Effectiveness of ICT Tools in Science Education

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Abstract
The objective of this study, "Effectiveness of ICT tools in Science Education," was to determine the current status of ICT use among secondary school students and teachers and to explore the problems while using the ICT tools. Simple random sampling was used as the sampling strategy. The instruments used to acquire the required data were student questionnaires and teacher interviews. I used a survey using descriptive data to achieve the study's goals. Simple statistical tools such as frequency and percentage were used to assess the data. The descriptive technique was used as the analysis procedure for quantitative data. The findings and conclusions were drawn after a thorough review of the data. According to the findings, the participants preferred ICT tools, but there was a lack of information about how to use it. It was discovered that students frequently confront issues such as a lack of access to an e-library and a lack of understanding of computer capabilities. Teachers do not have sufficient ICT tools for teaching them also. There must be included ICT tools in the science curriculum. It is necessary to provide ICT tools, an appropriate time, and ongoing training to increase ICT abilities. It included recommendations for improving ICT in the classroom instructors and students

Keywords : Hardware, ICT, participants, skills, software

Introduction
Information and communication technologies (ICT) were developed in the 20th century. Computer technology such as hardware, software, and communicative devices through the Internet like email, web, remote learning, video conferencing, e-banking, and distance learning has been developed. ICT plays an important role in science education. Teachers can engage students in the inquiry process through the help of ICT (Hennessy et al., 2007). Science professors who use a traditional teaching method face a significant hurdle. Transitioning from traditional to alternative education necessitates a change in teachers, influenced by various circumstances (Powell & Anderson, 2002). The characteristics of the teachers also have an impact on the use of ICT in the classroom (Supovitz & Turner, 2000). The computer and internet facility contribute sustainable and meaningful change to teaching and learning in science education for further education and training and for living and working in a digital world. To reap the benefits of ICT in science education, teachers must use and manage their ICT resources effectively. Business, banking, health, agriculture, communication, entertainment, transportation, manufacturing, and infrastructure development are just a few of the industries that employ ICT. However, incorporating ICT into science teaching has proven to be beneficial. In secondary school, computers, projectors, televisions, and audio-visual aids, as well as the Internet, were used.

Educators, administrators, and policymakers worldwide have tried in vain to improve science education by incorporating ICT into the classroom teaching and learning process. According to research, ICT professional development helps teachers improve their instruction, Buabeng (2012).

European countries and educational systems differ in terms of Internet connectivity and computer use in the classroom. Education and training are more vital than ever due to societal, economic, and technical advancements over the last few decades (Haddad & Jurich, 2002). The problems of growing marketplaces and sophisticated living environments necessitate expanding access, promoting efficiency, improving learning quality, teaching quality, and improving management systems. For example, master plans for promoting ICT in education have been developed in the United States, Denmark, Japan, Finland, the Netherlands, Portugal, and Spain (Cheng, 2002). Teachers' ICT use can be divided into supporting ICT and classroom ICT (Tondeur, van Braak, & Valcke, 2007). The first is the use of supportive ICT. The second goal of classroom ICT use is to support and enhance the actual teaching and learning process, such as using computers for demonstrations, drill and practice activities, modelling, representation of complex knowledge elements, discussions, collaboration, and project work, among other things (Sang, Valcke, van Braak, Tondeur, & Zhu, 2010). As a result, the focus of this research will be on how science students in grade ten use computers, projectors, and the Internet. In European countries, scientific classrooms have more Internet, computers, and projectors.

Statement of the Problem

Science and ICT are inextricably linked. Students, however, are earning inferior grades in science instruction, according to SSDP (SLC result-2075) (2016-23). The Ministry of Education has integrated ICT into the educational system by building computer labs in selected schools and offering internet connectivity to DEOs and schools. Furthermore, the Department of Education has produced interactive digital learning materials in Nepali, math, English, and science for students in grades two to six. Still, these materials have not been properly utilized in class or in other classes. Several people believe that incorporating ICT into the classroom would benefit students. However, it has not been investigated or seen in secondary or higher education courses. Computers are an effective educational tool that may boost both teaching and learning at the secondary and higher levels of science education. According to Ryan and Deci (2002), a student's mindset has a substantial impact on motivation. Motivated behaviour can be self-directed or regulated, and it can be motivated for various reasons. At the school level, information technology allows designers, academicians, and other educators to collaborate with administrators in education and students worldwide. Establishing a secondary school project management system would improve the quality of education management and project work.

As more people and institutions connect to the Internet, either through affiliations with non-profit networks or by subscribing to information services supplied by for-profit corporations, new chances for educators to overcome time and distance to reach students are opening up. Several studies have been conducted on computers and the Internet in secondary schools. On the other hand, what is the situation of ICT use among secondary school pupils?

