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# Investigation of Mathematics Teachers Conceptualisation of the Spiritual, Moral, Social and Cultural Role of Mathematics

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**Abstract**
The study sought to investigate mathematics teachers' conceptualization of the spiritual, moral social and cultural (SMSC) role of mathematics in Ankpa Education Zone of Kogi State. It used a purposive sample of all the 82 mathematics teachers in the zone comprising of 64 male and 18 female. The instrument used for the study was SMSC Role of Mathematics Questionnaire (SMSCRMQ) constructed by the researchers on a 4-point Likert scale. SMSCRMQ was face-validated by two experienced mathematics teachers at Kogi State College of Education, Ankpa. The instrument was subjected to reliability test using the split-half method and Spearman Brown Prophecy formula and the internal consistency was found to be 0.86. Using two research assistants, the instrument was administered on the 82 mathematics teachers in the zone and 100% return was achieved. Data collected was analysed using the mean for the research questions and chi-square for the hypotheses tested at 5% level of significance. Among other findings are: (i) majority of the mathematics teachers do not have full grasp of the SMSC role of mathematics, (ii) the poor rating of the teachers in SMSC role of mathematics has nothing to do with their qualifications. Based on the findings, some recommendations were made to popularize the SMSC role of mathematics in schools, among which is that agencies responsible for teacher production should include the roles of mathematics, especially the SMSC roles in the curriculum.
**Keywords:** Mathematics, spiritual, moral, social cultural

## Introduction

Among the many challenges confronting the teaching and learning of mathematics and performance in it is the inability of the mathematics teacher to establish a link between the subject and reality. Mathematics is therefore seen by the learner as an abstract concoction which only the highly talented can venture into (Agashi, 1997). This, perhaps, explains the lukewarm, the laxity, the passivity and lack of interest in the learning of the subject.
Reality, as used in this context, is all about the world of man, what happens around us, the way we feel and perceive events around us and all our activities. The world of man is made up of the seen and the unseen, the tangibles and intangibles such as spiritual, moral, social and the cultural (SMSC). The cultural aspect of reality gives identity to humanity and gives expression in our languages, clothing, dancing, festivities etc. Spirituality, according to Cook, Powell and Sims (2009), is concerned with finding meaning and purpose in the things we value, bringing hope in times of suffering and loss, encouragement to seek the best relationship with ourselves, others and what lies beyond. Spirituality therefore, can be seen as the awe with which man looks at his world and his reaction geared towards meaningful and purposeful existence here on earth and hereafter.

Morality has to do with the sense of judgment between goodness and otherwise of man's behavior and conduct in his interaction with fellow humans in all spheres–social, economical, political, cultural etc. The social aspect of reality is connected with the notion that man cannot exist in isolation; that is, there is the need to be continuously and genuinely engaged in the dynamics of interpersonal and group interactions for the evolution of a society that is beneficial to all.

Education which is devoid of the SMSC values is greatly lacking. In particular, mathematics which is an every day tool for living should lay emphasis on these values. The recognition of these values in mathematics education serves as an impetus to its teaching and learning. Closing the gap between mathematics and reality requires a conscious effort to incorporate the SMSC values in instruction.

On the cultural aspect of reality, one such effort was made by the Brazilian educator and mathematician, Ubiratan D'Ambrosio, who stunned the world in 1977 with a new lexicon in mathematics education, called ethnomathematics. Defining this new term has engaged the efforts of many scholars. Ascher (1991) defines it as the study and presentation of mathematical ideas of traditional peoples. D'Ambrosio (1979) himself looks at it as the relationship between mathematics and culture. The implication of these definitions is that mathematics and culture are interwoven. Ethnomathematics, therefore, seeks to explore and exploit the mathematics in the culture of peoples and how this exploration and exploitation can help to enhance the teaching and learning of mathematics. Also, Dede (2006) recognizes epistemological, social, cultural and personal values in mathematics and suggestes the inculcation of these values in instruction for a better society.

The inculcation of the SMSC values in instruction depends on the conceptualization of these values by the mathematics teachers. Since no one can give what he does not have, there is the need to investigate into the level of conceptualization of the SMSC role of mathematics by mathematics teachers. This is the problem of the study.

