SER, VOLUME 11, NUMBER 2, JULY 2009

PROBLEMS OF TEACHING SCIENCE, TECHNOLOGY AND MATHEMATICS (STM): (A STUDY OF RURAL SECONDARY SCHOOLS IN SOKOTO STATE)

DANTANI IBRAHIM (Ph.D.)
School of Science Education
Federal University of Technology, Minna.
E–mail: Dee–wushishi@yahoo.com

SHEHU UMAR
Department of Adult Education & Extension Services
Usmanu Danfodiyo University Sokoto
E – mail: nayabido@yahoo.co.uk.

ABSTRACT

This study investigated the problems of teaching science, Technology and Mathematics (STM) in rural secondary schools, of Sokoto State. A survey design was adopted using two instruments called Problems of Teaching STM in Rural Secondary Schools Questionnaires for students and teachers (PROT-STM-RUSSQ). The instruments were validated and have the reliability coefficients of 0.81 and 0.85 respectively. A stratified random sampling method was used to select 20 rural secondary schools out of 79 schools available in the three educational zones of the state. 200 students and 15 teachers were selected as samples. The students were randomly selected while all the science teachers available in each of the schools were administered the PROT-STM-RUSSQ by convenient sampling method. Simple percentages and frequency count were used for data analysis. Some of the major findings include:

1. *Teachers do not teach STM in the spirit of the concept.*
2. *The STM curriculum lacks elements of indigenous knowledge and there is limited enrolment of students in the STM subjects.*
3. *Absence of modern information technology (IT) based instructional media such as computer and the internet.*
4. *Lack of innovation and skills for improvisation of science materials.*
5. *Complete absence of science library and school library facilities that are adequately stock with current science based materials.*

It was concluded that STM teaching in rural secondary schools in Sokoto State have prospects in so far as the government adequately recruit qualified science teachers for the schools; provide good laboratories and laboratory equipment and facilities in line with modern IT thinking. It was

recommended that the STM curriculum should be incorporated with elements of indigenous knowledge because it will seek to enrich tradition or modern Science, Technology and Mathematics Education by making it recognize the logic of indigenous knowledge and also the values of the community where the knowledge is to be used (Ardo 2004).

Background to the study

Science, Technology and Mathematics (STM) is seen here in the context of science-; technology and society' (STS). STS explain the ways and manner the product of science and technology (S and T) influences human behaviour. It shows the inter-relatedness and interactions of S and T in the context of society (Ardo, 2004). Therefore, the society need to understand its basic meaning and application and its importance and relevance in their daily activities for the purpose of valuation 'and use. Therefore, the need for the society to be S and T literate.

Science is the process of searching for new facts and principles and requires the use of some skills called science process skills. These skills are also required in the application of this scientific knowledge for the service of man or the use of inventions and discoveries in order to satisfy human needs and desires called Technology. Mathematics on the other hand, is an essential tool in almost all scientific and Technological studies (Nwala, 1997). For a society to advance, by implication, required the triangulation of STM contents in its teaching and learning processes, in the same manner the STS is enmeshed. This is the spirit of STM- The teaching of Technology and Mathematics in Science, Science and mathematics in technology and mathematics in science and technology. This concept is aimed at producing individuals who are proficient in the knowledge-getting processes. Who will not memorise STM facts but to participate actively in the processes that leads to the creation of new knowledge (Gagne, and Bruner, 1965). This becomes important vehicle for the mastery of content knowledge of STM. STM teaching focuses on making students learn through the workings of hands, brain and the heart (Alebiosu, 2004). West et al (1991) suggested that strong relationship exist among hands, brains and hearts in a highly co -ordinated fashion to do useful tasks in a STM classroom.

So, STM is set to promote students long term memory, enhance the development of ethical dimension of STM, instills in the students the spirit of collaboration and active participation among learners, to expose the learners to STM experiences that is capable of assisting them to develop STM attitude and skills and also inculcates in the students the spirit of STM inquiry and mode of thinking (Gangoli, 1995).

There are several ways through which STM is being taught in our secondary schools. These include: Lecture method, demonstration, guided and unguided inquiry;- project, concept mapping, field trips and heuristic methods (Abdullahi, 1982). These processes of delivering STM contents have been bedevilled by a lot of problems. Some of which have been researched upon by experts. These areas include: Nature of STM teachers and their interest, availability of materials for teaching STM, contents of textbooks and their relevance/adequacy and cost, teachers supervision, time available for STM subjects and population of students per class (Shehu, 2005). There is also the problem of the use of language in STM teaching (Ato, 1991).