How do they use computers and the Internet to achieve various objectives? What are the problems that keep you using it? And what factors influence how people use computers

and the Internet that haven't been addressed in previous research? As a result, this study concentrates on using computers and the Internet in science education in the Kathmandu valley. Only a few schools and college achievements will be measured in this study. There has been no investigation into the incidences of ICT use. Students desire to study using ICT tools, but they don't have access to them. As a result, many pupils struggle in science and the educational system.

Research Objectives

The research objectives of research indicate the central theme of the whole work. In this article, I have mentioned some objectives for the vital concern of the work. This research aims to analyze the present situation of ICTs in science education and to probe the problems of using ICTs in science education. These objectives provide guidelines to complete the research work.

Research Questions

This study examined science teachers' role perception and their teaching strategies while using ICT in their classrooms. The questions raised in the study were: What is the present situation of ICT in science education? How do the teachers use ICT in their instructional process in the school? How do students feel to use ICT in their learning process? and; What are the major problems of using ICT in science education?

Methodology

The methodology of a research work reflects the way of conducting the work. According to Creswell (2012), the methodology is an important part of a research work that provides a clear way or a map to complete the work. This portion includes research design, population and sampling, data sources, data collection tools, data analysis procedures, and validation procedures. In this research, I have used a quantitative survey design. In this design Survey is a research technique in which data are gathered by asking questions of a group of individuals (Ary et al. 2002). I have used simple random sampling techniques. This research explained the current use of ICT tools in the Kathmandu district. Information was collected from an individual through questionnaires, interviews and observation.

Various issues explain why ICT is not employed in science education to the level that it should be based on the potential mentioned in the literature (Ana, 2011). The following are the issues: (1) there is a computer but not using it in school (2) the teachers have insufficient time to learn about the use of ICT and its applications in science classrooms, and they have no confidence in ICT use (3) teachers resistance to change (the Difficulty to change teachers' beliefs about teaching and learning). The teachers who attended the training course "Virtual Instrumentation in Science Education", organized in the frame of this project, were asked to fill in an initial evaluation questionnaire. The evaluation aim was to create a big picture of the course attendees' ICT skills level, their expectations from the course if they use or do not use the computer during the lessons and so on. This survey shows there are many lapses in the use of ICT in science education in Nepal. It offered interesting information regarding the use of computers in the classroom, in science education, in European countries is ahead because they always use ICT in school education and higher-level education. The study population includes teachers and students of the secondary level of Kathmandu district. In any research, the whole numbers of people who are related to the research are population.

All respondents are not possible to include in the research. Sampling is done in such conditions. So the random sampling method is better where the total number of people is represented in the research. In this research, the students who were studying in two private and two communities schools are the population of the study. A sample of two private and two public schools was selected as the study sample. They were a representative sample of the 10 students from each school studying in grade 10, and a science teacher teaching science in these schools was the sample size. Hence, 40 students and 4 teachers were the samples of the study.

Results and Discussion

This portion presents the interpretations of the results based on the research site's existing realities. The collected data were presented and analyzed to reach its goal. Analysis and results are presented in different headings. Utilization of Internet, computer and projector. Purpose of email and Internet. Students' views on the effectiveness of ICT tools. Teachers' views on the effectiveness of ICT tools.

Obstacles to using ICT tools

Availability of computers and projectors in science education Students and teachers were asked some questions regarding using computers and projectors in the classroom. The data relating to computers and projectors are presented as;

Table 1
Internet, Computer and Projector

Participants		Categories	Private School		Public School		Total	
			Fr	%	Fr	%	Fr	%
TEACHER	YES	Personal Computer	2	100	2	100	4	100
	NO	Personal Computer	0	-	0	-	0	-
	YES	Projector in class	1	50	0	-	1	25
	NO	Projector in class	1	50	2	100	3	75
	YES	Internet	2	100	2	100	4	100
	NO	Internet	0	-	0	-	0	-
STUDENT	YES	Personal Computer	8	40	3	15	11	27.5
	NO	Personal Computer	12	60	17	85	29	72.5
	YES	Projector in class	10	50	0	-	10	25
	NO	Projector in class	10	50	20	100	30	75
	YES	Internet	19	95	15	75	34	85
	NO	Internet	1	5	5	25	6	15

Data in table 1 shows that most of the students do not have computers, and most of the classrooms projectors. The respondents do not have good access to computers and projectors that are the basis of ICT in the classroom. In the case of the Internet, most students and teachers use it. It is clear that all (i.e. 100%) the teachers used computers and the Internet. On the other hand, only 27.5% of the total students have computers.

