items three and four were used under the research question two. For the research question three, items five and six were used.

The items are on MSIG are: (1) what are your means of learning Mathematics? (2) Why do you learn Mathematics through the means? (3) what are your views about Mathematics? (4) What are your orientation towards Mathematics? (5) what benefits can people derive from Mathematics? (6) why do you learn Mathematics? The items were used for the interview techniques adopted for data collection in this study. The researchers with the aid of research assistance conducted interview for the respondents one-on-one and in face-to-face method of interview. A recorder was used as an allied-interview instruments.

### **Statistical Analysis**

The software package of Atlas.ti 8 was used to analysed the collected data through the interview technique.

## **III. Results**

Figure 1 answered the research question one. The research question is: What are the means of learning Mathematics? The result of the analysis of the data collected through interviewing of the Mathematics Stakeholders revealed the indicators of the respondents' means of learning Mathematics. These are through conducive environment, availability of books, interesting methodology, focus, motivation, passion, teachers' factor, hard-work, preparation and proper consultation.

Respondents' Means of Learning Mathematics

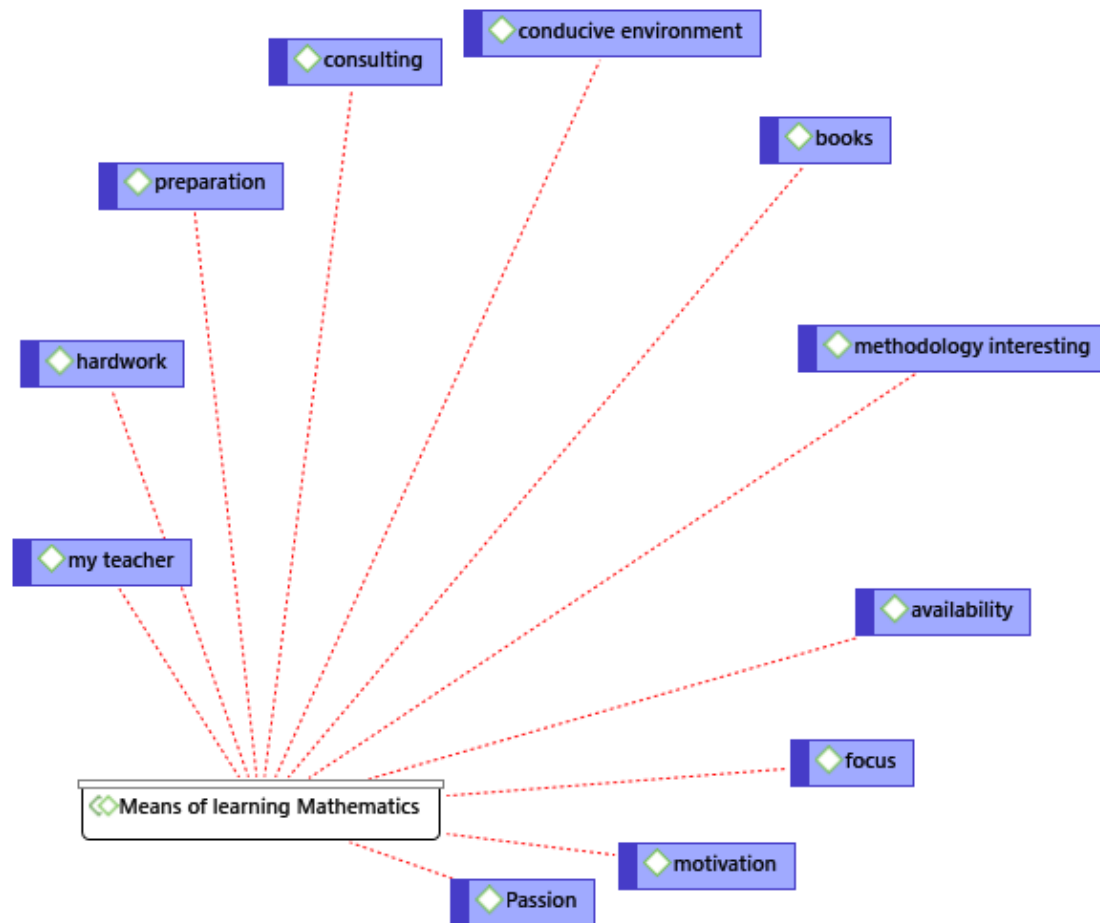


Figure 1: Respondents' Means of Learning Mathematics

Figure 2 answered the research question two. The research question is: What views and orientation do Mathematics Stakeholders have towards Mathematics? The result of the analysis of the data collected revealed indicators of the respondents' views and orientation about Mathematics. The indicators are that Mathematics is a general subject, it involves thinking, it is simple, is accumulative, it also involve calculation, it is important, it is difficult and daily applied.