This study is intended to deviate a little from the continued search for the recurrence of these traditional problems. It became relevant to look at five areas as far as rural secondary schools are concerned, since, the bulk of Nigeria population is in the rural areas. These areas are; the teachers teaching in the spirit of the STM, the incorporation of indigenous knowledge (IK) and enrolment of students in the STM curriculum and subjects respectively, information technology based instructional materials, and innovation and skills for improvisation of STM instructional materials.

In the first instance of the problems, indigenous knowledge can be understood from the context of Leeflang (1993) statement when referring to veterinary services planning. He says,

> "All indigenous knowledge and practices regarding cattle and other ruminants in Northern Nigeria can therefore be found among the Fulani. They have specific knowledge of the epidemiology and gross pathology of the diseases and ailments that affect cattle, sheep and goats."

This IK should form part of the content of STM curriculum. And, the best way to teach this content in this millennium is via the IT system in the classrooms. Such as audio or cassette tapes, computers and the internet. This is because the providers of education are increasingly turning to the internet facilities to facilitate educational delivery which is causing educators to re-think the very nature of the process of teaching and learning in the formal school system. The learning tools and forms of interaction that exist in the traditional classrooms also exist in the internet classroom or virtual classroom. Instructional materials and communications are easily accessed at a time and place that is convenient to the learner (Keegan, 1996).

The question of improvisation on the process of teaching and learning arises when the needed conventional teaching and learning tools are not readily available. Improvisation as an act of making something from whatever is available without-advance planning (Hornby, 2000) requires an innovative mind.

Improvisation in STM teaching is important because it facilitate the process of instruction where there are no first hand teaching aids. Many STM teachers were not drilled in the act of improvisation and cannot teach their students how to improvise (Ayodele, 1999).

The provision of library and science library facilities, stock with current science textbooks, magazines, journals and other sundry materials are important in STM teaching and learning. This is particularly important for rural secondary schools. Pondering about the questions "What is the situation and problems of science teaching in rural secondary schools?" "Are children of the peasantry alienated from science learning?" motivated the search for problems of teaching STM in this area.

STATEMENT OF THE PROBLEM

This study intended to look at the problems of teaching Science, Technology and Mathematics (STM) in rural secondary schools. It focuses attention in the areas of teaching STM in the spirit of the concept; indigenous knowledge content in the curriculum and students enrolment in the STM subjects; availability of information technology based instructional media such as computers and the internet; innovation and skills for STM instructional materials improvisation; and availability of science and school library facilities with adequate current STM based materials.

This becomes necessary in order to have a good picture of the contributions of the rural secondary schools on the quality of the STM students produced for higher education. Consequently, how they contribute to STM human resource development.

RESEARCH QUESTIONS

1. Do STM teachers in rural secondary schools teach STM in the spirit of the concept?
2. Is indigenous knowledge incorporated in STM curriculum and does it encourage rural secondary school students enrolment in the STM subjects?
3. Are modern Information Technology based instructional media available in rural secondary schools?

4. Are STM teachers having the necessary innovative skills for improvisation of STM teaching materials in rural secondary schools?
5. Are there STM library and school library facilities with adequate current STM based learning materials in rural secondary schools?

METHODOLOGY

Research design

The design for this study was survey which involved seeking opinions and response from both teachers and students by selecting and studying the opinions of the samples chosen from a population.

Sample and Sampling Techniques

Two hundred (200) STM students and fifteen (15) STM teachers constitutes the sample for this study. The' students sample were chosen randomly for the administration of the instrument. Ten(10) students sample was chosen from each of the twenty (20) rural secondary schools selected for the study. The schools selected for the study were chosen by stratified proportionate random sampling technique from the seventy nine (79) secondary schools available in the three educational zones of Sokoto state. The teachers used as sample were chosen by convenient sampling method, as all teachers available in the schools were used. They are fifteen in number for the twenty (20) schools used for the study.

Instrumentation

Two instruments were developed for the purpose of the study. They are 1. Problems of teaching STM in rural secondary schools questionnaire for student (PROT-STM-RUSSQS). 2. Problems of teaching STM in rural secondary schools questionnaire for teachers. (PROT-STM-RUSSQT). The instruments were validated and have the reliability coefficients of 0.81 and 0.85 respectively.

