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Computer Assisted Instruction (CAI) to Improve Students' Performance in Social Studies lessons: A case of Bawku Senior High School in Ghana

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Abstract:
Social Studies educators increasingly support the use of Computer-Assisted Instruction to transform Social Studies Education from a traditional mode to a more constructivist, student-centered, and active mode. This study experimented the impact of Computer Assisted Instruction (CAI) on students' performance in Social Studies. Learning package was examined. The study was a quasi-experimental research involving a pretest and posttest. The sample for the study comprised 40 first year students of Bawku Senior High in Bawku Municipal Assembly in Upper East Region of Ghana. The students' pre-test and post test scores were analysed using independent-samples t-test. The findings of the study showed that the performance of students exposed to CAI (experimental group) were better than their counterparts exposed to the conventional classroom instruction (control group). Based on the research findings recommendations were made on the need to develop relevant CAI packages for teaching Social Studies in Ghanaian Senior High Schools.

1. Introduction

At the beginning of the millennium, education authorities in Ghana embarked on a number of projects to introduce Information and Communication Technologies (ICTs)

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into the Ghanaian education set up especially, at the basic and secondary school levels. For instance, in the middle of the 1990s, educational providers realized that Ghanaian professionals could not compete on the global market for jobs, because they were limited in skill, especially in the area of Information Technology [1]

Subsequently, the authorities incorporated the study of ICT as part of the study of science. The government of Ghana with the collaboration of Non-Governmental Organizations (NGOs), philanthropists and Parent-Teacher Associations (PTAs) built about one hundred and ten science resource centres to aid the teaching of science and ICT. However, the initiators found that the various programmes were disintegrated, unstructured and did not cover all the schools.

Thus, at the end of the 1990s Ghana was host to a number of ICT initiatives supported by the government and NGOs. The Ministry of Education in conjunction with the Ghana Education Service (GES) and other partners undertook a critical analysis and review of the utilization of ICTs in education under the auspices of the United Nations Global E-Schools and Community Initiatives. Many lapses were identified for which the stakeholders agreed to work together to make education complete with ICT [1]. The review of how ICT is utilized in education gave birth to Ghana's current and on-going E-Schools and Community Initiative being undertaken under a unit within the Ministry of Education, Science and Sports. This programme seeks to incorporate ICT into all aspects of learning from kindergarten, through primary to the secondary school level. Providing IT to enabled students acquire the right skills should be the major priority and this has the potential to impact on professional work such as carpentry, building and construction. Other benefits to social life include the fact that knowledge of IT skills would mean increased use of facilities such as television, phone and other communication tools that would make life easier and comfortable [2]. It has become imperative for Ghana to use ICT to train children because the present-day school children are no longer interested in reading too many books for long hours. They are used to the TV and other digital appliances. It is therefore, necessary to devise means of educating them and facilitating learning through digital means [1,2].

The National ICT Policy and Plan Development Committee had a public lecture at the Ghana Secondary School, Tamale on Friday 23rd May 2003 as part of the National Consultative exercise aimed at developing an ICT-driven socio-economic development policy and plan. Present at the forum were the headmaster, staff and students of the school as well as the media. Source [3]. A presentation was made by a member of the National ICT Policy and Plan Development Committee on the topic: "The Ghana ICT for Accelerated Development Process: The Challenge of Our Time". Some key comments and suggestions made were as listed below:

• There is the need to deploy ICT facilities in the educational institutions especially in the remote areas. ICT must be introduced from the Basic to the Tertiary level.

• It is important to address policy issues relating to human resource development and the deployment of ICTs within the educational system.

• The ICT process must be extended to the remotest part of the country to create the awareness and the need for ICT for socio-economic development.

• The right environment must be created for locals to produce the required ICT technologies for the acceleration of the economy.

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• The Government must update the laws governing the use of telecommunication to make it more accommodating to embrace ICT.

• To benefit fully from ICT, the Government must address the issue of accessibility of ICT to the average Ghanaian.

• There is the need to make computers and its accessories more affordable for the middle-income earner, to afford more people the opportunity to use ICT. There is the need to change the curriculum of the educational system. ICT must be inculcated in the educational system from the Basic to the Tertiary levels.

