

Full Length Research Paper

Predominant teaching strategies in schools: Implications for curriculum implementation in mathematics, science and technology

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This descriptive survey is hinged on predominant teaching strategies in schools, implications for curriculum implementation in Mathematics, Science and Technology. Target population consisted of teachers in primary, secondary and tertiary schools. However, purposive sample of 900 respondents was drawn from the six BRACED states namely Bayelsa, Rivers, Akwa-Ibom, Cross-River, Edo, Delta states in the South-south region. Five research questions guided the study; and data collection was through a rating scale (PTSS) designed by the researcher. Analysis was through mean on item by item basis. The finding indicated that lecture method is still prevalent in schools at all levels, and that ignorance is a major setback to effective application of innovative strategies. The implication is that our MST classrooms are yet to encourage active, self-directed and higher cognitive skills highly needed for the increasing globalization, world of work and lifelong learning. Regular refresher programmes were therefore recommended for teachers at all levels to enlighten and motivate them to embrace innovative teaching strategies.

Key words: Teaching strategies/methods, curriculum implementation, classroom, Mathematics, Science and Technology (MST), innovative methods, traditional methods.

INTRODUCTION

The transformation towards the Information Society or Knowledge Economy may be described as more revolutionary, as it changes the fundamental processes of communication, cognition, memory, and identity construction that provide the foundation for social life and knowledge creation. At present, both tasks and division of labour between the different components of the educational system are changing. Learning itself and

where learning takes place can also be said to be changing from the physical to the virtual realm. It is becoming more learner-centred with a possible wider range of instructional opportunities for anytime, anywhere, any path and any pace. Learning is therefore demanding a commensurate change in pedagogy.

A comparison of the three eras of education is shown in Table 1. It can be discerned from the table that, although

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Table 1. The three eras of education.

ERA →	Pre-Industrial age (Apprenticeship)	Industrial Age (Schooling)	Information age (Lifelong learning)
Responsibility	Parents	State	Individual and Parents
Content	Practical Skills	Basic skills and disciplinary knowledge	Generic skills and learning to learn
Pedagogy	Apprenticeship	Didacticism	Interaction
Assessment	Observation	Testing	Embedded assessment
Location	Centred in the home	Centred in the school	Centred in multiple venues
Relationships	Personal bonds	Authority figures	Technology-mediated interaction

the three eras differ in many aspects, the lifelong learning era reflects a return to some of the core features of the earlier apprenticeship era in some ways.

Mathematics, science and technology now take centre stage in the learning arena, calling for the learner to be mathematics, science and technology literate, what is referred to in UNESCO (2010) as learning through MST, in contradiction to mathematics, science and technology through learning (Okeke, 2002).

Given that the world is profoundly shaped by science and technology, and so such issues as preserving the environment, reducing poverty and improving health: each of these challenges and many more create and continue to create changing social, and technological circumstances, hopes and expectations, and the learner must be prepared to respond and contribute to those developments (Botkins et al., 1980; Beck, 1994). There should not only be scientists capable of developing effective and feasible responses but also citizens who can engage in active debate on them. The rationale for the science and technological literacy is well elaborated in UNESCO (2010). According to the report, science education has a key role to play in helping reduce inequalities, and developing powerful ways of thinking, learning science increases the freedoms to choose from a wider range of careers in the world of work, careers that are more financially and personally enriching, and increasing globalization with its challenges, potentials and possibilities (Udousoro, 2002; Okebukula, 1990; Hmelo-Silver, 2000; Black and William, 1998).

It must be emphasized at this point that the actualization of these potentials requires the application of suitable pedagogies at all levels. The classroom, be it virtual or face-to-face, is the hub of curriculum implementation which is defined as the process of translating the curriculum document into operating curriculum in such a way that the pre-determined objectives are attained. Curriculum implementation is the actual execution of curriculum document in the classroom through effective teaching-learning process-interactions of teacher, learner(s) and other elements in the instructional system (Kpangban and Onwuegbu, 1992). The success or failure

of any curriculum depends much on what goes on in the classroom, the extent to which teaching-learning process is carried out according to plans as specified in the curriculum (Abimbade, 2006).

The process of teaching and learning is a very challenging one, particularly, as it concerns the teacher whose primary duty is to make learning take place. According to Kpangban and Onwuegbu (1992), the real teacher lets nothing else be learned than ... learning. The teacher achieves this by designing the learning environment in such a way that the learner is restless until he has satisfied his curiosity, and by acquiring and utilizing appropriate teaching approaches to getting the learners genuinely interested and participate in their own learning (Biggs, 1989; Biggs, 1999; Day and Williams, 2000).