These were determined after a pilot study had been conducted in four separate rural secondary schools using the split half method. The Spearman Brown prophecy formula was used to determine the coefficients.

FINDINGS

The data were analysed using simple frequency count and percentage methods in order to answer the research questions raised.

Research question one: Do STM teachers in rural secondary schools teach STM in the spirit of the concept?

Table 1: Frequency distribution and percentages of responses of teachers to items under research question one.

Items number	**Frequency of responses**			**Percentage Responses (%)**		
	Yes	No	Total	Yes	No	Total
a	0	15	0	100	100	100
b	0	15	0	100	100	100
c	0	15	0	100	100	100
d	15	15	100	0	0	100
e	1	15	6.70	93.30	93.30	100
Total	16	59	75	21.33	78.67	100

Table 1 above indicated that there are 59 negative and 16 positive responses representing 78.67% and 21.33% respectively. These indicated that the answer to research question one is that, STM teachers in rural secondary schools do not teach STM in the spirit of the concept.

Research Question Two: Is indigenous knowledge incorporated in STM curriculum and does it encourage rural secondary school students enrolment in the STM subjects?

Table 2: Frequency distribution and percentages of Responses of Students and Teachers to items under research question two.

Items number	**Frequency of responses**			**Percentage Responses (%)**		
	Yes	No	Total	Yes	No	Total
a	16	199	215	7.40	92.60	100
b	02	213	215	0.93	99.07	100
c	28	187	215	13.02	86.98	100
d	203	12	215	94.42	5.58	100
e	04	211	215	1.86	98.14	100
Total	253	822	1075	23.53	76.47	100

Table 2 above shows that there are a total of 1075 responses; 253 and 822 of these responses are positive and negative which represents 23.53% and 76.47% respectively. From this result, the answer to research question two is that, indigenous knowledge is not incorporated in the STM curriculum and it does not encourage rural secondary school students enrolment in the STM subjects.

Research Question Three: Are modern Information Technology based instructional media available in rural secondary schools?

Table 3: Frequency Distribution and Percentages of Responses of Students and Teachers to items under Research Question Three.

Table 3 above shows that there are five (05) positive and 1070 negative responses to items under research question three which represents 0.47% and 99. 53% respectively. This indicated that the answer to research question three, is that, there are no modia information technology (IT) based instructional media available in rural secondary schools.

Research Question Four: Are STM teachers having the necessary innovative skills for improvisation of STM teaching materials in rural secondary schools?

Table 4: Frequency Distribution and Percentages of Responses of Students and Teachers to items under Research Question Four.

Items number	**Frequency of responses**			**Percentage Responses (%)**		
	Yes	No	Total	Yes	No	Total
a	59	156	215	27.44	72.56	100
b	06	209	215	2.79	97.21	100
c	14	201	215	6.51	93.49	100
d	17	198	215	7.91	92.09	100
e	197	18	215	91.63	8.37	100
Total	293	782	1075	27.26	72.74	100

Table 4 above shows that there are 293 positive and 782 negative responses to the items under research question four which represents'27.26% and 72.74% respectively. The results indicated that the answer to question four is that, there is the lack of innovation and skills for improvisation of STM teaching and learning materials.

Research Question five: Are there STM library and school library facilities with adequate current STM based learning materials in rural secondary schools?

Table 5: Frequency Distribution and Percentages of Responses of Students and Teachers to items under Research Question Five.

Items number	**Frequency of responses**			**Percentage Responses (%)**		
	Yes	No	Total	Yes	No	Total
a	65	150	215	30.23	69.77	100
b	11	204	215	5.12	94.88	100
c	22	193	215	10.23	89.77	100

d	10	205	215	4.65	95.35	100
e	7	208	215	3.26	96.74	100
Total	115	960	1075	10.70	89.30	100

Table 5 above shows that there are 115 positive ad 960 negative responses to items under research question five which represents 10.70% and 89.30% respectively. This means that the answer to research question five is that, there is complete absence of STM library and school library facilities in virtually all the rural secondary schools of Sokoto State.

Summary of findings

The following submissions are the summary of the major findings.

