

# Artificial Intelligence As An Imperative To The Effective Delivery Of Instructional Materials' Content

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**Abstract:** This study looked at various Artificial Intelligence systems in Education and coined the concept of Classroom Robotic Assistant (CRA) which is an expert system that helps in the delivery of lessons and Instructional Materials content in classrooms. It observed that the forms of Educational Technology applied in Nigerian classrooms are medieval; and advocated for modern enlightenment on the delivery of Instructional Materials content. Available studies have concentrated on the impact of ICT and Expert systems on academic performance of Primary, Secondary and Tertiary Education without considering the practical use of Artificial Intelligence systems on the performance of teachers' duties. Instructional materials are not readily updated in any prescribed knowledgebase and cheaply available for the students to procure; and the periods used by Teachers to deliver the materials to students are constrained by human factors of weakness, time and expertise. Therefore the key issue is the application of Artificial Intelligence as a substitute for tutoring, especially when the teacher is sick, tired or not available to deliver his course contents. The approach of the study was descriptive and data were gathered from related secondary sources through content analysis of relevant documents.

**Keywords:** Artificial Intelligence, Education, Expert System, Instructional Materials, Robot

## 1. Introduction

Instructional materials are the devices developed or acquired to assist or facilitate teachers in transmitting organized knowledge, skills and attitudes to the learners within an instructional situation (Nwachukwu, 2006). Teachers use different instructional materials to motivate learning. Teachers often make use of textbooks, charts, models, graphics, realia as well as improvised materials (Awotua-Efebo, 2001). The success in the skill and knowledge acquisition in an instructional situation depends on the suitability of the instructional material, adequacy and effective utilization of the available materials (Olaitan & Agusiobo, 1994). Also, the relevance of instructional materials to the objective of the lesson and the ease of use of the instructional materials are serious considerations in instructional materials utilization to better the learner's performance. The contents of instructional materials according to Corcoran & Goertz (1995) are the knowledge expected to be inculcated into the students after the class. Ibe (1998) outlined the utilization procedures that the teachers should follow in using instructional materials to deliver this knowledge to students and summarized them as previewing the materials, preparing the environment, preparing the audience and finally presenting the materials. However, the content and practice of education have grown into the utility of Artificial Intelligence mechanism just like Cohen, Kulik & Kulik (1982) noted that a great deal of cognitive change in the school system could be made possible through the use of audio-visuals such as chart, tape recorder, radio and television programmes, pictures and programmed materials. Beal (2013) opined that: With the advent in Artificial Intelligence Innovations, the limitations which majority of Computer Aided Instruction suffered in the time past like; (i) an inability to conduct conversations with the student in the student's natural language; (ii) an inability to understand the subject being taught, thus being unable to accept un-anticipated responses; (iii) an inability to decide what should be

taught next; (iv) an inability to anticipate, diagnose, and understand the student's mistakes and misconceptions; (v) an inability to improve or modify current teaching strategies or learn new ones, have been addressed within major research areas of Artificial Intelligence, such as natural language understanding, voice recognition, pattern recognition, problem solving, knowledge representation, planning, expert systems, simulation and learning. Therefore, providing teachers with robotic assistance in learner diagnoses, instructional materials delivery and assessment of learning difficulties are now the major application roles of Artificial Intelligence in education. The major concern of this paper is the employment of Artificial Intelligence (AI) techniques in the classroom as to effectively support teachers in the delivery of Instructional materials; and enhance education and learning in Nigeria.

## 2. Educational Technology in Nigeria

Educational technology in Nigeria began with the visual era; that is the use of simple teaching aids like apparatus and the preparation of lesson notes. Emphasis was placed on the preparation of simple (low cost) teaching aids in school particularly in Teacher Training Colleges. It was in 1932, under colonial Britain, that the first form of communication media appeared in Nigeria (<http://edutech202.blogspot.com.ng>). A Radio Receiving Station was constructed in Lagos. Since then, the development of media has been rapid following the technological development in various parts of the world which have contracts and relationship with Nigeria. The visual era is followed by the Era of Radio media in Education which occurred between early 1940s and 1950s according to Ogunranti (1982). In the tertiary institutions, the first official support for educational technology was directed towards both pre-service and in-service training of teachers and audio-visual loan services (Imogie, 1984). Apart from the development in the areas of schools broadcast, there were the sponsored projects of the United