In comparison to the ICT users of private and public schools, all teachers have personal computers, but the projector is used only by 50 % of the total private school participants. Such opportunities are not available to teacher participants in public schools. In the case

of the Internet, all the teacher participants have such an opportunity. On the other hand, student participants rarely have personal computers.

The students are asked about the topics they were dealt with the help of computers and the Internet. The data reveals that the use of computer and projectors are very rare to them. The data related to the topics that they were dealt with, computers and projectors, are given in order as follows;

Table 2

Subject Matter dealt with projector in the classroom

Topics	Private School		Public School		Total		Total Students
	Fr	%	Fr	%	Fr	%	
Measurement	6	30	4	20	10	25	40
Light	5	25	4	20	9	22.5	
Machine	4	20	4	20	8	20	
Gases ($CO_{2,}$ O_2)	5	25	3	15	8	20	
The Earth in the universe	2	10	2	10	4	10	
Atmosphere	2	10	2	10	4	10	

Table two reveals that measurement is the most frequent subject matter to be taught using a projector was measurement. It was 25%. This data reveals that a projector was used for 6 different topics out of the total 23 topics in the text. The use of a projector was least found in the respondents' classrooms.

Purpose of using the internet

Students use the Internet to fulfil different purposes. Some students use it to study, but others use it for entertainment. The students are asked about their purposes for using the Internet. The data shows that most of them used the Internet for entertainment. However, the other stated to study. The data derived from the students is presented in table No. 3.

Table 3

Purpose of using the internet

Topics	Private School		Public School		Total		Total
	Fr	%	Fr	%	Fr	%	
Facebook/ Skype	20	100	19	95	39	97.5	40
Movie /Game	18	90	19	95	37	92.5	
Solving Problems	19	95	17	85	36	90	
Reading Theories	15	75	16	80	31	77.5	
News	16	80	14	70	30	75	
Language study	15	75	10	50	25	62.5	
Travel and tourism	10	50	8	40	18	45	
Finding advertisement	9	45	8	40	17	42.5	

Chat/ Mail	3	15	2	10	5	12.5	
Research materials	1	5	3	15	4	10	
Reading materials	2	10	1	5	3	7.5	
Music/Fun	1	5	-	-	1	2.5	

The table clarifies the significant number of skype, movie/games and chat/mail, i.e., 97.5%,92.5%and 90%, respectively. However, an insignificant number of students, i.e., 1,3 and 4 used the Internet for research material, language study, and reading material.

Obstacles in the use of ICT tools

The utilization of anything is affected by the obstacles faced by the users. The barriers can be related to the ignorance of using the computer and the internet, negative attitude toward authority, lack of infrastructure facilities, non-availability of computers, high cost/ expensive, lack of networking system, lack of e-library, and lack of encouragement. Table four presents the details of the obstacles the secondary level students face in utilizing computers and the Internet.

Table 4
Obstacles in the use of ICT tools

	Private School		Public School		Total		Remarks
	Fr	%	Fr	%	Fr	%	
Lack of infrastructure facilities	10	50	13	65	23	57.5	
Lack of e-library	5	25	15	75	20	50	
Non availability of computer	7	35	8	40	15	37.5	
Ignorance of potential of computer and internet	8	40	6	30	14	35	
Difficulty in using hardware and software	7	35	6	30	13	33.5	
Negative attitude of authority	5	25	7	35	12	30	
Lack of networking system	4	20	8	40	12	30	
Lack of encouragement	4	20	7	35	11	27.5	
High cost/expensive	8	40	2	10	10	25	

Table number four reveals the lack of sufficient infrastructure facilities and 50 % of the total face in private schools and about 65 % of the total in public schools. Likewise, 35 % of students sometimes faced the problem of ignorance in the potential use of computers and the Internet. Among them, 40 % of the total face in private school and about 30 % of the total in public school.30 % of the total faced Difficulty due to the negative attitude of

authorities. Similarly, the non-availability of the computer has been one of the barriers. Among them, about 40% of students in private schools couldn't use the computer due to high cost, and 33.5% of public school students couldn't afford it due to being expensive. The table demonstrates that about 35% of students faced hardware and software problems while using computers and the Internet. The table also shows a lack of a networking system; 20% of students of in private schools and 30% of public schools face the problem with computers and the Internet. Lack of e-library 75% of public school students couldn't serve Internet, and 25% of private school students faced the same obstacle. Lastly, the result indicates that most students faced problems with infrastructure and facilities to use computers and the Internet. There is no significant difference between public and private school students who face computer and internet access problems. Thus it is obvious from this result that most of the students always face the problem of lack of e-library, ignorance of potential use of computer and Internet sometimes, and they never face the problem of the negative attitude toward authority.

