DEVELOPMENT AND VALIDATION OF A COMPUTER- ASSISTED INSTRUCTIONAL PACKAGE FOR LEARNING BASIC SCIENCE IN NIGERIA

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Abstract

The emergence of Information and Communication Technology (ICT) revolution in the nation generally calls for update in teaching strategies. This study therefore developed and validated a Computer- Assisted Instructional Package (CAIP) for teaching a physics concept in Basic Science in Nigeria. The package was based on the Ina-Fourier (1994) instructional design model. Validation was done in line with the Dick, Carey and Carey's (2005) validation model. Seven students from target population participated in one-one validation with the total positive response of 85.7%, 12 students were engaged for the small group validation with the total positive response of 94.6% (on agree and disagree scale) while 30 students were engaged for the field trial evaluation with total positive response of 80.3% (on agree and disagree scale). Two physics experts and five (5) Basic Science teachers participated in the validation of the content area while two Senior Computer Programmers and two specialists in Educational Technology were also involved in the validation. Two instruments were employed: the evaluation questionnaire and the CAIP. All the instruments were face and content validated. Test-retest method was used to find the reliability coefficient of the instrument. The scores were correlated and analyzed using Pearson Product Moment Correlation. The result obtained was 0.78 at 0.5 level of significance. The overall reaction from the validating team was that the developed package (CAIP) is valuable for learning physics concept in Basic science. It is therefore recommended that CAIP should be produced to teach physics concepts in Basic Science on large scale.

Keywords: Development, Validation, Media package, CAIP, Evaluation Questionnaire, BSAT

Introduction

Every country desires and aspires to be among those that have been rated as advanced. Information and Communication Technology (ICT) is indispensable for any country that wants to belong to the global village. Integration of ICT into the teaching-learning process is adopted through the use of computers and other technological materials in delivering curriculum contents. Teaching and learning strategies can be strengthened by the use of computers. Computer technology can be used to complete school work more efficiently, either through the use of dedicated educational software or by simplifying basic tasks such as written assignment, checking of results, registration, among others. According to Abba (2003), to benefit from the opportunities derivable from the use of technology in learning, effective strategies should be provided for acquiring and using knowledge. He explained that science education in general and Basic Science in particular today, demand for teachers that are capable of handling the new technology and helping students interpret, re-package information and provide information - rich environment for communication. Technological revolution has placed a lot of demand on teaching and learning.

Computer-Assisted Instruction was defined by Sanni and Osungbemiro (2004) as programmed instructional material presented by means of computer or computer systems. They are of the opinion that the problem of lack of interest shown in scientific studies could be minimized by the adoption of a more innovative approach based on information technology. The innovative approach mentioned by these researchers is the use of Computer-Assisted Instructional Packages or Computer-Aided Learning.

Computer–Assisted Instructional Package is a technology- based method of instruction which can be used effectively to teach. To facilitate the use of computer and packages in teaching and learning, acquisition of basic ICT skills and capabilities has recently been made mandatory as part of the national minimum standard for teacher education and first degree education. Also, all universities in Nigeria have made ICT skills a requirement for all students in form of general studies that must be passed before graduation. Thus, the teacher education colleges have also been impacted by the current ICT revolution. (Ekireghwo, 2001).

Development of software occurs in three phases. They are design, develop and evaluation (validation) (Brandie et al 2000). To develop a package, models are selected (adopt) or combined/modify (adapt) to bring out the desired results. Several models have been developed for managing software development. One model developed by Ina Fourie model developed 1994 on the design of multimedia packages for distant teaching which consisted of seven phases. They are (1)determination of the need and situation analysis; (2) Determination of aims and performance objectives and development of items for evaluation; (3) Design of study material, including development of a teaching strategy and media selection and integration (e.g. the inclusion of sound and video); (4) Development and preparation (this includes story boarding and programming); (5) Implementation and use; (6) Assessment of student progress; and (7) Formative and summative evaluation on a continuous basis throughout all phases. (Fourier, 1994:220)

Several researchers have developed and validated packages on Science subjects. Among them were Philip and Moss (1993) on Biology, Afolabi (2006) on Biology, Oyelekan (2008) on Chemistry and Mahmud et al (2009) on Mathematics. All the developed packages were validated and field-tested. None of them has the same premise with the present study as this research work considers the foundation of learners in science and the developed package is meant for Junior Secondary Students for learning Basic Science and not Science as a single subject. The package centered on Physics-related concepts of Basic Science which had been identified and considered difficult to comprehend by teachers and students due to its abstractness.