1. Teachers do not teach STM in the spirit of the concept.
2. The STM curriculum lacks elements of indigenous knowledge and there is limited enrolment of students for the STM subjects.
3. There is the absence of modern information Technology (IT) based instructional media such as computer and the internet in rural secondary schools.
4. There is the lack of innovation and skills for improvisation of STM materials.
5. There is complete absence of STM library and school library facilities that are adequately stock with current STM based materials.

Discussion of results

The problems of STM teaching in rural secondary schools are sign-post to the general problems of formal school system in the rural areas. It need no emphasis to say that adequate attention is not given to schools located in the rural areas. This is noticeable in the absence of elements of indigenous or traditional knowledge in the STM curriculum. Despite government emphasis on the use and importance of IT particularly for E-Education, adequate attention and efforts are not been made to provide electricity to rural secondary schools talkless of being connected to the internet. The existence of computers are not known as much as possible, to rural students. The teachers and students do not possess any skill on the way to improvise STM teaching and learning materials. This is supported by the assertion of Ayodele (1999). There is also the absence of STM library and school library facilities that are stock with current STM materials.

All these problems put to question, the way the specific goal of providing technical knowledge and vocational skills necessary- for agricultural, industrial,

commercial and economic development of rural secondary school students could be achieved as spelt out in the National Policy on Education (NPE, 2004).

Recommendations

For the rural secondary schools to contribute to the development of proficient STM students for higher education, there is the need for:

1. The training of STM teachers to teach STM in the spirit of the concept through workshops, seminars and conferences.
2. The STM curriculum should be incorporated with elements of indigenous knowledge because it will seek to enrich traditional or modern science, Technology and Mathematics education by making it recognise the logic of indigenous knowledge and also the values of the community where the knowledge is to be used (Ardo, 2004).
3. Rural secondary schools should be provided with alternative source of power supply and IT facilities that can be used with this power for effective STM teaching / learning.
4. STM libraries and school libraries should be adequately provided in rural schools in order to increase the source of STM knowledge base. This will assist in increasing the interest and improving good students perception of STM subjects.

Conclusion

It is the conclusion of this study that STM teaching in rural secondary schools in Sokoto State have prospects in so far as the government work with the recommendations of this study and also adequately recruit qualified STM teachers for the schools. It should also make adequate provision for good teaching/learning materials, libraries, laboratories and laboratory equipment and facilities in line with the global trend.

References

Abdullahi, A. (1982): 'Science Teaching in Nigeria', Ilorin Atoto Press (Ltd) .\

Alebiosu, K.A. (2003): Readings in Science Education, Ibadan: Majestic Printers and Publishers.

Ardo, G. V. (2004): Indigenous Knowledge (IK) Science and Technology Education as partners in a democratic Polity: Resolving the African Dilemma. A paper presented at the 3rd annual conference of the Institute of Education, Lagos State University Epe Campus, 14th - 17th September.

Ato, T. (1991): Teaching Science, Technology and Mathematics in the Mother-tongue - Curricular Implications: The case o[Biology in Tiv Language. STAN 32nd annual conference proceedings.

Ayodele O. (1999): Science Education in Nigeria, Historical Development Curriculum Reforms and Research Lagos, Sunshine International Publishers (Nig) Ltd.

Gagne, R. M. and Brunner, J. (1965): The Psychological Basis of Science: A process approach (SAPA) Washington D.C. American Association for the Advancement of Science (AAAS), Miscellaneous Publication, pp. 65 - 68.

Gangoli, S. O. (1995): A study of the Effectiveness of the guided open ended approach to physics experiments. *International Journal of Science Education*, **17** (2): 233 - 241.

Hornby, A.S. (2000): Oxford Advanced Learner Dictionary, Oxford University Press.

Keegan, D. (1996): Foundations of Distance Education, London Routledge Taylor and Francis Group, London.

Leeflang, P. (1993): Some observations on ethnoveterinary, Medicine in Northern, Nigeria. Indigenous Knowledge and Development Monitor]-] page 1 - 4.

NPE (2004): National Policy on Education, Lagos, NERDC Press.

Shehu, U. (2005): A study of Relationship between students attitude to Integrated Science and Availability of teaching facilities among junior secondary schools in Sokoto State. An unpublished M.Ed. (Science Education) dissertation UDUSOK.

West, S. K.; Farmer, S. A. and Wolff, M. (1991): Instruction Design: Implication for Cognitive Science. London, Oxford University Press.