EVALUATION OF COMMERCIAL COMPUTER ASSISTED STRUCTIONAL SOFTWARE FOR SCIENCE AND MATHEMATICS' INSTRUCTION

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Abstract

This study was carried out to analyze commercial software available for science & mathematics instruction in Nigeria secondary schools. Adapting a software evaluation rubric, teachers and students from ten randomly selected secondary schools examined Biology, Chemistry, Mathematics and Physics Software available at Lagos Computer Village in Nigeria. Data obtained was subjected to descriptive analysis to answer the various research questions of the study upon which the following conclusions were drawn among others; that the sampled CAI Software generally have adequate Content for Science and Mathematics Instruction, they are adequate in terms of ease of use and technical quality, but deficient in provision of support materials and illustrations relevant to the user environment. Appropriate recommendations put forward. It is hoped to initiate a collaboration to develop instructional software and train teachers to use them.

Keywords: Computer Assisted, Instruction, Software, Evaluation, ICT.

1 INTRODUCTION

Technological advancement is one of the cardinal goals of the National Policy on Education (FRN, 2008; revised) as means of attaining technological independence and self reliance. This also explains the reasons behind the 60: 40 admission ratios given to science and technological related courses compared to humanities courses in the universities.

The advent of Information & communication Technology (ICT) has revolutionized every facet of human endeavour (Birgit, 2009) hence its benefit must be tapped by the entire education process; from planning to evaluation. The use of computer for teaching at different levels of education has been reported by many studies across the globe (Everett, 2000; Wade, 1995). There are however few or no reports on commercial software available for teaching science and mathematics education, especially in Nigeria

To help teachers cope with the proliferation of software and software sources, a number of resources are available to aid in the evaluation and selection of educational software. For instance, both the "Educator's Handbook and Software Directory" and "Swift's Directory of Educational Software, Apple II Edition" provide listings of educational software on specific subjects for the Apple microcomputer.

Since evaluating software requires teacher judgment and sensitivity, criteria for evaluating software could include such questions as: whether the software is computer-specific to learning; whether the program is fun to use; whether the software allows for practice or experimentation; whether the software is suitable for various age groups; whether the software is open-ended; whether there are learning assumptions behind the software; and whether there are moral values built into the software.

Guidelines developed by the International Council for Computers in Education (ICCE) and the International Reading Association (IRA) for the selection of appropriate classroom software are useful references for teachers who intend to maximize the use of computer in their classes.

A comprehensive approach to evaluating CBE requires multiple levels of design, data collection and interpretation and we must explore many alternatives. Each month sees the introduction of new commercial CBE packages advertised as effective instructional systems. Yet systematic evaluation of the implementation and efficacy of these systems is sadly lacking. In addition, many evaluators continue to employ outmoded experimental designs. Papert (1993) sums up the inadequacy of traditional evaluation designs thus:

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> "The method of controlled experimentation that evaluates an idea by implementing it, taking care to keep everything else the same, and measuring the result, may be an appropriate way to evaluate the effects of a small modification. However, it can tell us nothing about ideas that might lead to deep change"

In education today, we need "deep change," and therefore improving evaluation of CBE has never been more important. Technological advancements are increasing at an ever faster pace especially with respect to telecommunications and multimedia. At the same time, few teachers feel confident and competent with respect to the goals and functions of CBE in their classrooms (Becker, 1992; Siegel, 1994).

Despite some efforts to introduce pre-service teachers to computer education in their teacher preparation programs, Becker (1992) found that over half of the future teachers he surveyed never used a computer in any of their college courses. At least part of the problem may stem from a restricted vision of CBE as simply an alternative delivery system for traditional pedagogy rather than as a tool for implementing alternative pedagogical dimensions.

Evaluation approaches based upon clearer delineation of the pedagogical dimensions within different types of CBE will surely be a step forward.

There are a wide variety of evaluation models which "prescribe what evaluators ought to do and explain how to conduct a particular type of evaluation" (Patton 1982). House (1978 as cited in Patton 1982) has created taxonomy of evaluation models, distinguishable by the audiences the evaluation addresses, the outcomes they examine, the typical questions they ask and the methods they employ. The categories within this taxonomy include: systems analysis, behavioral objectives approach, goal-free evaluation, art criticism approach, accreditation model, transaction approach and decision-making models.

It is not necessary to evaluate only with regards to goals and objectives; instead "goal free evaluation" and "eolithic" evaluations are certainly possible. In fact, Patton (1982) states that; often goals and objectives constrain/limit an evaluation unnecessarily.

Evaluation models can be used to help you define the parameters of an evaluation, what concepts to study, and the processes or methods needed to extract critical data.