Before 1999, Basic Science was taught as Integrated Science but in 1999 Universal Basic Education (UBE) Programme was initiated which changed integrated science to Basic science in the first 9 years of the education system, i.e., primary school and the junior secondary school. The curriculum for Basic Science is designed to allow curriculum planners and implementers to adequately target pupils' needs and interests in a rapidly changing society like Nigeria. Since science is an indispensable phenomenon, it is imperative to look for better ways of teaching it. According to Agusiobo (2000), Basic Science curriculum planners stress three basic strategies in teaching the subject. They are the use of discovery teaching method, the inclusion of problem- solving activities; and the involvement of students in open- ended laboratory exercise.

The problems facing the teaching and learning of Basic Science emanated from the curriculum planners. The syllabus drawn for the three years was so voluminous that teachers could hardly cover them within the duration given, i.e., three periods of 40 minutes each per week. As a result of this, teachers rushed to finish the syllabus but not to achieve the set goals and objectives (Afolabi, 2006). Difficult concepts, especially those that are abstract in nature, could not be taught effectively using conventional method which consumed more time and teachers needed time to gather materials for demonstration at different intervals.

Odetoyinbo (2004) recommends that Basic Science teachers be exposed to various teaching techniques, such as inquiry, problem- solving, co-operative learning and concept mapping

among others to carry out hands–on tasks and activities in order to maximize the gains of Science. NERDC (2006) outlined the following as the problems facing the implementation of the Basic Science curriculum include inability to meaningfully interpret the performance objectives; skipping unfamiliar content areas; inability to organize activities for children; skipping activities where materials are not readily available; inability to identify sources of teaching aids; lack of assessment skills; and rushing the pupils to finish the scheme of work.

Well-developed packages can solve all the identified problems and simplify the teacher's work. This makes learning easier and faster. There is an urgent need to improve the performance of students in Basic Science as most of them have already created the impression that science is a difficult subject. They believe they can pass other subjects easily without stress. If learning of the subject is made interesting and technology- based, it is hoped that students of different ability levels irrespective of their gender will strive to improve in their academic performance in any instructional setting they find themselves.

In a new millennium when science and technology are expected to be integral part of the world culture, the focus should be on how to obtain and sustain effective strategies for teaching Basic Science, which is supposed to be the bedrock in the teaching and learning of pure and applied sciences at the higher level of education (Daramola, 2000).

Statement of the Problem

Basic science is meant to arouse students' interest, provide good foundational knowledge and encourage their enrolment in science -related courses at the Senior Secondary School level and to improve performance in the subjects. Presently, the margin in enrolment between science and non-science students is very wide (Oyediran, Agoro & Fabiyi, 2004). The margin is in favour of the latter, both at the senior secondary level and at the tertiary level of education. This is a problem because the teaching and learning of Basic science, which is the foundation for the study of the sciences at higher levels is at the lowest ebb. When the foundation is good, the build-up will be strong. Also, the emergence of Information and Communication Technology (ICT) revolution in the nation generally calls for update in teaching strategies; hence, there is a need to experiment the use of Computer Assisted Instructional Package for effectiveness and comprehension.

Purpose of the Study

This study developed a package on selected topics in Basic Science to find out if learning could be enhanced through CAIP than using conventional method. Also, the study set to find out if the developed CAIP covered all the required areas of the selected topics in the Basic Science curriculum using step-by-step approach; and if the package is well validated.

Research Questions

In order to address the problem better, the following research questions were raised:

(i) What are the steps involved in the development stage of a Computer-Assisted Instructional Package?
(ii) How was the developed Computer-Assisted Instructional Package validated?
(iii) To what extent has the developed package CAIP covered all the required areas of the selected topic in the curriculum using step by step approach?

Research Design

The study develops and validated a courseware titled Computer-Assisted Instructional Package (CAIP) based on Ina Fourie (1994) model. The model addressed the background of students, age and instructional setting and the differences by providing significant experiences for each individual learner.

