

The Role of Instructional Media in Enhancing Teaching - Learning of Engineering Education and Training

Gambari, A. I. and Gana, E.S.

Department of Science Education,
Federal University of Technology, Minna. Niger State, Nigeria.
gambari@yahoo.com

Abstract

This paper examines the causes of poor performances of students in science and technology education and identifies the role of Instructional Technology to solve the problems. The potentials and use of instructional media in the teaching and learning of science and technology (engineering) for better performance were also discussed. Barriers to effective use of instructional technology were highlighted. The use of instructional media in enhancing teaching and learning of engineering education and training were also discussed. Suggestions and recommendations were proffered.

Keywords: *Educational Technology; Instructional Technology; Instructional media; Science Technology and Mathematics (STM); Information Communication Technology (ICT).*

I. INTRODUCTION

In the words of Bajah (1995), “we are surrounded by science and its application. Our lives and attitudes are influenced by science”. Science and Technology education ultimately brings about creativity, inventions and of course technological advancement which lead to self-reliant economy. Science and Technology play a very important part in the socio-economic development of any nation. Nigeria informed by this direction, enshrined science and technology in the current National Policy on Education and

adopted education as an instrument for national development (Jangata, 2000).

There are lots of problems facing the effective teaching of pure science, applied science and engineering related disciplines at all levels of educational institutions. One of such is the problem of communication channels through which pieces of information, ideas, concepts could be disseminated to the learners. Effective communication through instructional media is paramount to effective teaching (Babajide and Bolaji, 2003). Bajah (1995) found that science has not been taught in Nigerian schools the way that pupils would benefit most, as science instruction has mostly been teacher-centred.

For the past two decades, Science Technology and Mathematics education has been facing a lot of difficulties which include poor performance of students in science (Adeyegbe, 1992); inability of the science teachers to put across the science concepts to students; inability of students to understand the science concepts; apprehension by students that science is difficult to learn; lack of skills and competence for teaching science; and shortage of qualified science teachers (Akale, 1986; Okebukola and Jegede, 1986). Many of the students see science as too abstract to comprehend, thereby resorting to memorization or rote method of learning. Many researchers have traced the poor performance in STM to lack of resourceful and creative science

teachers. Effective science teaching and learning should involve students' active participation in the teaching and learning process. Lack of active participation of students is one of the factors responsible for students' poor performances in science subjects (Inyang, 1988; Bichi, 1988). This has also been indicated in WAEC results of secondary schools where students' performances are generally poor in physics, chemistry, biology and other science-related subjects (WAEC, 2000). This pattern of poor performance in the STM education by students is also observed in tertiary institutions (Olarinoye, 1987).

Pressey and Robinson (1985) asserted that learning progresses most adequately when the learner's interest is aroused and also when the learner perceives some organization in the material he/she is learning. Unorganised instructional materials usually lack meaning, their motivational effects usually poor and the possibility of their effective use are doubtful.

The National Policy on Education (1981, revised), section 6, deals with science and technology education. The policy document sees Technology Education as "that aspect of education which deals with the acquisition of practical and applied skills, as well as basic scientific knowledge". The National Policy on Education (1981, revised), also identified six aims of Technology Education which are as follows:-

- (a) To provide trained manpower in applied science, technology and commerce particularly at sub-professional grades;
- (b) To provide the technical knowledge and vocational skills necessary for agriculture, industrial, commercial and economic development;
- (c) To provide people who can apply scientific knowledge to the improvement

and solution of environmental problems for the use and convenience of man;

- (d) To give training and impart the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self reliant; and
- (e) To enable our young men and women to have an intelligent understanding of the increasing complexity of technology.

The development of any nation is hinged on its technological progress which in turn is determined by its technology education. Nigerian government appreciates the facts that the most important means of experiencing national development is through strong technology education programmes at all levels of educational system.

For Science and Technology Education to achieve all these stated objectives, it needs to employ effective means of communication. Consequently, instructional media is being proposed as having some potential in the teaching and learning of science, technology and other related disciplines.