Most educational software is designed to foster students' learning outcomes but with little consideration of the teaching framework in which it will be used. Hinostroza and Mellar(2001) presented a significantly different model of educational software that was derived from a case study of two teachers participating in a software design process. It shows the relationship between particular elements of the teachers' pedagogy and the characteristics of the software design. In this model, the 'classroom atmosphere' is embedded in the human–computer interface scenarios and elements, the 'teaching strategy' in the design of the browsing strategies of the software, and the 'learning strategy' in the particular forms of interaction with the software. The model demonstrated significant links between the study of Pedagogy and the study of Information Technology in Education and has implications for the relationship between these two areas of research and consequently for teacher training. The model proposed a perspective on educational software design that takes into consideration not only learning theories, but also teaching theories and practice

If the fast growing educational software market is to be reflected in improvements in the quality of teaching and learning in African classrooms, capacity in evaluating and selecting the material will be crucial. It is important therefore that African educators feel empowered to make informed judgments as to the appropriateness of specific software for their own environments.

This task was embarked upon by this study.

2 STATEMENT OF PROBLEM

The introduction of ICT or computer to be specific in teaching and learning depends on several factors ranging from teachers' related, pupils related to availability and quality. The use of poor quality software for instruction will not only waste instructional time of teachers and students, it will waste the limited fund available for the school system, leads to poor performance in students and discourage the acceptance of ICT by teachers and students. This study therefore sought to analyze available software for teaching science and mathematics, as a precursor for advocating its integration into classroom instruction

guide to the study, the following questions were raised

1. What delivery methods are employed in science and mathematics software
2. What is the adequacy level of science and mathematics software Content
3. How adequate are science and mathematics software in terms of:
   i. Ease of Use
   ii. Support Materials
   iii. Technical quality:
   iv. Assessment

3 SIGNIFICANCE OF THE STUDY

The results of this study will provide useful information for teachers, students and the government in the quest of integrating ICT (Information & Communication Technology) into the nation's educational system at all levels. This will invariably lead to improved performance of students, improved quality of graduates and eventually the achievement of technological advancement goals of the country.

4 SCOPE OF THE STUDY

This study was limited to analyzing the software available for teaching science and mathematics in the market using the adapted rubrics only by science mathematics teachers from selected secondary schools in Lagos State. It did not include the utilization by teachers or students in classroom situations.

5 METHODOLOGY

The study adopted evaluative type of descriptive research designs.

The target population for the study comprise of commercial software available in the market and being used in schools to teach science and mathematics. The accessible population however comprised science and mathematics software available at the computer village, Ikeja; the most popular computer market in Nigeria.

The instruments employed in this study comprised computer set and a software evaluation rubric for teachers adapted from http://www.ed.brocku.ca/~jkerr/sftwreva.htm. The instrument has the following six sections used in determining the suitability of science and mathematics software available in the market.

1. Delivery Mode
2. Content
3. Ease of Use
4. Support Materials
5. Technical quality:
6. Assessment

Copies of the different types of instructional software available at the computer village were collected for analysis. The software were run on the computer and assessed using the adapted rubric by selected secondary school science and mathematics teachers.

The teachers were selected from five public secondary schools in Lagos State. Availability of computers and electricity were considered in selecting the five schools using purposive random sampling technique.

Each item in every section of the rubric were rated on a continuum from 0, 1, 2, 3, 4 to 5 (0 = not included or component is far below standard while 5 = very adequate). The rating scores of the software were converted to percentage and used to determine its appropriateness. Graphical illustrations were also used in the analysis.

RESULTS

The results obtained from the analysis of data on the delivery mode employed in the software sampled are presented in table 2 below:

Table 1: Delivery mode of Commercial CAI Packages for Science & Mathematics Instruction Packages

SUBJECT	TUTORIAL	DRIL & PRACTICE	REVIEW	SIMULATION	TESTING	GAME	DISCOVERY	PROBLEM SOLVING	APPLICATION
BIOLOGY	0	100	0	100	100	0	0	100	0
CHEMISTRY	100	100	50	50	100	0	0	100	100
MATHEMATICS	100	100	0	100	0	0	0	100	0
PHYSICS	100	100	100	0	100	0	0	100	0

Table 1 above shows that all the available commercial software packages sampled utilized tutorial (except biology), drill & practice, and problem solving mode. However, none of the software employed discovery and game modes of instruction for presentation. With the exception of chemistry, none of the CAI packaged employed application in their mode of presentation.