Sample and Sampling Technique

The selected topics for the content of the package cut across JSS 1-3 in the Basic science curriculum. Therefore, the target population for evaluation of the developed package was all JSS 3 students in Ondo State. The sample comprised of 120 JSS3 students selected from three private Secondary Schools. A purposive sampling technique was used in selecting the samples. The criteria set for this study required that the research samples are selected from schools where students and their teachers were computer literate and there are enough set of computers to serve the study groups.

Research Instruments

The instruments for the research were (1) Treatment instrument which is the Computer-Assisted Instructional Package (CAIP) and Evaluation Questionnaire.

This study adopted the design model provided by Ina, Fourie (1994) and the social constructivist learning theory to develop the package. The design model put into consideration the age of the subjects that are meant to use the package, aims and objectives of teaching the selected topics. The researcher developed the package with the assistance of four professional computer programmers. The teachers were expected to use the CAIP to deliver their Basic science lessons on the selected topics. Although, the contents for CAIP could be selected from any of the teaching subjects and topics, the researcher made consultations with five secondary school teachers teaching Basic science to identify difficult concepts used for dummies before concluding with the selected topic. Evaluation Questionnaires were designed for students, teachers and experts. They are the Content Expert Questionnaire, questionnaire for programmers and specialists in Educational Technology (Expert Evaluation Questionnaire), Students Validation Questionnaire (SVQ), {Individual Validation Questionnaire (IVQ) and Group Validation Questionnaire (GVQ).

Validity of the Instrument

Manuscript of CAIP was given face, content and constructs validity by specialists in Physics and Integrated Science in two Universities. Corrections and suggestions were effected before given to programmers for package production. The same group went through the package after production. Students outside the research Zone but within the population of study also validated the package for comprehension. Three sets of questionnaire were designed to validate CAIP after production. Observations were recorded and corrections effected. Questionnaires were validated by five specialists from two universities. Experts that validated the instruments included individuals who have expertise in instructional design and test construction.

Reliability of the Instruments

A test-retest method was used to find the reliability of the test instrument. An equivalent school outside the research zone was used for the pilot study. Questionnaires were administered to the group of 30 students in JSS3. After a period of two weeks, the same set of questionnaires was re-administered to the same group of students. Two sets of scores were correlated and analyzed using Pearson Product Moment Correlation (PPMC). The results were 0.78, 0.75 and 0.76 at 0.05 level of significance.

Results

All the data were analyzed descriptively using simple percentage.

Research Question One: What are the steps involved in the developmental stage of CAIP?

Development of CAIP

The study adopted the design model provided by Ina, Fourie in (1994) and the social constructivist learning theory. This is a traditionally designed model which is linear and sequential in nature. It emphasized the role of the designer as the expert. The design model put into consideration the age of the subjects that are meant to use the package, aims and objectives of teaching the selected topics as recommended by the National Education Research and Development Council (NERDC) Curriculum on Basic Science. The adopted model allowed development of the package to take less time and effort as it starts with specific set of prescribed objectives.

The team named the planned topic and its content as Scheme for Computer Assisted Instructional package (SCAIP). This was typed out from the curricula and developed, using viable teaching strategy including selection and integration of media, and copies were made for Basic Science teachers in five different schools for verification and validation. This is to ensure that nothing important has been left out and that there was no misinterpretation of concept. Useful ideas raised by the teachers were given consideration on the SCAIP before the final scripts were made for the production. The SCAIP was divided into 5 scripts with each of the scripts lasting 30 minutes for an average student. Script one dealt with meaning and concepts of energy. It considered the sources of energy, forms of energy and how the different forms could be converted from one form to another. Script two was on “work, energy and power” and its concepts. Script three was made up of Heat transfer and methods by which heat could be transferred. Script four treated electrical energy, conductors and insulators; while script five, also on Electrical Energy explained the concept of electron flow, types of circuit, some materials in the house circuit with their functions and how the students could read the electric meter in their various homes for billing.