Nations Educational Scientific Cultural Organization (UNESCO) in 1962 at the Institutes of Education, University of Ibadan. The audio-visual Unit was established in the Institute. Through this, UNESCO introduced New Methods and Techniques in Educational Practices. Moreover, programmed learning method and its application was introduced. Until the mid-90s, technology in Nigerian education was mostly based on the type writer. Secondary students were taught the use of a typewriter, however from the mid-90s till date; computer science has become a fundamental part of education. Students are taught the basics of word processing, the use of the internet and other computer based concepts. Okebukola (1997) concluded that computer is not part of classroom technology in over 90% of public schools in Nigeria. This shows that Classroom technologies are still in medieval era in Nigeria. The general application of overhead projectors in the presentation of instructions is not being implemented. Students just see presentations in Seminars and conferences only, instead of their classes.

### 3. Artificial Intelligence Robot in Nigeria

The advent of Robotics in Nigerian Education domain is recent and can be traced to 2015. A twenty-four year old Nigerian, Bobai Ephraim Kato built a fully functional artificial intelligence robot for his final year project at the International College of Business and Technology (ICBT) in Sri Lanka. When the directive came to Ephraim's class to create software that uses Artificial Intelligence for predictions and solutions, he couldn't think of anything. It was not until he did some research that the idea of a robot, which could solve puzzles struck him. This robot has been tested and trusted for puzzle solving. He did this in Sri Lanka, but it is a great feat in the evolution of Artificial Intelligence in Nigeria. Nevertheless, an internal Innovation can be traced to Obafemi Awolowo University iLab team. A member of this team, Ishola Babatunde Isaac in July 2016 developed a system called Remote Lab. This A.I system allows students to control real laboratory equipment over the internet. The Remote Labs are a great substitute for experimentation in Nigerian Universities. Given the chronic underfunding of higher institutions of learning; we get to see about 10 students clustered around a piece of lab equipment. With the remote labs, this problem is eliminated as only one equipment is needed regardless the number of students as students only get to access the lab remotely (over the internet) but without the time and space restriction associated with the conventional labs ([www.naijaloaded.com.ng/2016/07/17/](http://www.naijaloaded.com.ng/2016/07/17/)).

### 4. Classroom Robotic Assistant

Classroom Robotic Assistant (CRA) is a combination of hardware and software problem solving agents of Artificial Intelligence, super-encoded with a knowledgebase of an expert in a given field, to provide classroom help needed to be done by an expert of such field when he is not available. Shin & Kim (2007) have classified the role of robots in education into learning tool, learning companion, and learning instructor. As a tool, the robot is a technology aid which students can use to learn the Instructional material. As a learning companion, robots provide assistance like prompting or providing feedback to students in going through the Instructional material. The role that is found challenging is the tutor

role. Humanoids have been designed in some countries already to play teacher's roles but few loopholes are still recorded and as such, it has not been easy to fully implement a humanoid system as a teacher's replica. South Korea and Japan have started spreading robots in their schools to teach kids English Language. Rather than a human teacher waiting at the chalkboard, a robot comes to the class. A white and yellow tower on wheels, the robot has a screen face, moveable arms and has the capability to make gestures. According to Johnson (2014), education is about people, but robots can be excellent extensions of parents and teachers at home and in the classroom. For children with different learning styles or learning disabilities, robots can be excellent teachers and learning companions. They can give a child unfettered attention, something nearly impossible for one teacher to do in front of a classroom full of students. Unlike computers or tablets, robots are social and can connect with children. Also from the United Kingdom, the University of Hertfordshire-developed Kaspar also helps autistic children. Specially designed with a human-like face and the tacit complexities therein, Kaspar helps teach facial expressions and appropriate physical contact, creating a safer learning environment for special needs children. In the United States, a robot named RUBI runs through repeated exercises to teach foreign languages to preschoolers in California. Spearheaded by the University of California, San Diego, RUBI has proven quite successful at teaching language cooperation, though not quite as successful at convincing children it's not a toy. Classrooms use robots mostly for very specific and repetitive tasks, such as vocabulary, attendance and behavior imitation. This type of Artificial Intelligence-powered technology can learn as it teaches, in tandem of creating a persona (albeit artificial) of unbridled knowledge and limitless patience.