**Purpose of the study**

The purpose of the study is to find out the level of conceptualization of the SMSC role of mathematics by secondary school mathematics teachers. Specifically, the study intends to find out:

i. The mean response of secondary school mathematics teachers on their conceptualization of the spiritual role of mathematics.
ii. The mean response of secondary school mathematics teachers on their conceptualization of the moral role of mathematics
iii. The mean response of secondary school mathematics teachers on their conceptualization of the social role of mathematics.
iv. The mean response of secondary school mathematics teachers on their conceptualization of the cultural role of mathematics.

**Research Questions:**

The study is guided by the following research questions:

i. What is the mean response of secondary school mathematics teachers on their conceptualization of the spiritual role of mathematics?
ii. What is the mean response of secondary school mathematics teacher on their conceptualization of the moral role of mathematics?
iii. What is the mean response of secondary school mathematics teachers on their conceptualization of the social role of mathematics?
iv. What is the mean response of secondary school mathematics teachers on their conceptualization of the cultural role of mathematics?

**Hypotheses**

The study is also guided by the following hypotheses tested at 5% level of significance.

i. The response of secondary school mathematics teachers on the SMSC role of mathematics is independent of their qualifications.
ii. The response of secondary school mathematics teachers on the SMSC role of mathematics is independent of gender

**Method**

**Population/Sample**

The population of the study was all the 82 mathematics teachers in Ankpa Education Zone of Kogi State comprising Ankpa, Omalla and Olamaboro Council Areas. This population was used as the purposive sample for the study since it was possible to reach all of them through the research assistants. Out of this, 18 were female and 64 male. Forty one (41) were NCE, thirty (30) B.Ed, seven (7) B.Sc and four (4) M.Ed/M.Sc.

**Instrument**

The instrument used for the study is SMSC Role of Mathematics Questionnaire (SMSCRMQ) which was constructed by the researchers on a 4-point Liker Scale. SMSCRMQ has four sections A – D representing the Spiritual, Moral, Social and Cultural respectively. Each section has a list of items. The teachers are required to respond on how they feel about the items by ticking (/) under SA (Strongly Agree) or A (Agree) or D (Disagree) or SD (Strongly Disagree). The weights are 4, 3, 2 and 1 respectively.

**Validity of the instrument**

SMSCRMQ was validated by two experienced mathematics teachers at the Kogi State College of Education, Ankpa. After their inputs and suggestions, the final draft was produced for test of reliability.

**Reliability of the instrument**

SMSCRMQ was administered on twenty secondary school mathematics teachers in Idah Education Zone of Kogi State. The data collected was subjected to reliability test using the Split-half method and Spearman Brown Prophecy formula and the internal consistency coefficient was 0.86. This showed that the instrument was reliable for use.

**Method of data collection**

With the aid of two research assistants, one in Omala and the other in Olamaboro, SMSCRMQ was administered on the 82 mathematics teachers in the zone. The researchers took charge of Ankpa Council Area. A return of 100% of the instrument was achieved from where data was collected for analysis.

**Data Analysis**
Mean was used to answer all the research questions and Chi-square was used to test the hypotheses at 5% level of significance.

**Results**
The results of the analysis are presented below according to the research questions and hypotheses.
**Research Question 1:** What is the mean response of Secondary School mathematics teachers on their conceptualization of the spiritual role of mathematics?

**Table 1: Responses of secondary school mathematics teachers on the spiritual role of mathematics**

| S/N | Item | SA | A | D | SD | Total | $\bar{x}$ |
|---|---|---|---|---|---|---|---|
| 1 | There is mathematics in different patterns of creation | | 20 | 50 | 12 | 172 | 2.1 |
| 2 | There is wonder in the arrangement of numbers such as in sequences | | 20 | 37 | 25 | 159 | 1.9 |
| 3 | There is connection between nature and the mathematical idea of infinity | | 14 | 42 | 26 | 152 | 1.9 |
| 4 | There is mathematics in the recitation of religious chaplets | 12 | 10 | 38 | 22 | 176 | 2.1 |
| 5 | There is connection between nature and the exactness of mathematics | | 5 | 60 | 17 | 152 | 1.9 |
| 6 | There is connection between sense of personal achievement and success in problem solving in mathematics | | 9 | 49 | 24 | 149 | 1.8 |
| | **Cluster mean.** | | | | | | **1.9** |

Table 1 shows that for all the items under the spiritual role of mathematics, teachers' mean response is less than the bench mark of 2.5. The cluster mean is equally less than 2.5.
**Research Question 2:** What is the mean response of secondary school mathematics teachers on the moral role of mathematics?