At the production stage, the scripts were coded into computer readable language by the professional computer programmers that worked with the researcher for the development of CAIP which made it suitable for classroom instruction. The basic markup language used in describing the fonts, colour, graphics and texts in the package is called Hypertexts Mark-up Language (HTML). HTML gives users a way to identify the structural part of a document. The Editor used, where the source codes are typed before further processing was the macromedia dream weaver 8. Macromedia firework 8, Macromedia flash 8, Corel draw and Swishmax applications were used for the graphic and animation works in the package. Hypertext processor (Php) was the server-side language used for processing and validating the questions after each of the scripts in the package. The local host (server) which serves as the internet base on the system used for this package is called the Apache wamp server. The simplicity save Cascading Style Sheet (CSS) was used to enhance the html codes in the production. Microsoft word 2003 was used for the texts while CorelDraw was used for the graphics. Digital camera was used for snapping some of the images in the package while image scanner was used to scan some images got from websites into the work. Laptops, desktops and notebook systems, headphone and empty CD-ROMs were also used for the production. CD-ROM was the tool that houses the developed package for its availability, accessibility and efficiency.

To access information on the software product (the prepared package); insert the CAIP software (CD-ROM) into the system, five files will be displayed. The files are: CAIP, Answers, install_flash_play_ax, Installation guide of CAIP and Wampserver2.0b. User clicks on installation guide of CAIP which presents the steps to be followed for successful installation, nine steps to be followed will be displayed on the monitor. The work is made so flexible that it can be launched and used on any platform of operating system. It is interactive in nature. However, to use the developed package, users do not need any prior knowledge of the languages used to develop the package. The package is just like any other software products and need to be handled with care. It should not be scratched or rubbed on any

rough surface and needs to be kept in a dust-free shelf. The course content of the old JSS3 curriculum in Integrated Science on Energy conversion and transfer but cut across the new JSS 1-3 curricula in the Basic Science formed the Intended Learning Outcome (ILO) contained in the program. It is a self-instructional interactive package which lasts for 2 hours 30 minutes for the average student. This means that it contains 5 scripts, which lasts for 30 minutes each. It is structured in the following ways:

A folder, two short texts on installation guide and answers with the set-up of wamp-server and adobe flash player appears on the screen as the disc is inserted. The user clicks on the installation guide. This directs the user on how to access the content of the CAIP. After this, the guide instructs user to install the wamp-server. From the Wamp-server, users will right-click on the www directory, where the CAIP folder will be copied. User returns to the wamp-server from where he/she will click on the local-host. A page will be displayed on which the user searches for the CAIP project on which he/she will click. The main menu appears with the content of the CAIP. The main menu or homepage is the entry point to the content CAIP presents. Main menu implies some type of top-level index. It is the starting point to begin the program. It also presents the sequential order for content presentation. User clicks on "instruction". The student reads this for about three minutes. The five scripts are arranged consecutively after the short text. At the end of each script, there are questions based on the preceding text in the scripts followed with options (a) to (e) out of which the student picks one. A feedback of "correct" or wrong will be given by the computer.

Students can go back to the text and the diagrammatic illustrations to re-study them if any of the supplied answers are wrong. He then makes another attempt. The sequence of text display, question, answer options, feedback continues until all the contents of the package have been covered. The student cannot proceed to the next script unless he understands the previous script and get all the questions that followed correctly.

Research Question Two: How was the developed package CAIP validated?
Association for Educational Communication and Technology (AECT) 2007 recommended that for any instructional media designed and developed to be selected and approved for use, experts that are relevant to the work and the intended end-users must be involved in the validation processes. As a result of this, Validation of the developed package (CAIP) was done in line with Dick, Carey and Carey (2005)'s recommendation. According to them, validation of developed packages took the following forms:

(i) Expert validation;
(ii) One to one validation with students (the validation model recommended minimum of three students);
(iii) Small group validation with students (minimum of eight students); and
(iv) Field-trial evaluation with students (thirty students at least).

This method of validation was considered appropriate because it corresponds to the AECT's recommendation that the process must involve experts and students who are the end-users. Manuscript prepared by the researcher and five selected Basic science teachers was validated by specialists (lecturers) in physics and Basic science in two Universities - Adekunle Ajasin University, Akungba-Akoko and University of Ilorin, Ilorin. The manuscript was given to the experts for face and content validity. Corrections and suggestions were made and effected before it was given to the programmers for production. After production, the same group of experts in science education and another programmer went through it and necessary corrections were made.