#### 4.1 Classroom Robotic Assistant and vital Classroom skills

Salawu & Afolabi (2002) opined that in order to maximize teacher effectiveness, there is the need for the teacher to put into practice some teaching skills. These are:

1. Set induction
2. Stimulus variation;
3. Non-verbal communication;
4. Questioning;
5. Instructional media'
6. Reinforcement;
7. Closure;
8. planned repetitions (communication redundancy)
9. Use of examples and illustration.

##### 4.1.1 Set Induction

NTI (2009,p.203) explained that this is what you as a teacher do at the beginning of a lesson. It has been established that if the teacher succeeds in creating a positive set, the likelihood of pupil involvement in the lesson will be enhanced. The dressing and appearance of a humanoid Classroom Robotic Assistant alone is enough joke to set induce the Students before settling down for the Lesson of the day.

#### 4.1.2 Stimulus Variation in the Class

There are lots of competing external stimuli that can affect negatively, pupils' learning. The extent to which pupils are able to benefit from the classroom instruction will be determined by the degree to which the teacher is able to shift the attention of the pupils' mind away from the visible and many a time, invisible external stimuli (NTI, 2009, Chapter 3). A Classroom Robotic Assistant is good at easing cognitive stress. Each Lesson has been divided in blocks of time. So it knows when exactly to throw recorded jokes and music tracks to free the over-concentrated students. Upon receiving feedback from a Robot, the learners would laugh out loud, enthusiastically participate in the tasks, and show great willingness to talk.

#### 4.1.3 Non-Verbal Communication Skills

The degree of occurrence of learning depends on the way and manner the learnable items are encoded by the teacher. Research findings according to Salawu & Afolabi (2002) have however revealed that not less than 80 percent of our total communication was affected through non-verbal communication. There is more to non-verbal communication than gesticulations. A Classroom Robotic Assistant has a nodding head and moving hands too. So, it uses the skill of Non-verbal communication to tell the class to stand or sit.

#### 4.1.4 Questioning Skills

Questioning helps in calling a mind wondering student to order and keeps every student at alert in the classroom. Since no student knows when the teacher may call on him/her, everybody pays attention and gets prepared for the "bullets" from the teacher. It as well serves as evaluation instrument to the teacher. The student's response to question in the class promptly informs the teacher of the student's understanding or otherwise of the lesson (NTI, 2009, p.203). This is the simplest thing the Classroom Robotic Assistant implements. It has been already encoded with questions intermittently as the lesson proceeds. And when the questions are answered wrongly, it takes record as to know how to evaluate the students' learning outcome.

#### 4.1.5 Instructional Media Skills

The Instructional materials that are handled by Classroom Robotic Assistant are already embedded into it, so it is unlike the hardware type of Instructional materials that needs much carefulness to handle.

#### 4.1.6 Reinforcement Skills

NTI (2009,p.203) defines reinforcement as a kind of feedback given to the students as a result of the students' performance in a particular task. It further opined that if a student knows that he is performing a task well, he is likely to desire to continue doing that good thing and even may be doing it better than before. It can however be argued that a student who knows he is performing poorly may want to struggle to improve if he is encouraged and motivated with some other incentives. Classroom Robotic Assistant easily notes a student who answers questions correctly and uses multimedia reinforcement (playing of music or dancing) on such student.

#### 4.1.7 Closure Skills

Closure is the technical teaching skill that a teacher can use to help students perceive the logical organization of a classroom lesson. Here, the Classroom Robotic Assistant recapitulates the points it has taught before exiting the class.

#### 4.1.8 Planned Repetition

Repetition occurs when an action that has taken place before takes place at least once again. Sometimes such an action can take place several times over after the first occurrence. Psychologists believe that when an action occurs again and again, it implies that the object (person) that emits the action is certainly receiving a positive feedback or reinforcement to warrant the re-occurrence of the action (NTI, 2009, Chapter 3). Repetition can be intentional, planned and purposeful when the need arises. It is easier for a Classroom Robotic Assistant to plan repetition. When the Robot does not get the feedback expected from the students or when majority fails its assignment, it goes back to recall on what it has taught the students as to refresh their minds ones again.