Respondents' Views or Orientation about Mathematics

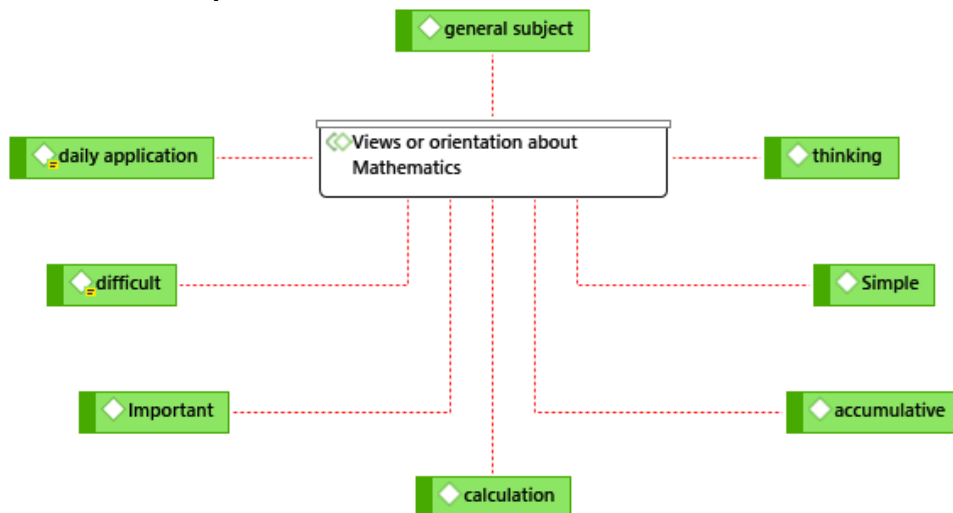
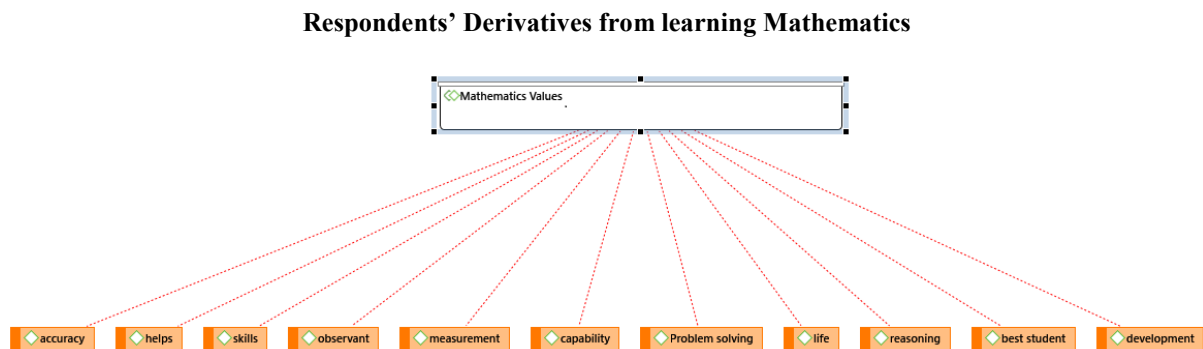


Figure 2: Respondents' Views or Orientation about Mathematics

Figure 3 answered the research question three. The research question is: What Mathematics values can be derived from learning Mathematics? The result of the analysis of the data collected revealed the indicators of the respondents' derivatives from learning Mathematics. These are accuracy, helps, skills, observant, measurement, capability, problem solving, life, reasoning, becoming a best student, development.



**Figure 3: Respondents' Derivatives from Learning Mathematics**

#### IV. Discussion

The results of the interview technique were used to answer the three research questions for the study. In figure 1, it can be seen that there are ten components of the means of learning Mathematics by the stakeholders. The ten components are focus, being proactive, love striving, desire, passion, teachers, motivation, always applying, practice or rehearsal. In figure 2, the components of the Mathematics stakeholders' views and orientation towards Mathematics are nine. The nine components are that Mathematics is interesting, encountered daily, requires hard-work, involves reasoning and calculation, it is a general subject, fearful, or challenging and difficult in nature.