Input and feedback from students and experts which include the teachers are important components of the developmental-process. Students that validated CAIP include JSS 3 students within the target population of study. Those in the expert group include individuals

who are experts in physics, Science education, instructional design, instructional technology and qualitative research.

Three (3) questionnaires were designed to validate the CAIP after production. At the end of each of the questionnaires, there was room for comments where observations could be written apart from the ones mentioned in the questionnaire. The questionnaires were made up of statements unto which options of strongly agree, agree, disagree and strongly disagree responses were given. The questionnaires are:

(i) Student Validation Questionnaire (SVQ) for individual and group of students. Seven (7) students were selected for individual validation within the target population and twelve (12) students for group validation. This questionnaire is made up of eleven (11) statements.

(ii) Content Expert Questionnaire (CEQ). This is made up of eight (8) statements and was given to five (5) Basic Science teachers in the Junior Secondary Schools within the target population, two physics lecturers and two science education lecturers in Adekunle Ajasin University, Akungba – Akoko; and University of Ilorin. The questionnaire was given to them to ascertain the adequacy of the developed CAIP in line with the recommendation of the NERDC in the UBE scheme of the Basic Science curriculum for Nigerian Junior Secondary Schools, they considered the content in terms of tense and grammar used, teaching methodology, legibility and clarity, nature of the questions after each of the scripts etc.

(iii) Programmers and specialists in Educational Technology Questionnaire (PETQ). This consists of eight (8) statements and was given to two (2) senior computer programmers and two (2) specialists in Educational Technology.

Research Question Three: Did the developed package cover all the required areas of the selected topics in the curriculum using step by step approach?

Topics used for preparing dummy for the developed package were decided upon by stakeholders and conclusion was made. Basic science teachers in the development team brought the NERDC (2007) recommended curriculum for Basic Science. This curriculum is divided into seven columns to guide the user. They are: topic, performance objectives contents, activities (teachers and students), teaching and learning material to be used and the evaluation guide. The curriculum was prepared using step by step approach, that is, from simple to complex. This was typed out the way it was arranged in the curriculum and given to five Basic science teachers for vetting to ensure nothing important was left out and no misinterpretation of concept. This was named Scheme for Computer Assisted Instructional Package (SCAIP). Textbooks recommended by the Universal Basic Education for Basic science and the Teacher's guide were used in planning the contents of the SCAIP. Content experts in the team verified and validated the SCAIP before the final production of the manuscript given to the programmers for coding. They all agreed that the content of CAIP covered every aspect of the selected concept- Energy conversion and transfer in the Basic science curriculum designed and recommended for junior secondary schools in Nigeria.

Results of the validation findings are given below:

Content Expert Validation: the subject content expert validation of the computer Assisted Instructional Package was done using the subject content expert validation questionnaire. The result obtained after administering the questionnaire revealed that the 8 validates strongly agreed with every statement in the questionnaire. From their comments, some were able to identify typographical error and graphical errors. All these were corrected before the final production. Some of the contents experts believed that the package could be useful in learning some topics successfully in SS 1 physics. This implies that the target

class (JSS 3) may not be the only class that may benefit from the developed package going by the Nigerian curriculum design.

Expert Validation (programmers and specialists in Educational Technology): Two programmers and two specialists in Educational Technology used the expert evaluation questionnaire to validate Computer Assisted Instructional Program (CAIP) after production. These validations were based on the following criterion: legibility, typography, animation, simulation, navigation, accessibility, functionality, packaging and durability. Two senior programmers and two specialists in Educational Technology were involved in the validation. Reports from the programmers suggested that the main-menu bar should appear on every page to provide the user the options of viewing any aspect of the work at will. According to them, making the main-menu bar to appear on every page will make the package more flexible and interactive. The developing team did not affect this during correction as it was considered that lazy students can easily abandon or skip areas that they are not interested in and proceed to the net stage. As the instruction was programmed, students must pass all the questions after a script before proceeding to the next script. The computer instructs the user to go back to the script to find out why the question was missed, after which the user is expected to proceed to the questions again and re-answer. This requires endurance on the part of the user. Apart from this, they recommended the use of colour in some diagrams to make them fascinating. They commented on the colour used for the texts as not good enough as it may affect the sight of readers (white texts over black background were originally used. This was changed to black text over white background). They agreed that the font size was okay and navigation good enough. They applauded the production for the inclusion of User Instructional manual or guides as it will enable any novice to install with ease and access the package. In terms of legibility, packaging, functionality and durability they considered CAIP superb.

