THE EFFECT OF USING INFORMATION AND COMMUNICATION TECHNOLOGY IN THE TEACHING AND LEARNING OF PHYSICS IN SENIOR SECONDARY SCHOOL STUDENTS: A CASE STUDY OF SOME SELECTED SECONDARY SCHOOLS IN JOS SOUTH LGA OF PLATEAU STATE

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Abstract
This study analyzed and evaluated the effectiveness of Information and Communication Technology (ICT) on the teaching and learning of physics in SS 2 in some selected secondary schools in Jos South LGA of Plateau State. In the study, a total of 105 students and 10 teachers made up the number of respondents who were randomly selected from 4 senior secondary schools cutting across the entire Jos South LEA. The instruments used for the study were Information and Communication Technology Impact on Teaching and Learning Question (ICT IT LQ) and a physics achievement test where the students were divided into two groups experimental and controlled groups. The Null Hypothesis (H_o) " there is no significant difference between students taught with ICT materials and those taught without " was postulated and tested using t-test statistical test and a 0:05 level and significance. The use of information and communication technology (ICT) in the teaching and learning of physics is essential and significant because it is necessary for the growth and development of our educational system was the conclusion reached. Therefore, Government should encourage and put incentives to attract State, Local, International bodies and Non-Governmental Organizations (NGOs) to invest in ICT related projects in secondary schools and ICT equipment, materials and facilities should be made available and accessible to all secondary schools.
Keywords: Information, Information and Communication Technology (ICT), Computer, Telecommunication, Internet, Learning, Physics.

Introduction
From time immemorial, man has always searched for and devised different techniques to pass across his thoughts and ideas. People communicated (Shared their thoughts) through speech, clinking sounds, written messages, smoke signals, carrier pigeons etc for both short and long-distance forms of communication. However, as civilization spread, the need for more effective and reliable means of communication leads to the discovery of courier services, telegraph, telephone, radar, microwave links etc. The advent of the telephone and electronic system of transmitting and receiving signals change the entire world of communication and it's now visible in what we have in our today's world that is we can now communicate with

voice, text, pictures and many other types of information via phones, computers, intranet and internet. The internet is a vast computer network that links smaller computer networks worldwide and allows computer users around the world to exchange information. (Dictionary.com). With the use of the internet, communication is made easier, faster and very efficient. Many bodies have emerged in other to assist the use of this technology such bodies as Management Information System (MIS), Information and Communication Technology (ICT) among others. Information and communication technology (ICT) refers to the collection, storage, retrieval, manipulation, transmission or receiving of information electronically in a digital form by a personal computer, digital television, email etc.

In education, (ICT) can be understood as the application of digital equipment to all aspects of teaching and learning. The use of (ICT) in teaching and learning is a relevant and functional way of providing education to learners that will assist in imbibing in them the required capacity for the world of work. Very few jobs today do not require the use of skill in technology, collaboration, teamwork and information. All this can be acquired through teaching with (ICT). We can therefore say that technology has entered the class in a big way to become part of the teaching and learning process. Physics as a science-oriented course or discipline is a unique subject that promotes the acquisition of specialized science skills and knowledge which explain the natural phenomena of life in society. It is a subject that grew up with civilization as man's quantitative needs increased. It arose out of practical problems and man needs to solve these problems. Physics has contributed to the development of the sciences and civilization in general. Despite the "abstract" nature of physics, its teaching is to bring about scientific thinking and a mindset that requires students to test out through experimentation.

Through the use of ICT in teaching physics whether, by CD RAM, PowerPoint, graphics etc, it is hoped that the so-called abstract nature of physics is eliminated and the teaching and learning process becomes interesting as students get to see and relate theories to real-life application.

According to Agommuoh and Nzewi (2003), secondary school students who are exposed to video-based instruction in physics had a significantly better result than those who were taught using the conventional method. It is against this background of looking at ICT as a medium for instruction in teaching and learning in secondary school that this study was conceived. Therefore the study seeks to establish using a statistical model the effect of ICT on teaching and learning of physics in secondary schools (especially in Plateau State).