II. HISTORY OF EDUCATIONAL TECHNOLOGY

The origin of educational technology can be traced to the ancient times, even to the Stone age man (NETC, 2001). During the stone age, rocks and stones served as media for human expression and communication. Man scratched figures and symbols on the rocks with stones to express himself and to send messages to others. The rocks on which these figures and symbols were scratched thus became the earliest forms of visual aids. Smoke and sound of the gun and of the drum had also served as aids in communication at various stages of man's development (Ibitayo and Inanoya, 1991). The

application of educational media in Nigeria has come a long way since the idea was introduced in 1953, when the British Broadcasting Corporation in London transmitted the first educational programme in its West African overseas services (NETC, 2001). Ever before this period, the use of audiovisual materials in the teaching and learning process was not new in Nigeria. In Western region, for example, marbles and sticks were used by teachers as instructional materials. In Eastern region, cowries and sticks were used while in the Northern region, beads, pebbles and other materials had long been in use. What seems new are the technological equipment and materials such as overhead projector, opaque projector, slides, transparencies, films, and computers that have been introduced into the teaching and learning process. The current trends in instructional technology are related to the use of technology to achieve instructional objectives (Spott and Browman, 1995). This technology includes computer hardware and software, networks, e-mail, multimedia, and computer peripherals.

Educational media and technology have been described by Teck (1992) as encompassing all kinds of devices relating to the use in the classroom of all the human senses for effective and meaningful learning. It is a departure from the age-old traditional approach of teacher-pupil one-way channel which lacked variety. Educational Technology is not just the use of tools of technology for the solution of problems of teaching and learning but a systematic integrated organization of machines (hardware and software) and humanware (teachers, psychologists, administrators and many others) to the solution of problems in education. Brown (1994) also stressed that the value of educational technology lies in its ability to actively assist the learner to learn better,

understand deeper, retain longer and apply more accurately what has been learnt, compared to other approaches.

Albright (1996) and Charp (1998) concluded that it is not the instructional media itself that matter but how it is being used to improve learning and increase student interest. Barbara (2002) asserted that application of instructional media could effectively have impact in higher education if used in a transmissive way to enhance student learning. In a survey of California community college, Luna and McKenzie (1997) found that 805 colleges were using multimedia as a form of lecture support. 73% of the students reported multimedia to be a positive addition to the course. Weigel (2002), therefore, suggested that instructional technology in higher education should be use to enrich and extend the student's exploration of new territory. He further explained that learning should involve a search for new knowledge that is related to "the activities of play, discovery, and problem-solving". Julia (2002) concluded that the current trends in instructional technology such as Computer-Assisted Instruction is a rewarding and useful experience. This view also agrees with the finding of Barbara and Sylvia (2002) that teachers demonstrate acceptance and adoption of instructional technology as a "good teaching" practice, while students agree that it significantly enhances their learning.

III. CONTRIBUTION OF INSTRUCTIONAL MEDIA TOWARDS EFFECTIVE ENGINEERING EDUCATION AND TRAINING

Instructional media has the following contributions to make towards effective teaching and learning of engineering course:

- (i) They provide increased interest in learning

- (ii) They offer a variety of reality of experience, which stimulates self-activity on the part of the learners.
- (iii) They offer rich opportunities for the students to develop communication skill while actively engaged in solving meaningful problems.
- (iv) They ensure effectiveness of teaching and learning through concretising ideas and engineering creativity,
- (v) They provide greater acquisition and longer retention of factual knowledge
- (vi) They provide the learner with the opportunities for independent and individualised learning,
- (vii) They help to hold the learner's attention.

The importance of instructional media cannot be over emphasized. When these contributions are viewed along side and implemented towards effective teaching and learning of engineering courses, it will be clearly seen, that instructional media really is a veritable vehicle for the achievement of educational goals and objectives in engineering in particular and other courses in general.

V. BARRIERS TO EFFECTIVE USE OF INSTRUCTIONAL MEDIA

Integrating instructional (media) technology into classroom instruction is a critical aspect of adoption process (Armstrong, 1996). The following factors have been identified as some of the barriers to the adoption of instructional technology.

- (i) The fear of failure in using the instructional media is a factor that has been cited as an initial barrier (Hannafin and Savenge, 1993). While instructors are experts in their content area, they are not experts in the use of instructional technology.

- (ii) The fear that they will not be able to use instructional media well in front of their students and colleagues. When teachers have this problem, they often refuse to use it again.
- (iii) Lack of availability of support staff when problems occur is an important barrier for teachers using instructional technology.
- (iv) Other anxiety that teachers face with instruction technology are the fear of devaluation of their profession and the possible elimination of their job. As distance learning and computer based instruction become more popular, some teachers may wonder if the role of the traditional campus is threatened.
- (v) Teachers also worry that instructional technologies may alienate students and diminish communication and other social skills.
- (vi) Infrastructure development is important to instructional technology. Without high speed networks there would not be the World Wide Web (WWW) and efficient e-mail. Development of multimedia classrooms brings computers, the Internet, video, and audio to the easy reach of the teachers. These are factors that students and teachers now consider essential.
- (vii) Insufficient time is always a critical resource for teachers, but time is at a premium with technology. Teachers relate that it takes time to learn the instructional technology and it takes even more time to develop instructional materials that utilize technology. Albright (1996) reported that the lack of time to develop instructional technology materials is a major deterrent to the adoption of instructional technology.