Specialists in Educational Technology considered the concept of the content good enough as it simplifies the topic. Both of them suggested the use of Audio explanations especially in the area of introducing the package when attempting the questions and at the completion of the package to reinforce users. They strongly agreed that the method of teaching matched the students' need and that the content will not confuse students. They agreed that the content of the package will match the level of students in terms of legibility, interpretation and comprehension. They strongly agreed that the graphics used served the appropriate level of students and that correct answers and appropriate feedback were supplied in the package. All the corrections made were effected on the package before the final production was made. Based on their comments and suggestions, colourful pictures were used except for few, background colour was changed and Audio added.

One to One Validation with Students: The questionnaire designed for individual students were given to seven students among the target population. They were to comment on the clarity of the package, simplicity and the aesthetic value of the content if it would hold or sustained the attention of students. From their response, it was gathered that the vocabulary used for the package could be easily comprehended, clear enough, and strongly agreed that the arrangement of the scripts is sequential in nature and it's arranged from simple to complex. The students agreed that they were able to understand the concept of the package better as examples used are more or less what they encounter in their day to day life. They confessed that they enjoyed learning through the package and wish to continue learning through the package since they have sets of computer in their schools with standby generators.

Despite the fact that the students finished the package at different times, the last person still finished within the pace of time i.e. 30 min per script. Students that worked on systems with multi-media speakers and in-built speaker were able to enjoy the audio aspect of the

package, though everybody had access to the contents of the scripts and animation. The participants were optimistic that the developed package CAIP could be used successfully to learn physics-related concepts of Basic Science in Nigeria especially for Remediation purpose. Students were not able to identify any error in the package. The summary table of the response and the percentage response of students to each of the items is on shown in table 1:

Table 1: Summary of the one to one students' validation questionnaire and % response

S/N	Statement	Response					
		SA	A	D	SD	% Agree	% Disagree
1	The content of the software attracted and held my attention more than the other methods my teacher uses to teach me	5	1	1	-	86	14
2	I gained more from the package than teacher standing in class to teach me	4	3	-	-	100	-
3	I understand easily the lesson scripts in the package	3	2	2	-	71	29
4	The scripts are arranged from simple to complex	5	1	1	-	86	14
5	Diagrams in the script are clear and self – explanatory	6	1	-	-	100	-
6	Most of the explanations given are related to things in my environment	4	2	1	-	86	14
7	Examples given in the contents of the script are on our day to day activities	5	2	-	-	100	-
8	The animation and the audio make the package more interesting	4	1	1	1	71	29
9	Questions asked after each of the scripts measures skill and knowledge acquisition	5	-	2	-	71	29
10	The test given before and after exposition to the package covered the content of the package	5	1	1	-	86	14
11	I will like to continue learning on the computer	4	2	1	-	86	14
	Total	50	16	10	1	943	

Key: SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

The one to one validation result of students shows that students are willing to learn through the use of Computer Assisted Instructional Package. To analyze the responses on the questionnaires, strongly agree and agree were merged as one while strongly disagree and disagree was merged as one; this allowed the use of simple percentage for statistical analysis. From the questionnaire given to the seven students selected for this purpose, Six (6) 86% of the students agreed that the content of the software attracted and held their attention than other methods used by their teacher. All the students (100%) agreed that they gained more from the package than teacher standing in class to teach them. On comprehension of the scripts in the package, they all agreed that they understood the scripts with ease. Although (6) 86% of them agreed that the scripts were arranged from simple to complex, (1) 14% of them disagreed. Despite this, all of them (100%) agreed that the diagram and illustrations in the scripts is clear and self-explanatory. This was confirmed when all except one of them (14%) agreed that the examples used in the content of the

scripts are on their day to day activities, hence, no foreign idea or example was used. Though they all complained that the audio of the package was bad they applauded the use of animation that is thought provoking to make the package more interesting. The total positive response from students for the one to one validation was 85.7%.

