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Contents	Page
Psychological Variables as Correlate of Students' Academic Achievement in Secondary School Economics in Oyo State, Nigeria <i>E. O. Adu & T. Oshati</i>	1
Differences among Age, Gender and School Factors in Ghanaian Senior Secondary School Students' Aspirations for Entrepreneurial Careers <i>Joshua A. Omotosho & Eric Nyarko-Sampson</i>	18
Theory-practice Dichotomy in Mathematics Teacher Education: An Analysis of Practicum Supervision Practices at One Teacher Training College in Zimbabwe <i>Michael Kainose Mhlolo</i>	34
Analysis of Students' Errors on Linear Programming at Secondary School Level: Implications for Instruction <i>E. Chinamasa, V. Nhamburo & M. Sithole</i>	54
The Impact of Computer-Assisted Instruction on Secondary School Students' Achievement in Geography <i>V. Oyedele, D. Munasirei, Y. Oyedele & S. Chikwara</i>	73
Problems Associated with Corporal Punishment as Perceived by Secondary School Students in Ilorin, Nigeria <i>F. N. Bolu-steve, M. C. Ogwokhademhe & M. A. Abejirin</i>	87
Social Media and the Moral Development of Adolescent Pupils: Soulmates or Antagonists? <i>Godfrey Museka & Nisbert T. Taringa</i>	100
The Social Reproductive Role of Christian Missionary Education in Apartheid South Africa: Evidence from History and Research <i>Aaron Ravhudzulo & Tawanda Runhare</i>	121
Book Review <i>Prof. F. Zindi</i>	144

The Impact of Computer-Assisted Instruction on Secondary School Students' Achievement in Geography

V. Oyedele , D. Munasirei, Y. Oyedele & S. Chikwara
Africa University

Abstract

This research, carried out in Manicaland Province in Zimbabwe, aimed to investigate the impact of computer-assisted instruction on students' performance in Geography. The equivalent group research design which included a pre-test post-test control group design was used. Respondents to interviews and pre-test and post-test questionnaires were made up of forty Form 3 students and eight teachers randomly selected from two secondary schools. The data obtained were analysed using t-test, chi-square and SPSS descriptive statistical techniques. The results showed that the computer-assisted instruction (CAI) gave a higher student performance rate in comparison to those who used expository (traditional) instructional strategy (EIS). There was no significant difference on performance between male and female students exposed to computer-assisted instruction. Recommendations for a follow-up study are made.

Introduction

The introduction of computers in schools in Zimbabwe has been a subject of much speculation and controversy especially in terms of the contribution of this new technology to students' academic performance. One of the national newspapers, (*The Herald*, 8 February 2005) notes that among the State's programmes in education in Zimbabwe is the information technology vision that seeks to supply secondary schools with enabling technology to enhance academic performance of the learners.

The government of Zimbabwe is of the belief that for the education system to be an effective one, there has to be an electronic drive through computerisation, (*The Herald*, 11 February, 2005). Computers are believed to be powerful devices that will assist learning of various subjects including Geography. The government believes that the computer has become such a significant gadget that the schools in Zimbabwe cannot do without. It is believed that today's students are the

leaders of tomorrow and therefore a strong foundation for their future should be built through high quality education. To achieve this goal, the government and other stakeholders have distributed computers to various schools in the country to furnish them with these modern e-learning equipment. Examples of secondary schools that have benefited from this programme in Manicaland Province are Gomorefu, Marange and Mweyamutsvene. It is evident that the school system in Zimbabwe is in a period of transition and is in tune with many other countries in the world.

Reactions of educators to the computer and its role as an educational tool cover a very broad spectrum (UNESCO, 2004). Some people are excited, some are passive and others are annoyed. There are also those who are apprehensive about the vast unknowns in the future of education. The availability of computers in schools brings new hope to some whereas to others they are regarded as threatening and alienating equipment. Such a scenario of conflicting views about the introduction of computers and with particular reference to the influence of this innovation to students performance is an issue that has not been thoroughly examined and challenged by researchers today (Scardamalia, 2001). Past findings, as shall be noted, left out some gaps that need to be filled and this has also necessitated this new study on the impact of computer-assisted instruction in Geography.