Classification of teaching methods

Concerning pedagogy, research findings have revealed several forms classified under traditional and innovative methods, individual and group methods, or teacher-centered and learner-centered (Ajelabi, 2000). Traditional teaching methods are characterized by teacher-centeredness, content-laden, passivity of learners, rote-learning, shallow-learning, examination oriented. A typical example of this category is the lecture method also called telling or talk-chalk method. It is probably the oldest well known and widely used method, still commonly practiced at all levels. It is a traditional method of teaching, and teacher-dominated. Lecture method refers to the complete, organized, verbal presentation of a subject matter. Teachers find it very convenient to adopt this teaching method (Ajelabi, 2000). Lecture method covers a large amount of information in a short time and is used for any group size of learners. It is however, a one-way mode of communication, in which learners are passive, making it inappropriate for practical/skill oriented subjects and hearing impaired learners. On the other hand, innovative methods are learner centered, encourages collaboration, cooperation, situated/contextual learning;

they are problem centered, activity laden, deep learning and practical oriented (Miller and Snelbecker, 2000; Bonwell and Eison, 1991; Zimmerman and Lebean, 2000; Scheffer et al., 2000). Examples here include: peer tutoring, problem-based learning, discovery/inquiry.

Nevertheless, there is no rigid form of classification since one method is not entirely independent of another, and no single method of instruction is best for all subjects and group of students. At times teacher may need to combine one or more methods and techniques so as to achieve the set objectives. This is the origin of hybrid formats which include, blended learning, lecture-demonstration method, etc. Therefore, ability to make appropriate selection requires basic knowledge of the characteristics of a good method and the criteria for selecting appropriate method(s), which could be acquired through reading research findings on teaching methodology, conducting educational research works and attending seminars, workshops, etc. (Ololube, 2006; Kpangban and Onwuegbu, 1992). These phenomena are presented below:

Characteristics of a good teaching method

Alcon et al. (1970) and Biggs (1999), listed some of the characteristics of a good teaching method:

- a. It should build on a foundation of knowledge already possessed by the learners,
- b. It should encourage students to learn by doing,
- c. It should ensure that learning grows out of useful experience and experimentation i.e. from known to the unknown, and from simple to complex
- d. It should make use of instructional materials effectively
- e. A good method should create in the classroom a conducive learning environment
- f. It should stimulate appreciation as well as cognitive development
- g. It should vary the grouping of learners to get the most efficient learning units for each type of lesson.

Criteria for selection of teaching methods

The selection of appropriate methods and techniques is of great importance to the achievement of learning by the learner. A lot of factors are considered in the process of selecting the appropriate method to use when embarking on an instructional activity. For example, the nature of the subject to be taught- a teaching method which is effective in one subject may be deficient in the other. For example, lecture method may be very efficient in teaching large number of history students, whereas it may be deficient in teaching the same number of chemistry students (Abimbade, 2006). Instructional objectives and the type of

learning task to be accomplished will to a very great extent determine the kind of method to use. The duration of the subject on the time table is also a factor that should guide in the selection of instructional methods. If there are lots of information to be imparted within a short time, a teacher may opt for the lecture method because of its attribute. Available human and non-human resources, learning attitudes, facilities, media and other personnel (e.g. laboratory assistants, fellow teachers) (Ajelabi, 2000) and size of the students in terms of quality are some of the factors that must be taken into consideration. It must be pointed out that methods are good for small groups, while some are good for large groups. Learning attitude must also be considered. The teacher, using his previous knowledge may favour the method preferred by most learners under which they can learn maximally based on their interest. However, the methods should be varied according to the age and level of learners; this to a very great extent determines the method to be adopted (Mang, 2013; Alcon et al., 1970; Biggs, 1999). For example, while play method may be good for small children, it may look repugnant to adult learner. Differences exist in the intellectual abilities of learners; because in classroom settings some are fast learners, some are slow while some are average learners. The knowledge of their individual differences will help in determining the method to adopt.

Statement of problem

Every curriculum is translated and made a reality by the classroom teacher. In planning for teaching, the teacher attempts to answer three basic questions: 'what' 'who' and 'how'. While the question, 'what', hinges on subject matter, the 'who' targets the learner, and the question on 'how' is all about the methodology of teaching. The question, 'what' is constantly answered through several curriculum reforms at all levels in response to changing needs in the society, learner and labour market. Similarly, curriculum is diversifying, extending contacts to wider range of learners through all manner of programmes. On the question of 'how', educators are not resting on their oars; they are researching continuously refreshing old teaching strategies while discovering new ones. In addition, minimum teaching qualification has improved from TTC to NCE; through Sandwich and satellite campus programmes more in-service teachers are upgrading their qualifications to B. Ed., M. Ed., and Ph.D. In addition, lecturers are mandated to obtain teaching qualification through Post Graduate Diploma in Education (PGDE) programmes.