#### 4.1.9 Examples and Illustrations

According to NTI (2009,p.203), examples and illustrations play vital roles in assisting learners to assimilate what the teacher says in the class. Examples, it appears are more real and concrete than illustrations. Classroom Robotic Assistants give examples that have been encoded in them. It has a user interface embedded on its chaste region. This interface can be used to display illustrations and examples of the subject matter.

### 5. What then is expected to speedily advance the ICT pace of Nigerian Education?

Osunde & Ogiegbaen (2005) posited that Classroom, equipment, furniture and other instructional materials are very inadequate to promote effective teaching and learning in Nigeria. Teachers also are not finding the pay condition bestowed on them by the government of the day very funny. It is either that the salary is not optimal or that teachers are being owed. So, government should not only make teaching jobs attractive by good pay, but should also implement Classroom robotic Assistant to ease the stress of teachers. According to Kazeem (1999), the willingness to go to an extra mile to ensure good students' performance is enshrined in the teacher's motivated spirit and such may be frustrated when there is no encouragement and benefit on the side of the teachers. Since the feelings of the teachers have been and is still being compromised by the government of the day, it therefore would be very important to categorically say that the man-man form of instructional material delivery alone is no longer favorable. A hungry teacher can't possibly deliver his or her course contents perfectly but an Artificial Intelligence Robot can. When procured, programmed and installed with the teacher's knowledgebase, a Classroom Robotic Assistant (CRA) embedded with Simulation, Voice recognition system and recording tool can stand and teach theoretical courses with perfection. If such Classroom Robotic Assistant is acquired, all a teacher needs to do is to practice his skills in front of the Robot which has been programmed to record and understand the teacher's language and

gestures. After such practices, the Robot can fully come to the classroom to teach the students while the teacher watches out for where human assistance is inevitable or where extracurricular activities are needed. As a human, the Robot comes to the class, recognizes the number of students in the class with its sensor, and takes attendance by name-calling and voice recognition technique. The Robot also takes into consideration and cognizance, all the teaching skills needed from a teacher to deliver his course contents perfectly. In other words, to be supportive to teachers and advance the students, Nigerian Educational system should acknowledge the application of Computer Robotic Assistant (CRA) as it will go a long way to ameliorate the stress of man-man tutor. Meanwhile, knowledgebase Mechanisms should be used while preparing instructional materials for the students and the CRA. This will make course contents readily available and accessible from any part of the world. Otuu (2014) stated thus: A Knowledgebase is the collection and backup of the entirety of what a human expert knows to be used in later times. To create a knowledgebase, the expert involved has to avail himself for knowledge extraction. After this, the knowledge is stored in order to be assessed in a later time. A knowledgebase of a Medical Doctor or an expert in medicine is enough to treat a non-surgical illness because all that he knows is retrieved from him and stored for future reference. This is why it is important for an expert to be truthful when building his knowledgebase in order to avoid mistakes when his knowledge is applied to solve a problem. Instructional materials prepared from curriculums should be saved and updated in a knowledgebase. Such knowledgebase should be encoded into a Robotic system to perform the task of expert remembrance and simulation when the teacher is weak. While there are obviously things that human tutors can offer that machines can't, the future could see more students being tutored by tutors that only exist in zeros and ones. There are programs which can teach students fundamentals of mathematics, but so far aren't ideal for helping students learn high-order thinking and creativity, something that real-world teachers are still required to facilitate. Yet that shouldn't rule out the possibility of AI tutors being able to do these things.

## 6. Conclusions

So far, Artificial Intelligence has proven successful with the most basic components of behavioral education and cognitive learning. Furthermore, the physical presence of a robot and receiving its hints and applause could bring about significant learning gains. While major changes may still be a few decades in the future, the reality is that artificial intelligence has the potential to radically change just about everything we take for granted about education. Education could look a whole lot different a few decades from now; and with the rapid pace of technological advancement that has marked the past few decades, advanced tutoring systems will not be a pipe dream for Nigeria.