Statement of problem

The educational sector today is faced with a series of changes and reforms, which have led to the emergence of diverse teaching and learning methods and strategies to accommodate cater and correspond to students' needs. One of such strategies is the use of Information and Communication Technology. Investigations reveal that many learners at the senior secondary school in Plateau State strongly detest how the physics teachers handle and deliver physics knowledge and lesson. This has made lots of students/learners lose interest in not just only physics but in the areas of scientific invention. However, it is hoped that the use of ICT in teaching physics can help salvage this quandary. ICT by itself is the use of technology in managing and processing information via electronic systems. It uses computer software to convert, store, process, transmit and retrieve information. Applying this to the teaching of physics will go a long way in addressing the difficulties experienced by teachers in relating physics to nature and solving problems. This research work is an attempt to identify those grey areas in physics

that verbalization of words alone in classroom teaching of some topics is not enough and also help introduce ICT to foster a better understanding of such areas. In so doing, the following problem will be addressed Extent of use of ICT

Advantages of ICT in teaching physics

Teacher's awareness and literacy level towards ICT

Existing problems of using ICT in teaching physics

Research questions:

i. What are the advantages of using ICT to teach physics?
ii. How many teachers make use of ICT to teach physic in senior secondary schools?
iii. What are the advantages and disadvantages of using ICT in teaching physics?

Research hypothesis

The following hypothesis was postulated.

Ho: There is no significant difference between students taught Physics with ICT materials and those taught without using ICT materials.

Literature Review

Physics by itself is defined as the branch of science concerned with the nature and properties of matter and energy and its motion through space and time along with related concepts such as force, heat, light, radiation, sound, electricity, magnetism, and the structure of atoms. More broadly, it is one of the main analyses of nature, conducted to understand how the universe behaves. M. Rafiq (2021). Physics is one of the oldest academic disciplines perhaps even the oldest through its inclusion of astronomy. Over the last two millennia, physics was a part of natural philosophy along with chemistry and certain branches of mathematics and biology but during the scientific revolution in the 17th century, the natural sciences emerged as unique research programs in their rights (Lumen Learning.com). Physics has made contributions through advances in the new technologies that arose from theoretical breakthroughs. An example is advances in the understanding of electromagnetic, nuclear physics (nuclear weapons) domestic appliances, computers, thermodynamics, calculus etc. All these advances have dramatically transformed our modern society.

According to Liver Poll (2002), Information and Communication Technology (ICT) is a generic term referring to technologies that are used for collecting, storing, editing and passing information in various forms. However, from the definition, the term information and communication technology refer to the process of acquiring, organizing, storing, retrieval, transmitting, and receiving information that has been processed using some electronic equipment and appropriate methods. United Nations Education, Scientific and Cultural Organization (UNESCO 2006) further defined Information Communication Technology as the scientific-technological, engineering and management techniques used in information handling and processing. This broad definition includes such technologies as radio, television, video, DVD, mobile phones, computer and network hardware and software. All aspects of life are influenced by ICT, for example, communication, studies, presentation, making decisions, solving problems, creativity and challenges Hamiti *et al*., (2015). According to Terpule *et al.,* (2015). Technology-enhanced learning has positive outcomes for learners who become central to their learning. Shah S. (2013) claims that integrating ICT within education has generated a "more stimulating learning environment" and this technology can make the learning process more entertaining and innovative.

Moreover, the importance of audio-visual aids in teaching physics in secondary schools cannot be overemphasized. This is because it suits the need for an effective teaching method in physics and enhances the better performance of students.

The role of technology in teaching and learning is rapidly becoming one of the most important and widely discussed issues in contemporary education policy. Most experts in the field of education agreed that when properly used, ICT holds great promise to improve teaching and learning in addition to shaping workforce opportunities. Poole (1998) indicates that computer illiteracy is now regarded as the new illiteracy. Many studies have found positive effects associated with technology-aided instruction. Mcfarlare AS (2002) in his role of ICT in science education publication considered two perspectives on the relationship between the science curriculum and the potential of ICT in science education, The first perspective was based on the current secondary school science curriculum, while the second looked at how the role of ICT might be enhanced if the curriculum were to emphasize scientific reasoning rather than the practice of empirical science. It focuses on the use of ICT to support or replace practical work and the use of the internet as a tool for scientific reasoning. The key findings of the research are using ICT either as a tool in a practical investigation or as a substitute for the laboratory base elements of an investigation can aid theoretical understanding. Electronic communication should be used not just to disseminate information but to create a community of learners.