With the level of progress stated above, one would expect more heart-warming academic performances at all levels of our educational system. Rather, the reverse is the case, as downward trends in academic achievement

are generally observed. The question is: why is this so? Poor academic achievement is an indication of teaching and learning problems of which methodology is a primary suspect. Looking at methodology, one wonders how much of these old and new strategies Nigerian teachers know and can properly select and apply in the classroom process. Or are there some factors that deter attempts to appropriately utilize the various teaching methods in the three tiers of our educational system? It is the attempt to find answers to these questions that necessitated this study.

Purpose of the study

This study was driven by the need to investigate Teaching Strategies, henceforth (TS), used by MST-teachers at various levels of curriculum implementation. The purpose of the baseline study was:

1. to ascertain the predominant TS in the-
 - i. Primary schools
 - ii. Secondary schools
 - iii. Tertiary schools
2. to identify factors driving the selection and utilization of TS, and
3. to suggest possible ways of improving teachers' selection and utilization of TS in schools.

Research questions

The study was guided by five research questions. They are:

1. What are the predominant TS in the Primary schools?
2. What are the predominant TS in the Secondary schools?
3. What are the predominant TS in the Tertiary schools?
4. What factors drive the selection and utilization of TS?
5. How can the selection and utilization of TS be improved?

METHODOLOGY

The research design adopted for this study is the descriptive survey design. The study targeted all MST-teachers in the three tiers of education- primary, secondary and tertiary institutions owned by private, state and federal governments in Nigeria. However, the study was purposively restricted to the six BRACED States namely, Bayelsa, Rivers, Akwa-Ibom, Cross Rivers, Edo and Delta in the South-South region of Nigeria. The sample consisted of 900 teachers derived using stratified random sampling technique as shown in the Table 2.

A 21-item questionnaire referred to as Questionnaire on

Predominant Teaching Strategies in Schools (Q-PTSS) designed by the researcher was used to collect data from the primary, secondary and tertiary school teachers. Each of the items is provided with a four-point rating scale of 4= "always used"(AU); 3= "Sometimes used"(SU); 2= "Rarely used"(RU); 1= "Never used"(NU). The instrument was validated for content and face validity by three professors in education; and reliability test of the instrument using Cronbach Alpha recorded reliability coefficient of $r = 0.82$. Distribution and collection of the questionnaire was during region-wide conference tagged the BRACED Commission Summit on Quality Education, 15 – 17 November, 2012 held at the Banquet Hall, Government House, Port Harcourt.

Data analysis was through mean on item by item basis, and it was based on the limit of the real numbers: 3.50-4.00(AU), 2.50-3.49(SU), 1.50-2.49(RU), 0.50-1.49(NA). The results were presented based on the stated research questions 1-4.

RESULTS

Research Question 1: What are the predominant TS in the Primary schools?

Table 3 shows that, even when teaching MST-subjects, primary school teachers always use lecture method, and rote learning method. Demonstration, Question and answer, and play-way methods are sometimes used, while discussion, experimental, project, simulation/game, and peer-tutoring methods are rarely used. Most of the innovative methods-discovery/inquiry, co-operation/ collaborative, contextual and problem-based methods are never used.

Research Question 2: What are the predominant TS in the Secondary schools?

Table 4 shows that secondary school MST-teachers always use lecture method and rote learning method. Question and answer, Demonstration, experimental and project methods are sometimes used, while discussion, Co-operative/Collaborative, and Peer-tutoring methods are rarely used. Other methods- Simulation/Game, Play-way discovery/inquiry, contextual and problem-based methods are never used.

Research Question 3: What are the predominant TS in the Tertiary schools?

Table 5 shows that tertiary school MST-teachers always use lecture method, and rote learning method. Sometimes they use Demonstration, experimental, and project methods. While discussion, question and answer, simulation/game, co-operation/collaborative, and peer-tutoring methods are rarely used. Never used methods at tertiary institutions include play-way, discovery/inquiry, contextual, and problem-based methods.

Research Question 4: What factors drive the selection and utilization of TS?

Table 2. Samples from the six BRACED states.