Research done in the past mainly focused on teacher attitudes towards the implementation of this new technology and questions such as follows were raised:

- a) State schools are throwing millions at new ICT suites, but should the money be funding better teachers instead? Private schools cannot rely on big government grants to enlarge their ICT resources, but they believe money should be funding better teaching staff rather than better computers.
- b) Are we racing towards a digital age in which computers will replace human interaction in schools? (BBC, 2009). However, it is imperative to note that the ultimate goal of the learning process is academic achievement on part of the learners. Thus this study seeks to investigate the use of computers in terms of

performance by secondary school students in Geography in Manicaland Province. This was done with the aim of finding out how classroom practitioners react in the face of this innovation (Sharma, 2008). According to Johnston (2001), this was a well thought out area of study because teachers are crucial in determining a wide range of learning activities in the classroom. Lodge and Reed (2003) rightly state that teachers or educators are required to be so focused on student performance. They further advocate that any new teaching method must be learner oriented and should be examined with respect to its influence on the learners' performances.

One other driving force for this study is the need to find out how this new innovation impacts on the performance of students with regard to gender in the school system. UNESCO (2004) supports this view by championing the need for educators in the contemporary times to find out how technology impacts on academic achievement with some reference to gender. Previous researches dealt with the performance of students in general and overlooked how certain circumstances like the relationship between gender and academic performance in the face of new technology (Reiser a& Dempsey, 2011). According to UNESCO (2004) the conditioning and stereotyping of the girl child starts at an early age and most girl children especially in developing countries have little exposure to new technology and in particular computers. So one can argue that a research investigating the impact of computer-assisted instruction in geography with special reference to the aspect of gender is a yielding experience since boys and girls will be exposed to the same technology without any form of discrimination. This will provide a stable environment from which research can be undertaken.

Research questions

The following are the research questions that guided this research:

1. Do students get motivated when computer-assisted instruction is used as a teaching/learning strategy?
2. Do teachers realise the significance of using computer-assisted instruction for their learners instead of the traditional methods

of teaching?

3. How can computers, as teaching aids, be improved and made available for use in the classroom?

Hypotheses

Two research hypotheses were generated to test the impact of computer-assisted instruction on students' academic performance in Geography.

1. There is no significant difference in terms of performance between students exposed to computer-assisted instruction (Experimental group) and those who are not (Control Group), and
2. There is no significant difference between the performance of male and female students exposed to computer-assisted instruction.

Research design

The research was both quantitative and qualitative in nature. The parallel-or equivalent-group design including pre and post-test control group was used.

Sample and sampling procedures

The source of data was from the Form 3 students in the Mutare district (Manicaland Province) who were the target population. Data were also obtained from the eight teachers who responded to the interview questions.

A sample of 20 students for the control and 20 students for the experimental groups was selected from Form 3 students at Mweyamutsvene and Tsvingwe secondary schools. Stratified random sampling was used as the sampling procedure. Stratified random sampling is a refinement of simple random sampling since, in addition to randomness, stratification introduces a secondary element of control as a means of increasing precision and representativeness. Thus for this study the 20 students for the control and the 20 students for the

experimental group were not just randomly selected but the sex for the students was also considered. Stratified random sampling was made in such a way that the number of girls and the number of boys was proportional so that greater precision could be obtained. A total of 8 Geography teachers were randomly selected from the two schools so that they could act as respondents to the interview questions. Only Ordinary level Geography teachers were selected because they are the ones who are dealing with computers in teaching more than other groups of teachers. The rationale for using stratified random sampling other than using simple random sampling was that stratification results in greater homogeneity within the strata with respect to the trait under study. As such more precise results bring meaning to the whole study since the results could be used by other researchers for the purpose of comparison with their respective studies.