• To reap the full benefit of ICT, the country must attach a lot of seriousness to it as has been given the HIV/AIDS pandemic.

• There is the need to make computer science applicable to every subject being taught in the schools.

• It is important for all to accept and embrace ICT as the only way forward in order to cross the digital river.

• It is important for the Government to put in the necessary measures to ensure effective inter-relation among the various schools to achieve the necessary level of learning and co-ordination as well as the sharing of information.

• There is the need to train qualified personnel to take up the task of teaching in the educational institutions.

• It is important to make the training of ICT an integral part of the Teacher Training Colleges.

• ICT would be more accessible to the ordinary Ghanaian if the Government was responsible for the sale of Computer and its accessories in order to make it more affordable to the ordinary Ghanaian.

• There is the need to create an ICT department in all schools in the rural areas.

• There is the need to make computers and its accessories available in all schools especially schools in the rural areas.

• It is important to extend telecommunication facilities as well as electricity to the rural areas since ICT is largely dependent on these facilities.

• To increase computer literacy in the country, computer training schools and community centers must be established in all regions and districts to increase access to computers. [3,4].

The Daily graphic of Wednesday, October 8, 2008, carried a front page banner headline: "COMPUTER PER- CHILD – Govt's initiative to boost ICT skills in public schools." According to the story, the Massachusetts Institute of Technology (MIT) in the United States of America (USA), had designed some computers that would enable Ghanaian children to acquire skills in Information and Communication Technology, "which is currently the most critical basic instrument of education world-wide," the paper stressed. Former Ghanaian President J.A Kufuor used the occasion to disclose that the deal for the supply of the computers was negotiated on behalf of the Government by the late Finance Minister, Hon. Kwadwo Baah-Wiredu about two years back. That the very day the creators of these unique machines from the MIT, dubbed "Magic Computers for children" came to demonstrate the computers to him during his recent trip to the US, he received the agonizing news of the transition of

our beloved Finance Minister. So, in order to honour his memory, the former President said the machines should be christened as "Baah-Wiredu's Computer for a child." This is an ample evident of how the government is committed to the use of computer technology in the schools. The use of computer technology is shaped into equipping the students with the needed technological skills that could enable them to learn ICT skills and develop their career in this era of the digital world. In view of this, The Ghana Government is making tremendous efforts to implement the computer application in the process of teaching and learning and has introduced computer course in the Senior High Schools and in other levels of education too. It is therefore, important that the schools integrate ICT in the schools' curriculums [1,4].

There is no doubt that, ICT has become a driving force of educational reforms and it is an integral part of national education polices and plans. During the last decade, the Ghana Government in collaboration with the Ghana Education Service has invested heavily in information and communication technology (ICT). ICT has had a major impact in educational context, in organization and in teaching and learning methods. Haven been a social studies tutor for years, I have envisaged the use of ICT in social studies can promote teaching and learning. This research therefore, aims at looking at how the use of computer assisted instruction (CAI) in the teaching and learning of social studies can improve students' performance. The computer's use cannot be over looked. This study will compare traditional method of teaching and Computer-Assisted Instruction in teaching social studies in Bawku Senior High School. One group of students will receive traditional social studies instruction from the researcher whiles the second group will receive instruction from a computer program called computer assisted instruction package (CAIP) This group will receive no other assistance. They will be given a time period comparable to that of a traditional classroom to complete the instruction. Both classes will receive a pretest and posttest. Statistical analyses will be performed on the data received from the tests.

This research aims at looking at how the use of Computer- Assisted Instruction (CAI) in the teaching and learning of Social Studies can improve students' performance. The study sought to answer these three hypotheses - Ho1: There is no significant difference in the pretest scores of the control group and the experimental group. Ho2:   There is no significant difference in performance between the control group exposed to the traditional method of teaching and the experimental group exposed to CAI. Ho3: There is no significant difference in the pretest scores as compared to the posttest scores of the control group and the experimental group.