- (viii) Lack of institutional commitment is a critical element that affects teachers' adoption of instructional technology in the academic environment. Institutional and administrative commitment to instructional technology through financial support, infrastructure, and support personnel is essential for the successful development of instructional technology.

IV. THE USE OF TECHNOLOGICAL INSTRUCTIONAL MEDIA TOWARDS IMPROVING ENGINEERING EDUCATION AND TRAINING

The use of technological instructional media (teacher-produced or commercially produced) for achieving instructional objectives are several and desirable. Hence the emphasis on the optimum utilization of instructional media in science and technology education. There are lots of problems facing the effective teaching of science and technology (engineering) related disciplines at all levels of our educational institutions. One of such is the problem of communication channels through which pieces of information, ideas, and concepts could be disseminated to the learners. Effective communication through instructional (communication) media is paramount to effective teaching. Owen (2003) states that awareness towards the use of Educational Communication Technology is increasing in the classroom of the third world such that mere verbalisation or over verbalization of words alone in the classroom to communicate ideas, skills and attitude to educate learners is futile. Therefore, there is the need to try Educational Communication Technology for the purpose of enhancing effective teaching of science and technology education.

Instructional media according to Adedoyin (1991) refers to all types of communication through which learning takes place. It includes objects and devices that are systematically designed, produced and evaluated, in which an instructor initiates and transfers encoded information to learners who decode the information by analysis and interpretation with the intention of facilitating learning. Based on the above, instructional media can be seen as information carrying technologies that constitute integral part of instructional process used for the delivery of educational information very quickly, widely and effectively (Nsofor, 2002).

The primary purpose of using instructional materials in the teaching-learning process is to make teaching more effective and facilitate learning. It does not do the whole job of a teacher because it cannot entirely replace the human teacher in the classroom. These teaching materials are administered and controlled by the teacher. If it is well selected and used accordingly, it works effectively. There are different types of instructional media, some of which include; slide projector, overhead projector, opaque projector, film strip, projector, cine projector, video projector, microscopic projector, microfilm reader, video camera, photographic cameras, video machine/systems, computers, audio-tape recorder/player, record player, and compact disc system. Other instructional materials include television, radio, satellite, public address systems, maps, models, flannel board, magnetic board cartoons and comics, flip, time and sequence, flow and stream charts, diorama and many others. These materials can be classified into three major groups namely; printed media, non-printed media, and electronic media. See figure 1. (See Appendix).

VI. FACTORS TO BE CONSIDERED IN SELECTION AND USE OF INSTRUCTIONAL MEDIA IN ENGINEERING EDUCATION AND TRAINING

Abimbade (1991) asserted that teachers should select and use materials which will enable the learners to master the desired objectives. For teacher to make decision about which media to use in the process of teaching, the following questions have to be answered:

(i) What medium/media would I like to use for each instructional event?

(ii) Where will I find the specific materials?

The first question bothers on the rationalization to use and on section while the second question is concerned with the use of the selected media.

The specific condition for media selection include:

(i) **The task:** this refers to work that must be accomplished. It is often referred to as the needs or the problems.

(ii) **The behavioural objectives:** in deciding which instructional media to use, the behavioural objectives should be considered.

(iii) **Practicability of the media:** the media must be practical. This involves using appropriate materials for appropriate situations and consideration for alternatives.

(iv) **Pupil learning style:** uniqueness of individual calls for special consideration in selecting media for a large group of students.

(v) **Availability of media:** it will amount to wasteful exercise if a teacher decides to use media that are not readily available.

(vi) **The teacher's ability:** teacher is expected to be a specialist or at worst be knowledgeable in the art of media selection and use. He is expected to be able to handle most of the educational

media especially those that are available in schools.