Another researcher Osborne J Hennessy (2003) who wrote on the role of ICT in science education (promise, problem, and direction) reviewed the current state of science education, the impact of ICT use on the curriculum, pedagogy and learning, the implication, diverse ways of linking ICT use to existing class teaching including supporting or replacing it. The researcher makes use of observation and questionnaire methods administered to secondary schools. Descriptive statistic was used for the analysis. Also, the research shows that the Transformative use of ICT in science found only in isolated pockets ICT may have a greater role to play in a curriculum that places greater emphasis on reasoning and analytical skill. The importance of ICT is quite evident from the educational perspective. Though the chalkboard textbooks, radio/television and film have been used for educational purposes over the years, none has quite impacted the educational process like the ICT while television and film impact only on the audiovisual facilities of the users. ICT can provide higher interactive potentials for users to develop their individual, intellectual and creative ability.

Method in teaching physics

For the purpose of this discussion, teaching methods/strategy means formulated plans for bringing about particular behavioral change in student. According to Dammar (2004), teaching strategy therefore includes not only the manner of presentation that the teacher employs but everything that he does in the way of arranging conditions, grouping students, providing activities, making assignments and providing information on learning. Thus teacher effectiveness would be a function of the strategy linked somehow to pupils learning outcome. Some of the method/strategies in teaching physics include

Demonstration: This is an example of teaching by showing rather than hearing as a major means of communication According to Dammar – (2004) in demonstration all five senses' are involved. Thus making the learner active as he/she can touch, feel, see and hear Audio – visual: this is a field of human expression that employs visual and auditory aids to learning, including motion, pictures, television, sound and silent film strips, slides sets, overhead projectors and variety of graphic arts.

Experimentation: This is teaching method that occurs mostly in the laboratory. Students are shown and taught using practical examples via experiments. They teacher shows them how to perform and carry out experiments teaching learning experience sticks is the learners.

Using ICT to teach physics

There is a long history of using computer to assist in teaching physics and many other disciplines. J. Risley *et al.,* (1988). It can assist in achieving many feature of flexible delivery including students' chance in time, place and space of study. We emphasize on the use of internet to support a variety of teaching and learning task. Including what Bednarz, (1997) observed as: Distributing information that could be conveyed in other ways e.g. a course syllabus is available electronically instead of being shown in class. Waves forms simulation as well as graphical projections shown in class gives the student a closer experience of reality than just seeing or reading it in textbooks.

Importance of ICT in teaching and learning physics

The importance of the use of ICT in the teaching and learning of physics cannot be over emphasized. This is because it is a promising asset that would modernize the teaching and learning of physics in such a what it becomes more attractive by engaging multimedia and internet communication with the help of ICT in teaching physics, we would become closer to the goal of having students who are autonomous, having a creative way of thinking by integrating their experimental theoretical, mathematical and IT skills such that they would be able to have proficiency of knowledge that is universal and useful.

Research methodology

Experimental research design was used for the study. The study was carried out in some selected Senior Secondary Schools in the four districts of Jos South Local Government Area of Plateau State. The students were divided into two Group in each of the schools. One group (control group) was taught without ICT materials. Thereafter, the two groups were tested using the same test items and the result collated were analyzed. The population for the study covered all Senior Secondary Two (SS 2) School in the four districts of Jos South Local Government of Area Plateau State. The school where grouped according to their respective district and a sample of 4 school were drawn using random sampling technique cutting across the ninety Senior Secondary Schools.

The researcher folded all the names of the ninety schools in pieces of papers into four separate containers according to their respective districts. The researcher then invited someone to freely hand pick one school each from the different district. One each from Du district, Gyel districts, Kuru district and Vwang districts respectively. Making a total of 4 schools. The sample of the four schools according to their respective districts are as follows:

Du District – Mount Carmel Christian School
Gyey District – Nobble College
Kuru District – GSS Kwata
Vwang District – Jesus Bride Secondary School

The students where SS2 students and each class was divided in two by way of giving them number of one's and two's all the one's where placed in the experimental group and the two's were the controlled group

Instrument for data collection

The major instrument used for the study was an achievement test on physics and a simple questionnaire to collect the respondent bio – data (age, gender) and some other details. The student in the experimental group were taught projectile motion physics using and animated video projection showing how a fired bullet obeys and follows a parabolic path at different

corresponding angles while the controlled group were taught the same topic but using the normal conventional chalk board method and at the end both group were now given the same Achievement test. The achievement test was designed such that the scores were graded thus:- (0- 19), (20 – 39), (40- 59), (60 – 79) and (80-99).