**Table 2: Responses of secondary school mathematics teachers on the moral role of mathematics**

| S/N | Item | SA | A | D | SD | Total | $\bar{x}$ |
|---|---|---|---|---|---|---|---|
| 1 | There is morality in providing solution to mathematics problem | 20 | 20 | 30 | 12 | 212 | 2.6 |
| 2 | There is moral connection in data collection and its use | | 12 | 50 | 20 | 156 | 1.9 |
| 3 | There is morality in profit making in business | 30 | 25 | 15 | 12 | 237 | 2.9 |
| 4 | There is moral connection in the way we react to students problem solving ability in mathematics | | 10 | 60 | 12 | 162 | 1.9 |
| 5 | There is moral connection in the way we respond to questionnaire such as this. | 12 | 30 | 27 | 13 | 205 | 2.5 |
| | **Cluster mean.** | | | | | | **2.4** |

Table 2 shows that out of the five items listed under the moral values of mathematics, teachers mean response in three of them is greater or equal to the bench mark of 2.5 while the cluster mean is 2.4.
**Research Question 3:** What is the mean response of secondary school mathematics teachers on the social role of mathematics?

**Table 3: Responses of secondary school mathematics teachers on the social role of mathematics**

| S/N | Item | SA | A | D | SD | Total | $\bar{x}$ |
|---|---|---|---|---|---|---|---|
| 1 | Mathematics is better learned when pupils/students work together. | 40 | 25 | 10 | 7 | 262 | 3.2 |
| 2 | There is mathematics in games. | 20 | 25 | 25 | 12 | 217 | 2.6 |
| 3 | There is mathematics in driving. | 10 | 10 | 45 | 17 | 177 | 2.2 |
| 4 | There is mathematics in dancing. | 9 | 8 | 50 | 15 | 175 | 2.1 |
| 5 | Statistics provide government the opportunity to plan for the provision of social services. | 45 | 20 | 10 | 5 | 265 | 3.2 |
| 6 | There is relationship between statistical data and control of crime. | 10 | 10 | 41 | 21 | 173 | 2.1 |
| 7 | There is relationship between statistical data and management of unemployment. | 10 | 9 | 40 | 23 | 170 | 2.1 |
| 8 | There is relationship between statistical data and control of birth rate. | 9 | 15 | 40 | 18 | 166 | 2.0 |
| 9 | There is relationship between statistical data and avoidance of road accident. | 8 | 10 | 40 | 24 | 166 | 2.0 |
| 10 | There is relationship between statistical data and government decision. | 11 | 14 | 30 | 27 | 173 | 2.1 |
| | **Cluster mean.** | | | | | | **2.4** |

Table 3 shows that teachers mean response to the items on social role of mathematics is not up to 2.5 for seven out of the ten items. The cluster mean is 2.4.
**Research Question 4:** What is the mean response of secondary school mathematics teachers on the cultural role of mathematics?

 

**Table 4**: **Responses of secondary school mathematics teachers on the cultural role of mathematics**

| S/N | Item | SA | A | D | SD | Total | $\overline{x}$ |
|---|---|---|---|---|---|---|---|
| 1 | There is mathematics in games. | 40 | 25 | 25 | 12 | 217 | 2.6 |
| 2 | There is mathematics in dancing. | 9 | 8 | 50 | 15 | 175 | 2.1 |
| 3 | The number systems we use today evolved from different cultures. | 15 | 10 | 37 | 20 | 184 | 2.2 |
| 4 | There is mathematics in art, e.g woven designs and carpet. | 10 | 9 | 33 | 30 | 163 | 1.9 |
| 5 | The measuring systems we use today evolved from different cultures. | 30 | 20 | 15 | 17 | 227 | 2.8 |
| 6 | The mathematical language is a universal culture. | 25 | 27 | 15 | 15 | 226 | 2.8 |
| 7 | Mathematics and history are interwoven. | 10 | 10 | 35 | 27 | 167 | 2.0 |
| | **Cluster mean.** | | | | | | **2.3** |

Table 4 shows that the cluster mean response of the teachers on the cultural role of mathematics is 2.3 which is less than the bench mark of 2.5. The mean response in three of the items is higher than the bench mark of 2.5.