Data collection instruments

To ascertain the authenticity of the hypotheses, the researchers made use of research instruments as follows: a pre-test and post-test were given to both the control and the experimental groups during the study. The pre-test and post-test at an interval of four weeks were given to test students' knowledge before and after receiving computer-assisted instruction. Both groups, i.e., those who were exposed to computer-assisted instruction and those who were not were given the same pre- and post-test. The pre-test and post-test had twenty multiple objective questions in Selection A and five matching items in Section B based on weather studies in Geography. Interview and a questionnaire were the other research instruments that were used to gather the data. In the experimental group, care was taken for the learning to become meaningful: the objectives were well set, computers were effectively organised to motivate student learning and computer-assisted instruction was purely a practical or hands on approach to learning. The control group was taught the content for weather studies in Geography but without the use of computer-assisted instruction that was used in the experimental group.

Data analysis

Both quantitative and qualitative analysis of data was used. The data involved the use of test scores obtained after the pre and post tests were

given to the students. The scores were put together to compare by treatment so that the truth or otherwise could be realised after having used the appropriate statistical technique. The t-test statistical technique was used to analyse data obtained after testing the first hypothesis. Apart from this, the chi-square statistical technique was used to analyse data after testing the second hypothesis, that is, to find out if there was a significant difference between male and female students taught using computer-assisted instruction. In addition, the Likert scale of five-point grade was used to analyse the questionnaires from the students. During the interview with teachers, the direct responses they gave were quoted.

Results based on the questionnaire and interview

Research question 1

Do students get motivated when computer –assisted instruction is used as a form of instruction in the classroom?

Table 1

Students' Motivation from Computer-Assisted Instruction

Response of Student	Total (on Likert Scale of 5 Point Grade)	%
Strongly Agree	3.4	68
Agree	1.3	26
Undecided	0.3	6
Disagree	Nil	0
Strongly Disagree	Nil	0

From Table 1, about 68% of the students that responded to the questionnaire strongly agree that computer-assisted instruction motivated them in their learning experience. A total of 26% agree that computer-assisted instruction motivate them during instruction. Only 6% of the students are decided on the role of computer-assisted instruction in terms of motivation to learn. Brophy (2004) pointed out that it is imperative for teaching aids to be well organised so that students are motivated to learn a particular course or area of study. It is argued that if the teaching aids are well organised, a foundation from which students' growth of interest and curiosity to pursue a course of

study is laid. Use of computers in the classroom creates the desire and determination for students to learn. Although, a little percentage of the students is undecided in terms of motivation that is brought about the use of computers, the result shows that many students have a positive attitude to learn because of the use of computers. Consequently, students are likely to perform better in Geography.

Research question 2

Do teachers realise the significance of using computer-assisted instruction for their learners instead of the traditional methods of teaching?

Some verbatim responses of teachers towards the importance of computer-assisted instruction:

- ☞ *It enables teaching difficult concepts and makes them easier to understand.*
- ☞ *Computer-Assisted Instruction generates students' desire to be engaged in the learning process.*
- ☞ *It gives students access to richer source materials.*
- ☞ *It can present information in new ways that help students to assimilate and use it more readily.*
- ☞ *It is flexible to meet the individual needs and abilities of each student.*
- ☞ *It holds attention of pupils with emotional and behavioural difficulties.*
- ☞ *It provides meaningful feedback on learners' performance.*
- ☞ *It creates a stable foundation from which continuous student knowledge is built.*
- ☞ *It encourages analytic and divergent thinking that are some of the pre requisites for students' academic achievement.*

From the verbatim responses of the teachers, it can be pointed out that teachers realised the importance of computer-assisted instruction in the classroom. Despite this positive attitude that teachers have on the use of computer-assisted instruction, it is imperative to note that computers

are devices that assist the teacher in the teaching-learning process. They are not totally self-supporting; they are supplementary teaching devices. The key factor is that computers support, supplement or reinforce the teaching. Therefore, teachers must have sufficient knowledge on the use of computers so that students' academic achievement is realised in the end of course of study. If set objectives are to be well achieved, there is need for effective use of the computers as teaching aids in the classroom. This can be made possible by:

- ✍ clearly establishing the lesson objectives

The teacher must be certain of what is to be communicated to the learner.