Method of Data analysis

The researcher used simple percentage for data analysis given by

$P = \frac{n}{N} \times \frac{100}{1}$ Where P = percentage n = Number of response,

N = Total number of responses

100 = constant

The statistical technique used in testing the Hypothesis was the t – test for independent variable

Given by $t = \frac{\frac{X1}{S2} - \frac{X2}{S2}}{n_1 + n_2}$ Where x = mean

s_2 = Standard deviation n = sample size

DATA PRESENTATION AND ANALYSIS

Age of respondents

The researcher sought the ages of both the student and teachers of physics in the various schools the research was carried out and it is represented below.

Table (1) showing Age of students (SS 2)

Age Group	**Frequency**	**Percentage**
14 – 15	45	43%
16 – 17	58	55%
18 and above	2	2%
Total	105	100%

Table (2) Showing Age of physics teachers

Age Group	Frequency	Percentage
21 – 30	3	30%
31 – 40	5	50%
41 and above	2	20%
Total	10	100%

From the above table, 43 percent of SS 2 student are between the ages of 14 and 15 year and 55% of them are between 16 and 17 year while only about 2% are 18 year and above.

And for the teachers, we see that 30% of them of the age bracket of 21 to 30 years and the 50% are between 31 and 40 year while 2 percent represent 41 years and above.

Sex distribution of the respondents

Data was collected to determine the gender or sex group that dominates the science class for the student as well that of the teacher who teach physics respectively and it is shown below.

Table (3). Showing the Respondent gender

Respondent	Male	Female	Total
Students	69	36	105
Teachers	8	2	10

From the above table, the research shows that about 66% (69) of the respondents are male student and 80% (8) of the respondent are male teachers while for the female student they are about 34% (36) of them and for the female teachers they represent 2% (2) of the teacher's population.

Research question 1.

What are the advantages of using ICT in the teaching and learning of physics?

The respondent's responses where summarized as follows:

The use of ICT saves time

Table (4) showing the responses gathered

Respondent	Strongly agree	Agree	Disagree	Strongly disagree	Total
Students	73	20	8	4	105
Teachers	6	3	1		10
Total	79	23	9	4	115
Percentage	69%	20%	8%	3%	100%

From the table above, it shows that 69% of the respondents both students and teachers strongly agree and 20% agree that the use of ICT saves time in the teaching and learning of physics. While 8% disagree and 3% strongly disagree that the use of ICT saves time.

The use of ICT makes learning concrete

Table (5) showing the respondents responses

Respondent	Strongly agree	Agree	Disagree	Strongly disagree	Total
Students	69	31	5		105
Teachers	9	1			10
Total	78	32	5		115
Percentage	68%	28%	4%		100%

From the table above, 68% of the respondents and 28% strongly agree and agree respectively that the use of ICT makes learning concrete while only 4% disagree.

Research question 2

How many of the respondents (number of teacher that use ICT to teach physics)

Table (6) showing the response of the Respondent

Response	Frequency	Percentage
Yes	3	30%
No	7	70%
Total	10	100%

The table above shows that only 30% of the respondents use ICT to teach physics while 70% say they do not ICT materials to teach physics.

Research question 3

Disadvantages or constraints of using ICT in the teaching and learning of physics

Inadequate finance to equip ICT laboratory for teaching physics is a major constraint of using ICT

Table (7) shows the respondents responses

Respondent	Strongly agree	Agree	Disagree	Strongly disagree	Total
Students	53	30	12	10	105
Teachers	5	2	1	2	10
Total	58	32	12	12	115
Percentage	50%	28%	12%	10%	100%

From the table above, 50% and 28% of the respondent strongly agree and agree respectively that inadequate finance is a major constraint of using ICT, while 12% and 10% Disagree and strongly disagree as well that inadequate finance is a major

Inadequate power supply is a major constraint

Table (8) shows that respondents response

Respondent	Strongly agree	Agree	Disagree	Strongly disagree	Total
Students	49	33	21	10	105
Teachers	5	5			10

Total	54	38	21	10	115
Percentage	47%	33%	18%	2%	100%

From the table above, 47% of the respondent and 33% strongly agree and agree respectively that inadequate power supply is a major constraint of using ICT while only 18% and 2% disagree and strongly disagree as well that inadequate power supply is a major constraint in using ICT.