S/No.	States/Educ. Level	B	R	A	C	E	D	Total
1.	Primary	50	50	50	50	50	50	300
2.	Secondary	50	50	50	50	50	50	300
3.	Tertiary	50	50	50	50	50	50	300
	<i>Total</i>	150	150	150	150	150	150	900

Key: B- Bayelsa; R- Rivers; A- Akwa-Ibom; C- Cross-Rivers; E- Edo; D- Delta

Table 3. Mean ratings of teaching strategies used by primary school teachers.

S/N	Item statement	Mean	Decision
	Teaching strategies used by teachers		
1	Lecture/Telling Method	3.76	AU
2	Discussion	1.62	RU
3	Question & Answer	2.54	SU
4	Demonstration	2.64	SU
5	Experimental	2.04	RU
6	Project method	1.86	RU
7	Simulation/Game	1.63	RU
8	Play-way	1.52	RU
9	Rote-learning	3.61	AU
10	Discovery/Inquiry	1.21	NU
11	Co-operative/Collaborative	0.51	NU
12	Peer-tutoring	1.54	RU
13	Contextual	0.62	NU
14	Problem-based	0.44	NU

Table 4. Mean ratings of teaching strategies used by secondary school MST-teachers.

S/N	Item statement	Mean	Decision
	Teaching strategies used by teachers		
1	Lecture/Telling Method	3.86	AU
2	Discussion	1.64	RU
3	Question & Answer	2.56	SU
4	Demonstration	2.74	SU
5	Experimental	2.64	SU
6	Project method	2.63	SU
7	Simulation/Game	1.03	NU
8	Play-way	1.32	NU
9	Rote-learning	3.64	AU
10	Discovery/Inquiry	1.21	NU
11	Co-operative/Collaborative	1.51	RU
12	Peer-tutoring	1.50	RU
13	Contextual	1.12	NU
14	Problem-based	1.06	NU

Table 5. Mean ratings of teaching strategies used by tertiary school MST-teachers.

S/N	Item statement	Mean	Decision
	Teaching strategies used by teachers		
1	Lecture/Telling Method	3.86	AU
2	Discussion	1.62	RU
3	Question & Answer	1.54	RU
4	Demonstration	2.64	SU
5	Experimental	2.74	SU
6	Project method	2.86	SU
7	Simulation/Game	1.53	RU
8	Play-way	0.52	NU
9	Rote-learning	3.61	AU
10	Discovery/Inquiry	1.06	NU
11	Co-operative/Collaborative	1.52	RU
12	Peer-tutoring	1.56	RU
13	Contextual	1.52	NU
14	Problem-based	1.22	NU

Table 6. Mean ratings of factors for selection and utilization of teaching strategies.

S/N	Item statement	Mean	Decision
	Factors		
1	Ignorance of meaning & applications	3.42	AU
2	Poor remuneration and working conditions	2.53	SU
3	Poor facilities (obsolete/lack)	3.33	AU
4	Large content/curriculum over load	3.61	AU
5	Limited Time duration	2.57	SU
6	Emphasis on examination/certificate	1.52	RU
7	Poor administrative support	2.34	RU
8	Parent-guardian/societal pressure	1.32	NU
9	Class population/level	3.22	AU

Table 7. Mean rating of suggestions for improving selection and utilization of TS.

Item statement	Mean	Decision
Regular seminars, workshops, and conferences on methodology organized for teachers at all levels	3.57	AU
Books and journals on research findings on teaching methods should be made available to school- teachers	3.36	AU
Teacher refresher courses should be organized for in-service teachers at the beginning of every term/semester	3.48	AU
Lay emphasis on teaching methods, particularly the innovative methods at the teacher training institutions.	2.67	SU
The curriculum planners should reduce the course load and number of subject and content to be covered within a given period	2.58	SU

From Table 6, it is observed that teachers’ decision on the selection and utilization of teaching methods is mostly influenced by ignorance, poor facilities, subject/contents, and class population/level; but never by pressures from parent and members of the society.

Research Question 5: How can we improve the

selection and utilization of TS?

As can be deduced from Table 7, the respondents generally accepted items 1, 2, and 3 as major strategies for improving teachers’ abilities to properly select and utilize TS. However, items 4 and 5 were not completely left out, as they were also seen as possible means of

achieving improvement in the desired direction.