2. Materials and Methods

A quasi–experimental pre-test, post-test control group design was used for this study, which consisted of two groups, namely the experimental (treatment) and control groups. This design was chosen because it controls many threats to validity, such as history, maturation and regression. Initially both groups were pre-tested, after which the experimental group was exposed to CAI, whilst the control group was exposed to traditional method. All the groups were taught for four weeks; after which they were then tested again to estimate the 'impact' of the four-week teaching. The Independent Samples t-test was used statistically to analyse the data to examine the significances of their mean deference. Similarly, the post-test scores were also compared using the Independent Samples t-test to analyse the significance of their mean deference. The School sampled for the study was Bawku Senior High in the Upper East Region of Ghana. There are two Senior High schools in the Municipality,

namely Bawku Senior High and Bawku Secondary Technical School. Bawku Senior High was randomly sampled for the study. The sample population was made up of 40 students in the class.

2.1. Instruments

The instruments used for the study were teacher made objective test for pre-test and post-test. The pre-test was made up of 20 objective questions, from topics that had been treated already. Students were to answer all questions within 30 minutes. The pre-test was administered to determine which group would be used as the control group and experimental group respectively. The class was randomly assigned into experimental and control groups respectively, using the pretest scores. Unlike the pre-test questions, the post-test questions were based on the topic used to develop the sessions covered by the software (constitution and nation building). The hypothesis underlying the design was that "the use of computer assisted instruction will not significantly increase students' performance in social studies". To somewhat remove experimental bias, the two classes were taught by the same teacher. To ensure the reliability of the instruments; both the software and the post-test instruments were tested in a pilot study. This was to ensure that the software developed, and the post-test were very reliable for the purpose. Any problems found in the software as well as the post-test instrument were addressed accordingly.

With regard to validity of instruments for the study, the post-test items were submitted to lecturers of measurement and evaluation and my supervisor who have expert knowledge in validation of research instruments to scrutinize in terms of content. Apart from submitting for validation, the point biserial correlation as a statistical method was applied between the scores on each item and the score on the total test. With this method, test items that were not consistent with the total score were removed [5]. The software was piloted at a neutral school (Tempane Senior High School) to help identify problems that students were likely to encounter. During the piloting phase, the students were asked to indicate questions which seemed confusing to them. This information was used to modify the initial instrument to produce the final instrument.

2.2. Software Design

The software was developed on visual basic six and Microsoft PowerPoint using a slideshow format. PowerPoint was chosen as the software to use for the tutorial because it is easy to create slides with, which is the format for the tutorials. It is also easy to show the steps the students need to follow. Arrows and buttons are placed to show where the students should move their mouse to and click to enable commands in the software, showing them exactly how to navigate through the various menus.

Students in the experimental group were taken through how to use the software, especially how to use the buttons such as exit and how to answer questions and check their performance. Students were given four weeks to go through the software. To lessen the possibility that a halo effect might cause the treatment group to outperform the control group, all students in the study were told they were part of a special project. To help prevent any perceived additional attention given to students using the CAI, the researcher explained to all subjects that they were playing an important part in research that would help students in the country. To remove experimental bias, all the two classes were taught by the researcher.

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2.3. Data Collection Procedure

There were two data collection components to the study- Pre-test, Post-test multiple choice items. After each class was pretested the subjects were randomly assigned to traditional and experimental group respectively. The two groups had post-test, after the treatment group had gone through the use of the software and the control group had been taken through the traditional instruction based lessons. The software was installed into the computers of the experimental group. The students were guided on how to use it. Whilst the experimental groups were going through the software, the researcher started teaching the control group using the traditional method. Both groups started the lessons on the same day. The experimental groups were visited twice a week by the researcher to correct and guide them where necessary.

2.4. Data Analyses Procedure

The researchers used statistical package for social science (SPSS 18) to analyse the data. First, descriptive statistics was used to give an overall picture of the distributions of the pre- and post-test scores. The descriptive statistics tool used included frequency distribution and bar charts.

For the analysis of the differences between the methods of instruction, inferential statistics was used and the variables identified were:

Independent variable – type of instruction.

Dependent variable – achievement on the post-test.