But, in figure 3, the Mathematics Stakeholders' derivatives from learning Mathematics are of eleven components. The components are capability, life, measurement, observant, being the best, development, help, accuracy, skills like reasoning and problem solving. Through the research question one, the means of learning Mathematics varies from one individual to the other. This is as it was revealed in the result of the study with the Mathematics stakeholders (these are the Mathematics lecturers, Mathematics teachers and Mathematics students). It was revealed that passion, focus and desire are the means of the lecturers understanding of the subject to the extent of making it a means of their livelihood.

Whereas, only few of the students with all the lecturers and the teachers declared that they learn Mathematics by practicing and rehearsing whatever they have learnt. But, most of the students declared that, teacher factors are their own channel of motivation through they learn Mathematics. These are through the methods their teachers utilized for teaching them. Through such methods, there are being motivated and encouraged to develop interest in learning Mathematics.

It is important for the Mathematics teachers to take cognizance of such means of learning. So that, learning will be more convenient for the students and this will definitely improve the students' performance in Mathematics. SMAV Scale may be a tool for such the teachers to appreciate their teaching impartation level. This may let the teachers be able to improve where and when necessary.

The results of the research question two (shown in Figure two), the views of some Mathematics stakeholders are that since Mathematics is involved in everyday life transactions, it cannot be avoided. It is a general subject in which students may develop some skills that will be useful for them in their future endeavors. It was viewed that Mathematics is difficult and challenging but, it is a very interesting subject that is full of fun. Most importantly, Mathematics makes calculation to be easily done. It also causes some people's versatility in their areas of disciplines. Even for scientific and technological development, it is a fundamental discipline. But, some of the students viewed it as a subject to be dreaded of because of its appearance and nature to them. So, if there can be a means of making the students understand the values, it may change their orientation for a glaring improvement in their Mathematics performance.

The results of the research question three (shown in Figure three) revealed that by learning Mathematics, there are many derivatives to be acquired. Such derivatives like cognitive domain improvement, reasoning accurately, measuring, being able to cope with daily activities, being creative and skillful. These are that learning Mathematics helps to develop the capability to become best students that can do measure accurately, reason appropriately, be observant of trending needs in the society, and possess problem solving skills with many other skills. The results of the analysis of the Mathematics stakeholders' responses showed

that, there are many values which Mathematics can add to its learners. It will also make the students become valuable in any society they may be found.

In as much as students can derive many values in Mathematics, there should be a means of accurate information for the students. They should also be constantly informed about their specific feedback and the rate by which they are really developing Mathematics skills. So that, they will be able to improve their efficiency.

### **V. Conclusion**

For the students to improve their efficiency, it is needful to find a means of measuring the rate by which they are really deriving from learning Mathematics the useful skills which would make them valuable in the future. So, for the development of such needed tool, the qualitative approach of scale development has been used to explore some indicators that are needed for the development of SMaV Scale. For appropriate scale development, the qualitative approach is important for the extraction of necessary information from the people concerned.

### **References**

- [1]. Falaye, 2018. Qualitative Research and Evaluation Basic Issues and Methods. 2<sup>nd</sup> Edition. Ibadan University Press. Pgs 4-33.
- [2]. Johnson, J. 2019. Where Can Mathematical Economics Take Me? <https://www.mathnasium>
- [3]. Kellinger and Lee. 2000. Foundation of Behavioural Research, Earl McPeck, 4<sup>th</sup> Edition, 1992, USA. pp 692-703.
- [4]. NPE, 2013. Federal Republic of Nigeria National Policy on Education. 6<sup>th</sup> Edition. NERDC Press, Yaba, Lagos.
- [5]. Shetty, S. 2018. Determining Sample Size For Qualitative Research: What Is The Magical Number? <https://bmcmedresmethodol.biomedcentral.com/articles/10.1186/s12874-018-0594-7>
- [6]. Sravan, P. 2017. The beauty of the concept of mathematics. <https://www.thehindu.com/Opinion/open-page/the-beauty-of-the-concept-of-mathematics/article10384973.ece>
- [7]. Tay, L. and Jebb, A. 2017. Scale Development. In S. Rogelberg (Ed), The SAGE Encyclopedia of Industrial and Organizational Psychology, 2nd edition. Thousand Oaks, CA: Sage. Retrieved from <https://www.researchgate.net>.
- [8]. Teachnology, 2019. Top 4 Basic Math Skills Students Should Learn. <https://www.teach-nology.com>

Flourish Isaac-Oloniyo. "Inductive Approach of Students' Mathematics Value Scale Development." *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 10(3), (2020): pp. 31-36.