After each of the scripts, questions were asked (formative evaluation). They all agreed (100%) that the questions were straight forward, and treated all the domains of learning i.e. affective, cognitive, and psychomotor they agreed that the question measure skills and knowledge acquisition. They agreed that the test treated the content of the package.

Finally they all pleaded to continue learning on the computer and recommended that more topics should be prepared on packages.

Table 2: Summary of the Students' questionnaire for group of students used for the validation of Computer-Assisted Instructional Package (CAIP).

S/N	Statement	SA	A	D	SA	% Agree	% Disagree
1	The contents of the software attracted and held my attention more than the other methods my teacher uses to teach me	11	1	-	-	100	-
2	I gained more from the package than teacher standing in class to teach me	9	3	-	-	100	-
3	I understand easily the lesson scripts in the package	10	2	-	-	100	-
4	The scripts are arranged from simple to complex	8	2	2	-	83	17
5	Diagrams in the script are clear and self-explanatory	8	2	2	-	83	17
6	Most of the explanations given are related to things in my environment	9	2	1	-	92	8
7	Examples given in the content of the script are on our day to day activities	10	2	-	-	100	-
8	The animation and the audio make the package more interesting	11	1	-	-	100	-
9	Questions asked after each of the scripts measure skill and knowledge acquisition	10	2	-	-	100	-
10	The tests given before and after exposition to the package treated the content of the	8	3	1	-	92	8
11	I will like to continue learning on the computer	11	1	-	-	100	-
12	I prefer working alone on computer than in group	9	3	-	-	100	-
13	I enjoyed working with my peers to learn on computer	8	2	2	-	83	17
14	Every member of my group participated actively in the work	8	3	1	-	92	8
	Total	130	29	9		1325	75

Key: SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

Most of the response of the students in group tallied with that of students in one-to-one validation results which reflected positive attitude towards the use of Computer Assisted

Instruction in learning the selected topics. All the students that participated in group validation agreed that they like working alone but 83% of them still which to learn with peers to learn on the computer. This implies that they are ready to learn in any of the two instructional settings i.e. group or individual. 92% agreed that every member of the group participated actively in the work. This gives room for low ability level students to ask questions from their peers to explain areas that are not clear to them in simple and clear language that could be best understood. Though this may slow down and waste the time of high ability level students as the bulk of the work most of the time will be on them. Hence, rather than teacher dominating class, students feel empowered and less afraid to contact others. They believe they learn faster and better with CAIP. Shy students can feel free in their own students'-centered learning environment. This can improve the level of knowledge acquisition. CAIP test students' ability and mark their progress. It gives to the active participation of the learner. Their overall positive response to the questionnaire was 94.64 %. Since the developed package is meant to be used in teaching Basic Science in Nigeria, the report and candid approval by the teachers and students in Nigeria schools are very vital.

Field-trial Validation with Group of Students: The questionnaire designed for field-trial was given to 30 students selected for that purpose within target population. They were to comment on the clarity of the package, content of the package, its simplicity and its aesthetic value. The response gathered was not different from the ones gathered from one to one and group validation. They all agreed that vocabulary used for the package was clear, easy to be comprehended and are sequential on nature. The arrangement of the package to them was satisfactory, as they were arranged from simple to complex. They were able to finish the given task within the given period of 30 minutes per script. The summary of the response of students to the questionnaire during the field-trial validation is shown in table 3:

Table 3: Summary of the field-trial validation questionnaire and percentage response with a larger group of students

S/N	Statement	Response					
		SA	A	D	SD	% Agree	% Disagree
1	The content of the software attracted and held my attention more than the other methods my teacher uses to teach me	20	4	5	1	80.00	20.00
2	I gained more from the package than teacher standing in class to teach me	25	2	2	1	90.00	10.00
3	I understand easily the lesson scripts in the package	18	2	8	2	66.67	33.33
4	The scripts are arranged from simple to complex	20	6	4	-	86.67	13.33
5	Diagrams in the script are clear and self-explanatory	20	4	4	2	80.00	20.00
6	Most of the explanations given are related to things in my environment	20	3	4	3	76.67	23.33
7	Examples given in the contents of the script are on our day to day activities	20	6	2	2	86.67	13.33