3. Results and Discussion

The study sought to examine the impact of Computer Assisted Instruction on the performance of students towards the study of Social Studies in the Senior High School. Forty students were sampled for the study with twenty students each in the experimental and control groups respectively. Random assignments were used to assign the students into control and experimental groups after a pretest. Random assignment has been used for more than 50 years and is the preferred method of assignment. Randomization eliminates the source of bias in treatment assignment; facilitates blinding the type of treatments to the investigator, participants, and evaluators; and finally permits the use of probability theory to express the likelihood of chance as a source for the difference between outcomes [6]. The independent samples t-test was used as the statistical tool to determine whether differences in scores between the control and the experimental groups were significant at the alpha (α) level of 0.05.

3.1. Pretest Scores

Both the control and experimental groups were given a pretest as a baseline study. The pretest was administered after all the participants have been taught a topic in social studies using a traditional method. Upon completion of the pretest, the class was randomly assigned to control and experimental groups. Whiles the experimental group was taught using Computer-Assisted Instruction (CAI), the control group was taught using Traditional Methods of Instructions. Table 2, shows the number (N) of students, the mean (M) scores, standard deviation (SD) and standard error mean of Bawku Senior High School in the pretest.

From Table 1 it can be seen that the overall mean score of Traditional group of Bawku Senior High was M=6.65 with SD =2.681 and standard error mean of .599. The mean score of Experimental group was M=6.65 with SD=2.870 and standard error mean of .642.

Table 1. Mean, standard deviation and Std. error mean of Bawku SHS (pretest).

Bawku SHS	N	Mean	Std. Deviation	Std. Error Mean
Traditional Group	20	6.65	2.681	.599
Experimental Group	20	6.65	2.870	.642

Source: fieldwork

Testing of Hypothesis 1

The two groups involved in the study were administered a pretest to assess how similar in ability the students in each of the groups were, therefore, the design of null hypothesis to test the results.

Ho: There is no significant difference in the pretest scores of the control group and the experimental group.

To test the hypothesis, the independent sample t- test was performed comparing the mean score for the control group (M = 6.65, SD = 2.681) with that of the experimental group (M = 6.65, SD = 2.870). With alpha set at .05, the test has shown to be not statistically significant, t (.000) = 1.000, p > .05. Based on the result the null hypothesis is therefore, accepted that, there is no significant difference in the pretest scores of the control group and the experimental group, as illustrated in Table 2.

Table 2. Independent Samples t-test on group mean scores for Pretest.

Group	Mean	Mean Difference	Std.Deviation	t-value	sig (2-tailed)
Control	6.65	.000	2.681	. 000	1.000
Experimental 6.65			2.870		

Source: fieldwork

This showed the equivalence of the control and experimental groups. There was no significant difference in their mean scores. Hence the elimination of the source of bias in treatments assignment [6].

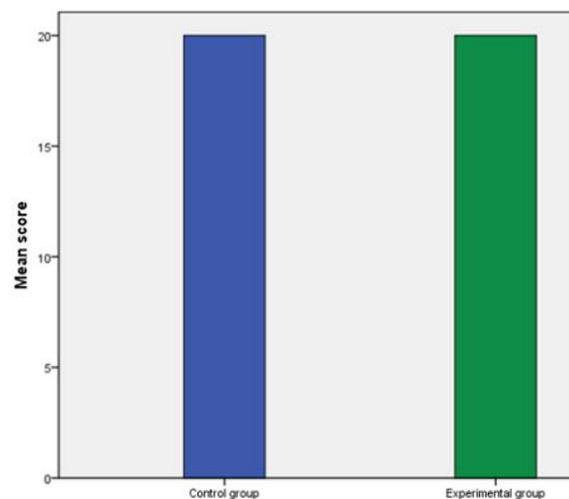## Graphical Presentation of Pretest Scores

Figure 1. Bar Chart Presentation of Mean Scores of control group and experimental group (Pretest).

Source: fieldwork

In addition to Table 2, the mean distribution of the raw scores of the students of the two groups in the study have been analyzed and shown in Figure 1 to help give quick and pictorial presentation of the scores.

From Figure 1, it can be seen that the overall mean score of traditional group was M=20. The mean score of experimental group was M=20. This confirms that there was no significant difference in the mean scores between the two groups in the study.

3.2. Posttest Evaluation

After both classes received four weeks of instruction in a unit in social studies, the classes were administered a posttest. The posttest was designed to evaluate the progress made from the pretest to the posttest and to compare the instruction received by both classes.