VII. SUGGESTIONS AND RECOMMENDATIONS

From the findings of the present review, the following recommendations are made:

1. The use of instructional media for teaching and learning of Science Technology and Mathematics (STM) education should be encouraged. Therefore, government should provide adequate infrastructure and facilities for instructional technology.
2. Educators should continue to lay more emphasis and implement the concepts of educational technology as a means of enhancing the quality of education.
3. In-service training should be given to teachers on Educational Technology particularly on the production and use of technological instructional media.
4. There is need for government and non-governmental organisations to organise seminars, workshops and conferences for teachers on methodology of teaching so as to be able to compare and contrast effects of different methods of teaching on students' achievement.
5. Emphasis should be placed on making learning to be a learner-centred affair as well as teaching for meaningful learning.

VIII. CONCLUSION

This paper has made an attempt to look into the role of instructional media to improve the teaching-learning of science and technology (engineering) education. The future of any nation depends on science and technology. This has altered economic, social and environmental conditions of mankind in the areas of food production, medicine, transportation, communication, environmental improvement

and protection as well as energy production and renewal. Therefore, effective teaching of science and technology in our school should not be under rated. Efforts should be made by school administrators, government and stakeholders to provide adequate instructional media and encourage teachers to acquire sufficient knowledge in the use of instructional media for effective teaching and learning of engineering and science related subjects.

REFERENCES

- Abimbade, A. & Agun, I. (1991). *General principle of Educational Technology*. Ibadan. Oluseyi press.
- Adedoyin, J. A. (1991). *Introduction to Educational Technology*. Lagos: Johns-Lad Publishers Ltd.
- Adeyegbe, S. O. (1992). *Assessing students' work in Chemistry: the WAEC state of the Art*. A paper delivered at STAN Chemistry workshop for Chemistry teachers, ABU, Kano campus, 10-15 April.
- Akale, M. A. G. (1986). *Assessment of students' achievement in science: what implications for teacher training*. Proceeding of the 27th annual conference of the science teachers association of Nigeria (STAN).
- Albright, M. (1996). *Instructional technology and higher education: rewards, rights and responsibilities*. Keynote Address at the Southern Regional Faculty and Instructional Development Consortium. Baton Rouge, LA. (ERIC Document Reproduction Service No. ED 392 412).
- Armstrong, G. (1996). One approach to motivating faculty to use multimedia. *T.H.E. Journal*. 23(10), 69-71.
- Babajide, V.F.T. & Bolaji, A.O. (2003). *Perception of lecturers and pre-service teachers towards the use of communication media in teaching pure and applied science related disciplines*. Proceedings of the 44th annual conference of STAN, Abuja 17th – 23rd August.
- Bajah, S. T. (1995). *Practical skills in science and technology*. A key note address delivered at the 36th annual conference of STAN, Maiduguri, 14th – 19th August.
- Barbara, D. & Sylvia B. (2002). *Assessing the impact of technology on teaching and learning: student perspectives*. Seventh Annual Mid-South Instructional Technology Conference Proceedings, Middle Tennessee State University, April 7-9.
- Bichi, S. S. (1988). *The design of inventory skills in senior secondary schools practical Biology*. Unpublished M.Ed. thesis ABU, Zaria.
- Brown, J. (1994). *Audiovisual instructional media and methods*. New York: McGraw Hill Book Co.
- Charp, S. (1998). Measuring the effectiveness of Educational Technology. *THE Journal*, 25, 6.
- Dale, E. (1984). *Audiovisual methods in teaching*. New York: Holt, Rinehart and Winston.
- Federal Republic of Nigeria (1988). *National policy on computer literacy*. Lagos: Federal Government Press.
- Hannafin, R. D. & Savenye, W. C. (1993). Technology in the classroom: the teachers' new role and resistance to it. *Journal on Educational Technology*, 33, 26-31.