8	The animation and the audio make the package more interesting	20	2	6	2	73.33	26.67
9	Questions asked after each of the scripts measures skill and knowledge acquisition	24	4	2	-	93.33	6.67
10	The test given before and after exposition to the package covered the content of the package	20	5	5	-	83.33	16.67
11	I will like to continue learning on the computer	18	2	8	2	66.67	33.33
	Total 80.30%	215	40	50	15	888.34	216.66

Key: SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

Reaction from the students in this group tallied with that of their colleagues with general positive response of 80.30% which was considered good enough by the stakeholders. From their comments, they all confessed to like learning the selected topics using the developed package.

Discussion

Three research questions were raised to guide this study. The development of CAIP was based on Ina Fourie (1994), design and the behaviorist learning theory. The model provided the opportunity of mastering the script step by step. The model prescribed that the stated behavioral goals of teaching that particular topic should be considered. The stated objectives were expected to translate into questions for formative and summative evaluation after each of the scripts on continuous basis. Also the model requested that an identified media should be used, hence during production of this package, Computer software was used (CD-ROM). Manuscripts were translated into Computer readable language. Hypertexts Mark-up Language (HTML) was the basic markup language used in describing the fonts, colour, graphics and texts in the package.HTML give users a way to identify the structural part of a document. The Editor used, where the source codes are typed before further processing was the macromedia dream weaver 8. Macromedia firework 8, Macromedia flash 8, Corel draw and Swishmax applications were used for the graphic and animation works in the package. Hypertext processor (Php) was the server-side language used for processing and validating the questions after each of the scripts. Learners can use the package when they want to read alone or in groups. All these were considered during the developmental stage. The developmental pattern was supported by Oyelekan (2008) when developing Computer-Assisted Instructional Package on electrochemistry for secondary Schools in Nigeria and Omiola (2011) that designed, developed and validated a web-based instructional package in Basic Technology for Junior Secondary School Students.

Validation of the CAIP prototype was done using the JSS3 students who are the end-users of the package. Relevant experts also participated in the validation exercise as recommended by Dick, Carey and Carey (2005). The developed package (CAIP) was validated by selected students based on individual (7 students were involved) small group interaction with the content (12 students) and field-trial (30 students). Observation and comments from the category of students were used to revise the package. Their response to the questionnaire was used to judge the quality and viability of the package developed. 5content experts (Specialists in Basic Science and Physics) participated in the validation process. The 5 content experts agreed that the content of the package developed covered the required areas of the selected topic. The content experts strongly agreed that the SCAIP used for the

content of the package covered the specified areas recommended by the curriculum planners on the selected topic-energy conversion and transfer for the junior secondary schools in Nigeria. All the teachers strongly agreed that the subject content was presented satisfactorily, the theses and grammar were correctly used and that the content will not confuse students. They all agreed that the content of the developed package satisfied the U.B.E Curriculum. Observations were made and corrections were effected before the final production of the package.

Seven Programmers and Educational Technologists went through the prototype of the package to validate its technological aspect. Navigation errors were detected by them and corrections were effected. Students strongly agreed that they could understand easily the lessons script in the package and the drawings clear and self-explanatory. They attested to it that explanation given and drawing are related to the environment. Both teachers and students agreed that the test given before and after exposition to the scripts in the package treated the content of the package. And are arranged from simple to complex, this ensures clarity. This results are in line with the results obtained by Oyelekan (2008) and Omiola (2011) in their various works. AECT (2007) also support the Validation process adopted.

Recommendations

Based on the outcome of this research work, it is recommended that the developed package be used as an adjunct to teach Basic Science in Nigeria as it cannot replace textbooks and the computer system cannot replace the teacher. Best results would be achieved if teachers could monitor and assist students when using the package to learn Basic Science. Also the contents of the package are selected from the JSS 1-3 curriculum contents on energy conversion and energy transfer. Therefore, it is recommended that the package should be used for revision and remediation especially when working towards improvement in performance in the Junior Secondary School leaving examinations. There is a need to allow students to interact with computer and the need to buy ready-made software's on different topics in the Basic Science curriculum. Students hardly interact meaningfully with computers except to access mails and face book.

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