Testing of Hypothesis 2

The hypothesis was designed to ascertain whether the use of Computer- Assisted Instruction (CAI) in the teaching and learning of Social Studies can improve students' performance as compared to the traditional classroom method.

Ho: There is no significant difference in performance between the control group exposed to the traditional method of teaching and the experimental group exposed to computer –assisted instruction.

To test the hypothesis, the independent samples t-test of alpha (α) value of 0.05 was performed comparing the mean score for control group (M = 14.20, SD = 2.353) with that of the experimental group (M = 18.80, SD = 1.105) with alpha set at 0.05, the test was shown to be statistically significant, t (-7.913) = 000, p < 0.05. The results of the t-test showed in Table 3 shows that there is a significant difference between the posttest score of the control group and that of the experimental group. On the basis of the result, the null hypothesis was rejected, indicating that, the mean score of the experimental group compared to the control group was significant. The detailed scores are illustrated in Table 3.

Table 3. *Independent Samples t-test on group mean scores for Posttest.*

Group	Mean	Mean Difference	Std.Deviation	t-value	sig (2-tailed)
Control	14.20	-4.600	2.353	-7.913	000
Experimental 18.80			1.105		

Source: fieldwork

Eta Squared as proposed by Cohen, (1988), was used to determine the effect of the result.

Eta Squared

$$\text{Eta squared} = \frac{t^2}{t^2 + (N1 + N2 - 2)}$$

$$= \frac{-7.913^2}{-7.913^2 + (20 + 20 - 2)}$$

$$= 87.23$$

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From Cohen, (1988); 01= small effect, .06 = moderate effect, .14= large effect.

Given our eta squared value of 87.23, we can conclude that there was a large effect. With a substantial different in the statistical scores obtained before and

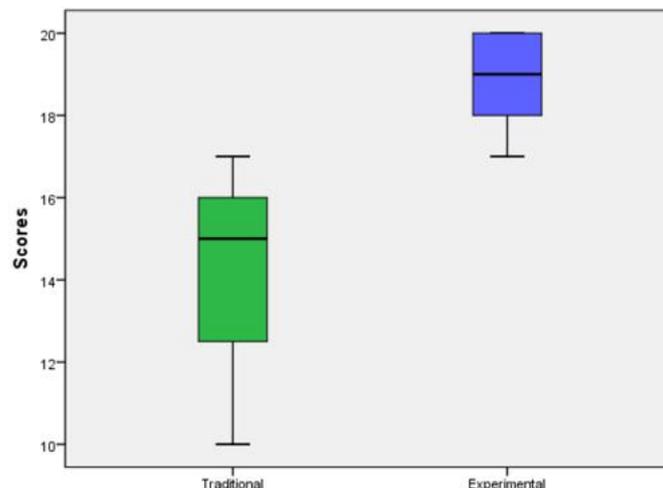after the treatment. This is further illustrated in Figure 2 for quick and pictorial presentation.

Figure 2. Box plot showing the median and inter-quartile ranges of Bawku SHS (Posttest).

Source: fieldwork

Figure 2 illustrates the median and the inter-quartile ranges of the raw scores of students from the two groups in the study. As depicted in figure 2, the experimental group had median value of 19 with lower and upper quartile value of 18 & 20 respectively, with the traditional group having median value of 15, lower and upper quartile value of 12& 16 respectively. This confirms that the experimental group did better in the posttest as compared to the traditional group.

Testing Hypothesis 3

Ho: There is no significant difference in the pretest scores as compared to the posttest scores of the control group and the experimental group. To test the hypothesis, the independent samples t-test of alpha (α) value of 0.05 was performed comparing the mean score for control and experimental group.

Table 4. Independent Samples t-test on group means scores for control group (Pretest –Posttest).

Group	Mean	Mean Difference	Std.Deviation	t-value	sig (2-tailed)
Pretest	6.65	-7.550	2.270	-9.427	000
Posttest	14.20		2.353		

Source: fieldwork

Table 5. Independent Samples t-test on group means scores for Experimental group (Pretest – Posttest).