Testing of the hypothesis

H_0: There is no significant difference between physics students taught using ICT material and those taught without ICT material

H_1: There is significant difference between physics student taught using ICT material and those taught without ICT materials.

The outcome (result) of the research carried out by the researcher would be used for the testing of the hypothesis as shown below.

Group	N	X	S^2	DF	T - Calculated	T Critical	Decision
Experimental (1)	52	10.4	9.40	8	1.89	1.86	H_0-Rejected
Controlled (2)	53	10.6	8.46				H_1-Accepted

Decision: Since the t-calculated 1.89 is greater than the t-critical 1.86, the Alternative Hypothesis was accepted and a conclusion that there is significant difference between physics students taught with ICT material and those taught without ICT materials was made.

SUMMARY, CONCLUSION AND RECOMMENDATION

The world today is being run mostly on communication medias such as computer internet, mobile phones etc. which can share information from person to person from different parts of the world without leaving where one is or traveling to different states or countries simply because one needs ideas or for communication purposes. Information and communication technology has shown that it can be valuable asset when it comes to communication and linking people around the globe and that it can also be used in impacting and improving the knowledge data base of students especially in physics. And this is what lead to this research work.

The objective and purpose of this study was to investigate the use of information and communication technology (ICT) in the teaching and learning of physics in some selected senior secondary school (SS 2) students in Jos South Local Government Area of Plateau State.

Summary of finding

From the findings, the study confirmed that majority of the SS 2 students are between the ages of 16 and 17. For the teachers, the major age bracket is (31 and 40years). The study revealed that the male folk are the majority both for the teachers and student in physics. While both female teachers and students are a minority. In answering the research question of the research, the finding are as follows;

Research question 1 (a): revealed that both the student and teacher respondents strongly agree that the use of ICT materials in the teaching of physics saves time.

Research question 1 (b): revealed that the respondents strongly agree that the use of ICT makes learning concrete. In agreement with Athanasios *et al.,* (2016)

Research question (2) also revealed that only 30% of teachers use ICT materials to teach physics and 70% of the teachers do not use ICT materials.
Research question3 (a) the respondents strongly agree that inadequate finance is a major constraint of using ICT to teach physics.
Research question 3 (b) the respondent strongly agree and agree respectively that inadequate power supply is a major constraint of using ICT to teach physics
The investigation also lead to the rejection of the null hypothesis (H_0) that said "there is no significant difference between physics, students taught with ICT material and those taught without ICT material" and the acceptance of the alternative hypothesis (H_a) stated as "There is significant difference between student taught with ICT materials and those taught without ICT materials.

Conclusion
The research was able to achieve the aim, goals and objectives on which is set to achieve. That is, the assessment of the impact of ICT in teaching and learning physics in senior secondary schools, to find out the advantage and constraints of using ICT to teach physics and also to recommend ways of improving and encouraging the use of ICT in secondary school.
In conclusion, I dare to say that information and communication technology is significant because it is necessary for the development of our education system. We have the advantage to develop our educational system to meet the demand of other developed countries. So the need for ICT is of advantage for our schools.
Recommendation
The major focus of this study was to evaluate the impact of information and communication technology in the teaching and learning of physics in senior secondary school. Based on these investigations, it is considered very important to make the following recommendations;
Those teachers that are not ICT compliant should be encouraged to study further in order to meet up with the new demand.
Attention should be paid to the deploring state of facilities in our secondary schools. Also ICT systems together with necessary peripherals should be bought these will enhance the teaching and learning of physics and allow discovery of more facts.
Conferences, seminars, workshops and relevant programmers should be organized by professionals to teach physics teachers on modern technology and its uses.
Since ICT depends largely on the steady supply of power, the erratic power supply needs to be improved upon throughout the country. Also schools authority should improvises for alternative source of power supply such as renewable source of power, generator sets etc. in case of power failure.
ICT relevant curriculum should be developed especially for primary schools, secondary schools and tertiary institutions.
Finally student be open to new ideas, technology and advancement programmers so as to enable them learn and develop factor so as to meet up with both local and international needs.
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