- ✍ gathering the necessary data by researching for support material

- ✍ organise the material into an outline or a lesson plan

The plan should include all key points that need to be covered. This may include important safety considerations.

- ✍ selecting the ideas to be supported with the computer as a teaching aid

The computers as teaching aids should be concentrated on the key points of the learning process. Teachers must clarify the difficult concepts before progressing to the next stage outlined in the lesson plan.

Research question 3

How can computers as teaching aids be improved and made available for use in the classroom?

Verbatim recommendations from the teachers on the improvement of computers as teaching aids in the schools:

- ✍ *The student-computer ratio needs to be increased so that all students can benefit from the rich learning resources.*

- ✍ *Funds must be generated through different ways so as to purchase new computer hardware and software.*

- ✍ *The school must employ a computer technician to repair dysfunctional computer parts.*

- ✍ *The school must be connected to the internet so that new*

learning materials and information on the effective use of computers as teaching aids can be accessed.

- ✦ *The school must endeavour to create links with resource persons and institutions of higher learning like universities that continuously carry out research on the use of computers so that they are up to date with relevant information on the use of computers.*

The above recommendations are clear on how computers, as teaching aids, can be improved and made available in the school. If the academic performance of the learners is the ultimate goal of the learning process, computers need to be available for use by the student. The school needs to come out with different ways of generating income so as to purchase more computers. Continuous repair of the computers is vital so that learning becomes a continuous process for the advantage of the learner. Research contributes to the growth of knowledge. Hence it is of importance for the schools to be engaged in meaningful communication with richer sources of information brought about by research on the effective use of computers in institutions of higher learning.

Hypothesis 1

There is no significant difference in terms of performance between students exposed to computer-assisted instruction (Experimental Group) and those who are not (Control Group).

Table 2

Summary of Pre -Test and Post -Test Mean Scores of Experimental and Control Group Students

	Pre-test			Post-test		
Group	N	X	SD	X	SD	t-value
Experiment	20	19.15	3.94	27.15	4.32	3.21
Control	20	20.60	4.39	22.20	5.14	3.21

Significant at 0.05

Table 3

T-test of Difference between the Post -Test Mean Scores of Experimental and Control Group Students

Group	N	X	SD	t-value
Experimental	20	27.15	4.32	3.21
Control	20	22.20	5.14	3.21

Significant at 0.05

The t-test statistical technique was used to test the Research hypothesis 1 (See Table 3). The calculated t-value, $t=3.21$ is greater than the tabulated value $t_1 1.68$ (setting $\alpha=0.05$ with a degree of freedom 38). A significant difference exists as indicated by the result between the performance of students that were exposed to computer-assisted instruction and those taught without. This shows that computer-assisted instruction helped students to perform better than those taught using the ordinary teaching methods

Chi-square results

Hypothesis 2

There is no significant difference between the performance of male and female students exposed to computer-assisted instruction.

Table 4

Chi-Square Results: Observed (Post-Test Means) and Expected Frequencies for Experimental and Control Groups

Cells	Fo or O	Fe or E	Fo-fe	(fo-fe) ²	$\frac{(fo-fe)^2}{fe}$
I	27.40	28.39	0.99	0.98	0.03
II	24.20	23.21	0.99	0.98	0.04
III	26.90	25.91	0.99	0.98	0.04
IV	20.20	21.19	0.99	0.98	0.05
					0.16

χ^2 calculated= 0.16

Hypothesis 2 stated that there is no significant difference between the performance of male and female students exposed to computer-assisted instruction. The chi-square statistical technique was used to test this hypothesis. The calculated chi-square value 0.16 (see Table 4) is less than the chi-square tabulated 3.84 (setting $\alpha = 0.05$ with degree of freedom 1) Therefore the hypothesis was accepted. A significant difference does not exist as indicated by the result between male and female students exposed to computer-assisted instruction. The result therefore confirms that there is no statistically significant difference between the performance of male and female students exposed to computer-assisted instruction. The result indicate that the performance of male and female not a result of sex differences or other attributes related to gender since statistically there is no significant difference between male and female students in terms of performance.