- Ibitayo, A. & Inanoya, I. (1991). *Fundamentals of Educational Technology*. Ibadan: Y- Books Nigeria Ltd.
- Inyang, N. E. (1988). *The constructing, validation, standardization of integrated science achievement test*. Unpublished Ph.D Dissertation. ABU. Zaria.
- Jangata, B. (2000). The role of women in science and technology education for the realization of vision 2010. *A journal of NATT* 3(1), 108- 116.
- Julia, H. (2002). *Developing a computer-assisted tutorial: A beginner's experience*. 7th annual Mid - South instructional technology conference Proceedings, Mid – South instructional technology conference, Middle Tennessee State University, U.S.A. April 7 – 9.
- Luna, C. J.& McKenzie, J. (1997). Testing multimedia in the community college classroom. *THE Journal*, 24, 78-81.
- NETC (2001). *Information bulleting of National Educational Technology Centre, Kaduna*. Kaduna: NETC Press.
- Nsofor, C. C. (2002). *Potentials of technological instructional media in environmental education*. Proceedings of the 15th Annual Conference of NATT, FUT Minna, 18th-22nd November.
- Okebukola, A. O. & Jegede, O. J. (1986). *The under achieving student in science: opinions on the aetiology of ailment*. Proceedings of the 27th annual Conference of the STAN. Pp. 57-63.
- Olarinoye R. D. (1987). The inquiry and discovery methods of teaching science. *Journal of STAN*, 21 (1), 168-180.
- Owen, M. (2003). ICT and the future of science education NESTA future lab. Retrieved January, 2, 2003 from <http://www.scienceyear.com>.
- Pressey, A. A. & Robinson, D. (1985). *Psychology in education*. New York: Herper and Row.
- Spott, T. H. & Bowman, M. A. (1995). Faculty use of instructional technologies in higher education. *Journal of Educational Technology*, 35, 56-64.
- Teck, M. K. (1992). *Principles of instructional design*. New York: Holt, Rinehart and Winston.
- Weigel, M. V. (2002). *Evaluation of engaged learning activities used in interactive television course*. Proceedings of Seventh Annual [Mid-South Instructional Technology Conference](#), Middle Tennessee State University, U.S.A. April 7-9.
- West African Examination Council (WAEC), (2000). *Examiners report in science subjects*. Lagos: WAEC.

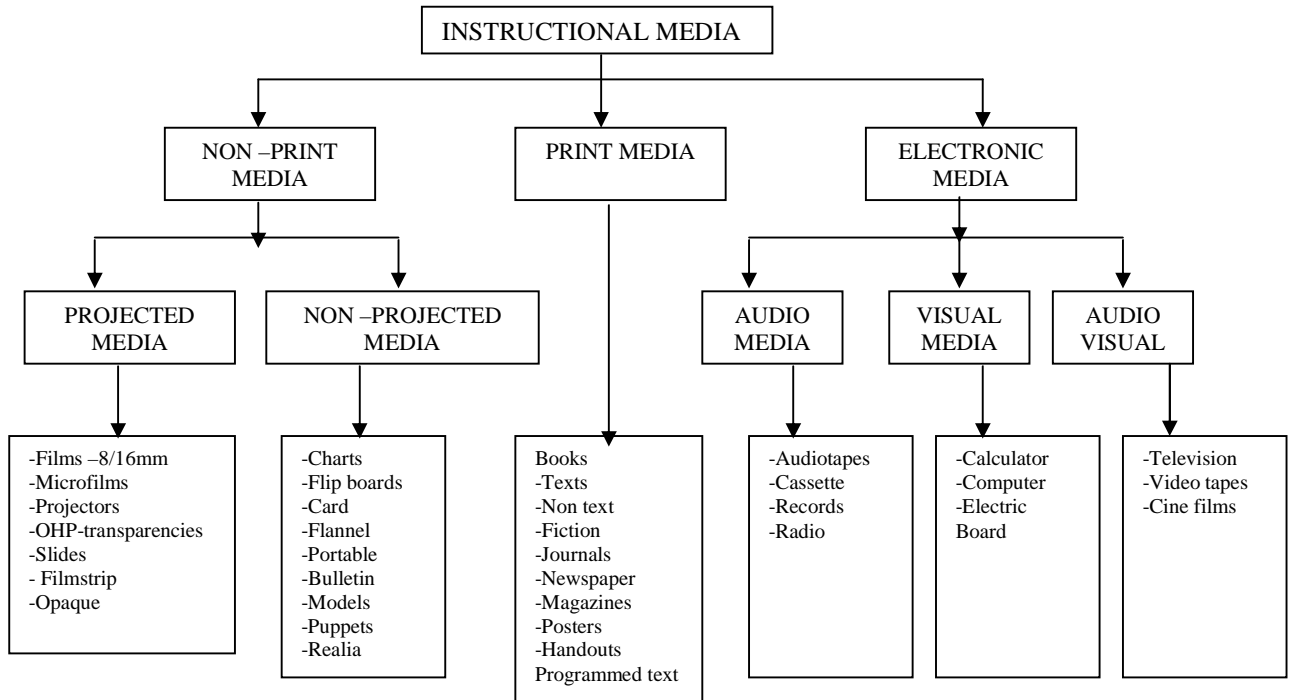


Fig. 1. Instructional Media Categorization

Source: General Principle of Educational Technology