Group	Mean	Mean Difference	Std.Deviation	t-value	sig (2-tailed)
Pretest	6.65	-12.150	2.353	-17.666	000
Posttest	18.80		1.105		

Source: fieldwork

From Table 4 and Table 5 it is observed that, there was statistically significance difference in the performance after treatment for both groups; however, it was much

greater with the CAI group than the traditional group. This is an indication that students exposed to CAI perform better than those exposed to traditional method of teaching.

4. Discussions

A drill and practice program design includes four steps:

• the computer screen presents the student with questions to respond to or problems to solve;

• the student responds;

• the computer informs the student whether the answer is correct; and if the student is right, he or she is given another problem to solve, but if the student responds with a wrong answer, he or she is corrected by the computer [7].

Computer instructions for each topic was left on the computers, students had the opportunity to go over and over again at their own pace until they understood the lesson. This opportunity was not so with the traditional method of teaching. With reference to the data analysis, Students in the experimental group who were exposed to Computer-Assisted Instruction achieved significantly higher posttest scores than those in the control group who were exposed to the traditional method of teaching. Instruction supplemented by properly designed Computer-Assisted Instruction is more effective than instruction without Computer-Assisted Instruction [8]. Computer-Assisted Instruction to increase learner knowledge when it involves the synergy of multiple senses. Learners were found to retain new knowledge better when the curriculum was presented with a combination of formats of text, sound, graphics and video [9].

The study further shows that the experimental group performed better in the posttest due to the computer assisted instructions method used. In this approach, the flow of information is basically from the computer to the student. The computer presents the learning materials or activities for students to respond. During the course of the program, the computer retains records of the student's progress [10]. This gives the learners and teachers an environment to learn and teach more effectively. Learners can select the best activities to suit their own learning pace, style and level, as well as time and place. They can be more independent and self-reliant on their own learning. There are facilities in the drill and practice software that provide feedback to the learners and to keep track of their performance [11]. They can also be able to take decisions, think creatively and critically, investigate and explore as well as solve problems they face in learning and real life. Computer-assisted instruction is appropriate when subject matter needs to be mastered or for practice of basic skills before advancing to higher levels of learning [12].

The high performance of the group that was exposed to Computer- Assisted-Instruction was not surprising because Information Technology is new in Ghanaian educational system; students were excited when they were asked to use the computer to study. For example, the computer instructions had both pictures and simulations to show them clearly how various skills which were difficult to understand with the traditional method of teaching were performed and as stated earlier exercises were given at the end of each lesson for students to do, to find out their performance level for immediate remediation before moving on to the next lesson. On the other hand, it appears the group that was exposed to the traditional method of teaching performed

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poorly because of their apparent low interest in the traditional method of teaching, since it was not something new to them. It was the usual repeated way of teaching. Students did not have the opportunity to go over lessons at their own pace as their counterparts in the experimental group and therefore, contributed to their low performance. This confirms the assertion that instruction supplemented by properly designed Computer-Assisted Instruction is more effective than traditional method of instruction [8].

Others believe that even though the computer assisted instruction module may hold little advantage over the traditional chalkboard method in terms of knowledge transfer, it can influence students' attitude towards the quality and organization of teaching and learning. Computers are used not only as a means of helping schools analyze data; but computers have also become a pervasive tool toward optimizing student learning [13]. The computer assisted instruction module may enable students to process information at their own pace which is usually rigidly controlled by the instructor in a traditional objectivist learning environment, hence making the leaning process more individually tailored or teacher centered. Computer literacy and operation in the senior high schools and relevant computer assisted instructional packages should be developed for use within the Ghanaian school systems. In addition, Ghanaian public schools should be equipped with necessary ICT facilities to leverage the potentials of ICT in Ghana schools. CAI may also be used effectively in teaching subjects in which simulation models can help improve cognitive abilities [14].

5. Conclusions and Recommendations

The study concluded that students who used the software or exposed to computer assisted instruction performed better than those who were exposed to traditional method of instruction. It is an ideal using the CAI since the computer is a very versatile tool; it can be used to enhance lessons in many ways; through animations, videos, graphics, simulations and other application. It is therefore recommended that Ghana education service should organize ICT applications in lessons to teachers at all levels of the educational ladder and in Senior High schools in particular since it improves student performance.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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