Recommendations

- ✍ From the study it can be concluded that computer-assisted instruction helps the learners to achieve better compared to traditional methods of teaching that lack most of the important aspects that are vital for the academic performance of the learners. As such it is imperative for the curriculum planners to ensure that computers are a part of every school. The curriculum developers must design more syllabi for different subjects that can be taught using computers so as to enhance the academic achievement of the learners.
- ✍ Since the role of computer-assisted instruction can be highly appreciated in the modern times, it is vital for teachers to undertake further training in computer technology. This can be achieved by the use of in-service computer courses so that teachers remain in tune with the new and ever changing technology. New versions of computer software such as Microsoft Windows 7 and Microsoft Windows 8 have new features that must be introduced by the teachers to assist their learners who may not be able to access such important information.
- ✍ Computers can provide a rich learning environment if they are

connected to the internet. it is therefore useful for the schools that are receiving computers to be connected to the internet so that they get a variety of ideas from other e-learning sources found on the worldwide web. This can assist learners to access useful information if they do not have textbooks. The government must assist rural schools to connect to the internet because most students in rural areas cannot access internet facilities yet these learners have the potential to perform as well as those in the urban areas.

- ✎ More research work is needed on the aspect of gender and academic performance especially in relation to new technology like computers. This research was limited to Manicaland Province only. There is therefore the need to expand it to other provinces before generalisation of these results is made. Although research results from this study revealed that there is no significant difference between the performance of male and female students exposed to computer-assisted instruction more research work is needed in rural schools where some traditions that do not promote the learning of the female students are still present.
- ✎ It is also suggested that students must be allowed to go on field trips to centres that deal with computers, for example WorldLinks in Harare, so that they can receive some career guidance. This is highly motivating and can develop the learners' appreciation of the usefulness of computers in their pursuit for academic excellence. Schools in particular must consistently be thirsty for knowledge about the effective use and availability of computers.
- ✎ Schools must generate funds that will enable the purchasing of new computer equipment for use in the schools.
- ✎ In addition to the above, schools must form partnerships with other stakeholders such as resource persons and institutions of higher learning to continuously tap knowledge on the effective use of computers.

- ✍ Teachers must make meaningful planning before they use computers for instructional purposes since lack of knowledge on the use of computers is detrimental to the academic achievement of the learners.

Conclusion

From this study, it can be shown that teaching methods such as computer-assisted instruction, which are learner oriented, contribute greatly to the academic performance of the learners. This correlates with the previous findings that highlighted that computer-assisted instruction assists the learners to achieve better results than some traditional method of teaching.

Computer-assisted teaching methods enhance many vital aspects of the learning process such as student motivation, creativity and assists in the cognitive element of the learners. It can be noted that the use of computers in the school system provides none threatening environments for learning compared to teacher centred teaching methods whereby the teacher dominates in the learning process of the students. It can be pointed out that computer-assisted instruction enable learners to achieve the best in the learning source which offers immediate feedback on any task that is undertaken. Computers do not just enhance the academic performance of the learners but they demystify some misconceptions in relation to gender.

Most researchers had concluded that female students do not perform better when they are taught using innovative methods such as computer-assisted instruction because many factors in the socio-cultural environment are a drawback to the academic performance of female students. These findings do not correlate with the results of this study because it was found out that there was no significant difference between the performance of male and female students exposed to computer-assisted instruction.

From this study, it can also be concluded that teachers realise the importance of using computers for instruction purposes. The recommendations from this research, if implemented, will enable teachers in schools to assist students in their pursuit for academic excellence using e-learning.

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