DISCUSSION

This study set out to identify most commonly used teaching methods at all levels of our education system and how they affect curriculum implementation. The findings shown in Tables 3, 4, and 5 indicate that lecture method (traditional method) is still the predominantly used teaching strategy at primary, secondary and tertiary institutions. This finding gave credence to Ajelabi's (2000) observation that lecture/telling method is probably the oldest well known and widely used method, still commonly practiced at all levels, and teachers find it very convenient to adopt. On the contrary, the three tables reveal that innovative methods- discovery/inquiry, problem-based learning, and contextual methods are least used or never used, even though these are the research-proven strategies that enhance learner-centeredness and active, deep learning which promote creativity, higher cognitive skills, self-directed, and life-long learning that are very much needed in every functional education (Biggs, 1999; Biggs, 1989; Blumberg and Michael, 1992; Bonwell and Eison, 1991; Botkin et al., 1980; Day and Williams, 2000; Miller and Snlbecker, 2000).

In Table 6, the least factors driving teachers in their choice of teaching strategy are parent-guardian/societal pressure, poor administrative support, and emphasis on examination/certificate. It is, however, clear from that table that ranking highest are: ignorance of the strategies and uses, poor facilities, large content/curriculum over load, and class population/level. This finding supported Ajelabi (2000), and Abimbade (2006) who stressed the need for teachers to possess good knowledge of methodology, and understand the class for effective classroom delivery. It further revealed that content and time availability are also factors considered by teachers. This finding, in agreement with Ololube (2006) and Mang (2013), explained why lecture method is still much on top of the list because it covers a large amount of information in short time and is used for any group size, learners. It is however a one-way mode of communication in which learners are passive. It is therefore, not appropriate for practical/skill oriented subjects and hearing impaired learners. Table 7 buttressed the importance of regular enlightenment and refresher courses for teachers at all levels. This is in line with Fabgemi and Anyanwu (2013), who stressed that training and re-training programmes must be organized for teacher and educators in order to update them.

Implications of the findings

The findings of this study indicate that our MST-teachers

at all levels are still much attached to traditional teaching methods, particularly the lecture format. This is not a good sign, as it implies that our educational system is still wallowing in passivity and shallow learning which are not relevant in this era of Mathematics, Science and Technology (MST). To make progress in this field, particularly in this era of unprecedented progress in ICT, requires men and women who are skilled in higher cognitive thinking, deep learning, and self-directed, life-long learning must be utilized. Researches, over time, have continued to buttress the efficacy of innovative methods in stimulating learners in this direction. Ironically, those innovative methods are being successfully applied at all levels of education in developed and developing countries, but Nigeria is yet to imbibe them and as long as this sole dependence on lecture-based methods continue, our institutions and their graduates shall remain irrelevant in the global trends for many years to come. This study is a distress call for a quick shift from telling methods to innovative strategies in all MST classrooms to stimulate creativity and innovations for technological development.

Conclusion

Oil exploration, drilling and processing, with environmental management are strongly science and technology-based, and of common-place in the BRACED states. This stimulated the need for quality graduates with strong background in Mathematics, Science and Technology (MST). Perceiving the laudable curriculum, this study examined the teaching strategies and the extent to which they affect MST-classroom processes at all levels, such as the primary, secondary and tertiary. The findings revealed that telling method dominated the MST-classroom, and that the shortage of modern resources and ignorance were major setbacks to the use of innovative strategies. Such credence to talk-chalk implied passivity, rote and shallow learning in supposedly activity packed sessions. Moreover, creativity and deep learning are direly needed for progress in science and technology. This exposure is therefore a call for a paradigm shift to innovative strategies and an exposure to the need for concerted efforts to promote the use of innovative methods in teaching and learning MST without which attainment of the laudable curricular goals shall remain a mirage for many more years to come.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are eminent,

1. Seminars, workshops, and conferences on

methodology should be regularly organized for teachers at all levels by the ministry of education and other concerned organizations,

2. Books and journals on research findings on teaching methods should be made available to schools and teachers,

3. Teacher refresher courses should be organized for teachers at the beginning of every term

4. More emphasis should be made on innovative teaching in all teacher training programmes,

5. The curriculum planners should reduce the course load and number of subjects and contents to be covered within a given period.

Limitation of the study

This study sought to find out the dominant teaching strategies used by Mathematics, Science and Technology teachers at all levels with the aim of improving knowledge and skills in those fields to meet the challenges of the present era. However, as a result of limited funds, the researcher could only study the six BRACED states. Considering the increasing global need for proficiency in MST, this study should further be extended to other states of Nigeria so that any change in teacher training and re-training would be more general in all institutions in the country.

Conflict of Interests

The authors have not declared any conflict of interests.

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