## Reference

- [1] Awotua-efeb, E.B. (2001). Effective teaching: Principles and Practice. PortHarcourt: Para graphics.
- [2] Beal, C. R. (2013). AnimalWatch: An intelligent tutoring system for algebra readiness. In R.Azevedo & V. Aleven (Eds.), International Handbook of Metacognition and Learning Technologies, pp. 337-348. New York: Springer.
- [3] Beverly P.W, Chad H.L, Vinay K. C. , & Janet L. K. (2013). Special Issue on Intelligent Learning Technologies, AI Magazine Fall 2013. Version 10-Jun-13.
- [4] Cohen P.A., Kulik J.A., & Kulik C.L. (1982). Educational Outcomes of Tutoring: A Meta-analysis of Findings, American Educational Research Journal, 19(2), 237–248.
- [5] Corcoran, T., & Goertz, M. (1995). Instructional capacity and high performance schools. Educational Researcher, 24(9), 27–31.
- [6] History of Educational Technology.(n.d). Retrieved March 12, 2016, from Nigeria, Education communication Technology website, <http://edutech202.blogspot.com.ng/>
- [7] Ibe, B.G. (1998).The Selection and use of Instructional materials. Implications for teachers' Effectiveness. J. Educ. Media and Technol.3(1):66-86
- [8] Joint Communiqué Review of Cooperation Between the Federal Republic of Nigeria and UNESCO signed in Abuja, Nigeria, 18<sup>th</sup> November, 2002.
- [9] Johnson, B.D. (2014). "Science Fiction Prototypes Or: How I Learned to Stop Worrying about the Future and Love Science Fiction" (PDF). Retrieved April 17, 2014.
- [10] Kazeem, S.O. (1999). Correlates of job motivation of workers in selected public and private secondary schools in Ife-Ijesa Zone, Osun State, Nigeria. Master of Arts in Education thesis. Department of Educational Foundations and Counselling, Faculty of Education. Obafemi Awolowo University, Ile-Ife, Nigeria.
- [11] Mbadiwe H. C. & Anulobi J. C. (2013). Availability and utilization of instructional materials in teaching and learning of library education in tertiary institutions in Abia state. Journal of Educational Research 2(8) 111–120.
- [12] Meet Nigerian Engineer. Retrieved November 10, 2016, from Nigeria, naijaloaded website, <http://www.naijaloaded.com.ng/2016/07/17/meet->

nigerian-engineer-ishola-babatunde-builds-robots-home-photos/

- [13]NTI (2009). Teaching Practice Manual. Kaduna: National Teachers Institute (NTI) Press.
- [14]Nwachukwu, C.E. (2006). Designing Appropriate Methodology in Vocational and Technical Education for Nigeria, Nsukka, University, Trust Publishers
- [15]Ogunranti, A. (1982). Educational Technology: Basic concepts and issues. Nsukka: University Trust Publishers.
- [16]Okebukola, P. (1997). Old, new and current technology in education. UNESCO Africa, 14(15), 7-8.
- [17]Olaitan, S.O, & Aguisiobo, O.N (1994).Teaching of clothing and Textile. New York: John Wiley and Sons Publisher.
- [18]Osunde K. & Ogiegbaen M. (2005). An assessment of factors associated with students poor performance in senior school certificate English language in Nigeria. Language in India. [http: www.language in India.Com/April 2005/English Nigeria. Html.](http://www.languageinindia.com/April2005/EnglishNigeria.html)
- [19]Otuu, O.O. (2014). Universe of Computer: A guide to Data Processing. Onitsha: Sans-Prints publishers.
- [20]Salawu, I. O. & Afolabi A. O. (2002). Microteachers: Theory and Practice. Odumalt Press & Publisher.
- [21]Shin, N., & Kim, S. (2007). Learning about, form and with robots: students' perspectives, Proc. 16<sup>th</sup> IEEE Int. Symp. Robot and Human interactive Communication (RO-MAN), Jeju, Aug 2007, pp. 1040 - 1045
- [22]Vangie, B. (2015, April 12). Latest Technology terms. Webopedia. Retrieved from <http://www.webopedia.com/TERM/A/authentication.html>.

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