This result is also presented in fig1 below:

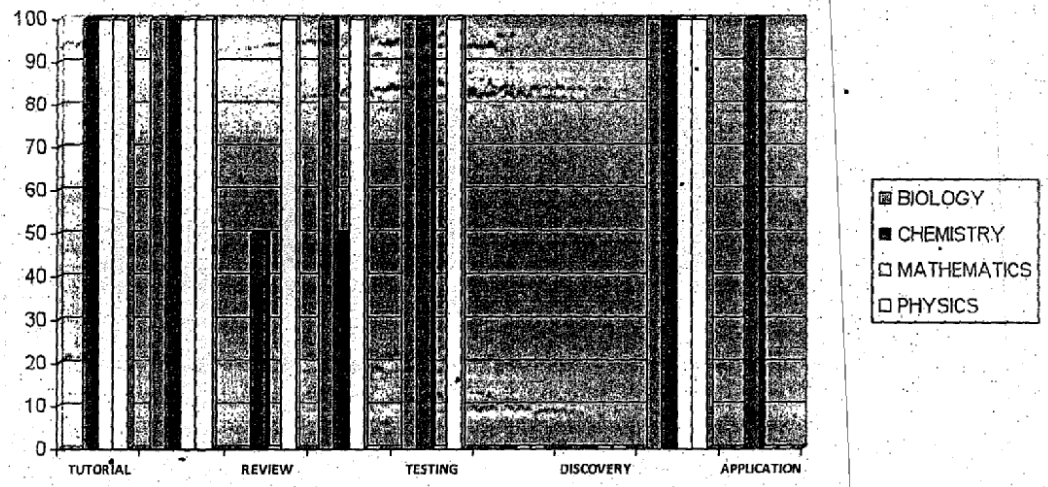

Fig 1: Bar Chart showing delivery mode of Commercial Software for Science & Mathematics

Table 3: Rating score of Commercial CAI Packages

SUBJECT	RATING SCORE IN PERCENTAGE				
	ADEQUACY OF CONTENT	EASE OF USE	ADEQUACY OF SUUPORT MATERIALS	TECHNICAL QUALITY	ASSESSMENT QUALITY
BIOLOGY	75	80.67	44	72	60
CHEMISTRY	82.75	81.25	44	80	84
MATHEMATICS	55	65.5	44	60	56
PHYSICS	75	73.2	40	76	80

From the result in table 3 above, all the software evaluated except the ones for mathematics were rated high, and adequate in terms of content, ease of use, technical quality and possession of quality assessment contents; ranging from 60% to 84%. The mathematics software packages were only rated high in technical quality(60%) and Ease of use(65.5%), where as, they are rated average in adequacy of content(55%) and assessment quality(56%).

All the evaluated software were deficient in adequacy of support materials as rated by the science and mathematics teachers.

This result is further presented in fig 2 below:

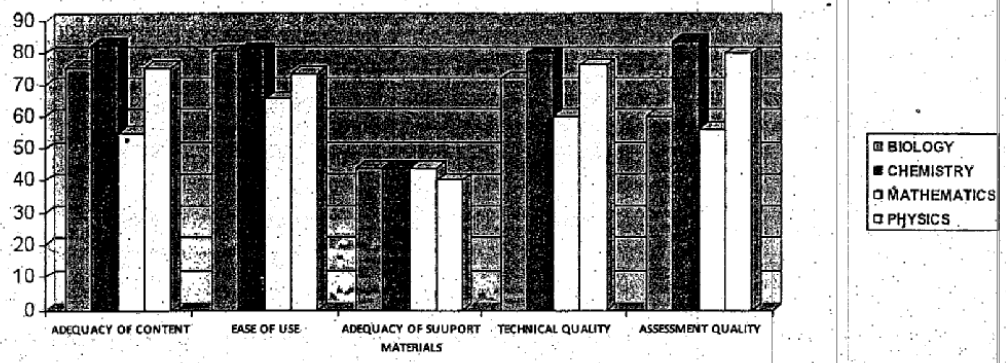

Fig 2: Bar Chart showing Rating of Commercial CAI Packages

7 CONCLUSIONS

Based on the findings from this study as presented above, the following conclusions are drawn:

- Most of the software employed drill & practice, and problem solving mode, but none of the software employed discovery and game modes of instruction for presentation.
- With the exception of chemistry, none of the CAI packaged employed application in their mode of presentation.
- The sampled CAI Software generally have adequate Content for Science and Mathematics Instruction
- The CAI software are adequate in terms of Ease of Use, quick installation and interactivity.
- All the sampled software are deficient in provision of support materials and illustrations relevant to user environment

- The technical quality of the commercial CAI software are adequate to stimulate learning
- Most of the commercial software have assessment adequately incorporated to serve as feedback for users.

8 RECOMMENDATIONS

In order to improve the teaching and learning of science and mathematics in schools, the following recommendations are put forward:

- Computer Teachers in schools and Computer Science education departments of tertiary institutions should be equipped with necessary skills through re-training programmes for developing software/ multimedia programmes for schools
- Subject teachers at all level should be encouraged to develop the skills required to use computer in their instructional activities
- Subject teachers should also be involved in the development of CAI software in their areas of specialization to ensure the adequacy of contents of such software is not only relevant but in line with contemporary instructional practices of their subjects.
- Government and other stakeholders in the education sector should encourage the use of computer and other ICTs to improve instruction by providing enabling environment and adequate facilities and funds.

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