**Table 5: $X^2$ analysis of teachers conceptualization of SMSC role of mathematics based on Qualification**

| | N | df | A | $X^2_{cal}$ | $X^2_{crit}$ | Remark |
|---|---|---|---|---|---|---|
| NCE | 41 | | | | | * |
| B.Ed | 30 | | | | 16.9 | NS |
| B.Sc. | 7 | 9 | 0.05 | 13.52 | | |
| M.Ed/M.Sc. | 4 | | | | | |

* NS= not significant

From table 5, since $X^2_{cal}$ is less than $X^2_{crit}$, we accept $H_0$, that is, teachers' conceptualization of the SMSC role of mathematics is independent of qualification.

**Table 6: $X^2$ analysis of teachers conceptualisation of SMSC role of mathematics based on gender**

| | N | α | $X^2_{cal}$ | $X^2_{crit}$ | Remark |
|---|---|---|---|---|---|
| Male | 64 | | | | * |
| Female | 18 | 0.05 | 0.65 | 7.82 | NS |

NS = not significant

From table 6, since $X^2_{cal}$ is less than $X^2_{crit}$, we accept $H_0$, that is, teachers' conceptualization of the SMSC role of mathematics is independent of gender.

**Discussion**

For all the items under the spiritual role of mathematics, the mean response of the mathematics teachers is less than 2.5 with cluster mean of 1.9. This is indicative of the low level of conceptualization of the spiritual role of mathematics by the teachers. With this low level of conceptualization, it can hardly be expected that the mathematics teachers can draw illustrations from our spiritual environment during instruction as a way of creating a real image of mathematics.

Teachers mean response to three out of the five items under the moral values of mathematics measured up to the benchmark of 2.5. Even though the cluster mean is slightly below 2.5, it can be observed that the level of the teachers' conceptualization of the moral values of mathematics is encouraging compared to the result on the spiritual values. This finding may not be surprising since mathematics as a discipline deals with truth and truth is the chief anchor of morality. That the response of mathematics teachers on the moral value of mathematics is encouraging is a positive signal that the teachers can draw illustrations from our moral environment during mathematics instruction as a way of bridging the gap between mathematics and reality.

Table 3 shows that mathematics teachers are very much aware of the importance of group work in mathematics learning. Their mean response on the value of mathematics in the provision of social services is encouraging. However, the teachers seem to be lacking in the awareness of mathematics in many other social issues of life such as control of crime, birth rate, unemployment etc.

Table 4 shows that the cluster mean response of the teachers on the cultural role of mathematics is 2.3 which is less than 2.5. The teachers are reasonably aware of the place of mathematics in games, measuring systems and mathematics language as universal culture. However, there are other aspects of the cultural environment where the mathematics teachers failed to indicate reasonable awareness of the involvement of mathematics. Such areas are woven designs and carpets, history, evolution of mathematics from culture etc. It is the realization of this disconnect between mathematics and culture that led Ubiratan Ambrosio to come up with a body of knowledge called Ethnomathematics.

**Conclusion**

The truism in "No one can give what he does not have" served as a major driving force in the birth of this paper which is an attempt to rate practicing mathematics teachers on their know-how of the values of mathematics. The findings have rated the teachers low. Since the teachers themselves have problem in connecting mathematics with the world around us, there is therefore little wonder why the learner finds it difficult to connect mathematics

to everyday living. It is hoped that with appropriate measures to address this short coming, instruction in mathematics will be laced with the everyday realities of man. In turn, this will attract the interest and enthusiasm of learners which can by extension, enhance achievement in mathematics.

**Recommendations**

In view of the findings of this study, the following recommendations are put forward:

1. Agencies responsible for the curriculum of teacher production such as National Commission for Colleges of Education (NCCE), Faculties of Education of Universities etc should include in the curriculum a course on values of mathematics with emphasis on SMSC. This will expose the pre-service teachers to the reality of mathematics.
2. Workshop on SMSC Role of Mathematics should be organized by State Universal Basic Education Board (SUBEB) for the in-service teachers to drive home the message of the reality of mathematics.
3. With (1) and (2) addressed, the mathematics teachers should, at each necessary stage of his lesson, strive to link up the topic with the world around us.

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