Teachers' Views on Effectiveness of ICT Tools

The selected teachers were questioned using guided questions to determine their views on the effectiveness of ICT tools. Teachers' attitudes toward ICT were measured using the information they provided. In the following section, we'll go over the information we got from the teachers. The first question was whether or not using a projector in the classroom was effective. They were also asked what topics they thought would be most effective to teach using ICT. According to the data, all teachers were enthusiastic about using ICT as a projector in the classroom. They also alleged that the classroom did not have a projector. Only two teachers said they used technology in the classroom. The teachers wanted that they have ICT tools as projectors. One of them stated that the projector is time-consuming and students did not have enough interest in learning ICT tools. For the topics, they stated solar system, metals magnet, electricity, magnetism, daily use materials, atmospheric layer periodic table, and the layer of earth surface and origin of the earth.

Students' Views on Effectiveness of ICT Tools

The students were asked different questions to find out their views on the effectiveness of ICT tools. Firstly, the students asked whether they understand if the teacher uses a computer and projector in the classroom. Three scales are used to rate their response, such as always, sometimes and never. The views given by the students are listed as;

Table 5
Understanding teaching using computer and projectors

School	Categories	I understand if teachers use computer and projectors in the classroom.		If teachers become lazy, they will display the matter in projector	
		FR	%	FR	%
Private	Always	14	70	3	15
	Sometimes	4	20	8	40
	Never	2	10	9	45

Public	Always	2	10	2	10
	Sometimes	-	-	-	-
	Never	3	15	3	15
Total	Always	16	40	5	12.5
	Sometimes	4	10	8	20
	Never	5	12.5	12	30

Table number five signifies that only a few participants have not responded to these issues about using computer and projector. The respondents' responses display that they always, sometimes and never understand if the teacher uses computer and projector in the classroom 40%,10% and 12.5% of the total participant, respectively. In comparison to private and public school, the public school participants were reluctant to respond. A very greater number of participants understand in private school, whereas very few participants were from the public school. It might cause less use of such materials in the classroom. The respondents' responses display that they always, sometimes and never understand. If teachers become lazy, they will display the matter on a projector; 12.5%,20% and 30% of the total participant, respectively.

In comparison to private and public schools, the public school participants were reluctant to respond. A very greater number of participants understood in private school whereas the very few participants were of the public school. It might cause less use of such materials in the classroom.

These data could be inferred that the students enjoy computers and projector in private schools than in public schools. Public school students might not get the opportunity to operate computer and the Internet in learning.

Table 5

Like ICT for learning

Categories	**Private**				**Public**				**Total**			
Would you like to use ICT for learning activities?	**YES**		**NO**		**YES**		**NO**		**YES**		**NO**	
	FR	%	FR	%	FR	%	FR	%	FR	%	FR	%
	7	70	3	30	6	60	4	40	13	65	7	35

Table number five displays that 65%of the total participants accepted that they like ICT for learning, whereas the rest of the participants, that is 35% of the total, denied that they like ICT for learning. Unlike private school, public school participants accepted and rejected that they like ICT for learning in the classroom. Through the data, it can be inferred that about two-thirds of the participants accepted that they enjoy learning through ICT. The rest of the participants strongly rejected ICT in the classroom.

Suggestions for Addressing the Problems

The teachers were asked about the advantages of using ICT in the science classroom. The response differs from one teacher to the next. One of them mentioned that they get

students to study by beginning with interest, which drives them to learn. According to the other Teacher, such gadgets are highly useful in the science lab. The next teacher had similar sentiments, stating that they are extremely beneficial since they allow kids to learn for the rest of their lives. Including the teachers' opinions, some suggestions can be given to address the problems. Making science lab work more effective by attracting, arousing, and motivating students is necessary. Teachers should provide feedback to aid in the memorizing and comprehension of knowledge. Facilitate the implementation of school curricula by integrating ICT with the material. It is essential to construct students' ability through their creative work. Cause association computer-aided work with simplifying since understanding, as computer helps solve common and complicated problems. Information and communication technology (ICT) instruction should be mandatory in all schools. Through in-service education, it is notable that serving scientific education instructors should be able to become ICT literate. The government should ensure that every school has access to ICT devices.

Conclusion

Looking across the short period in different 4 schools represented in my study, I gained a broad picture of the kinds of contributions that teachers and students saw the use of ICT as making to teaching and learning and some of their reservations about such use. The first theme, tasks affected, illustrated how pupils viewed ICT tools as enabling them to carry out tasks easily, rapidly and reliably and to present neat and attractive products. The second refinement assisted and emphasized how these tools facilitated the progressive editing and modification of written work and exploratory development of ideas and designs. The third theme, feel altered, revealed that many pupils regarded computer use in school as typically distinct from regular classroom activity in terms of novelty, location, layout and interactions between themselves and their teachers. Elements from these three themes were also closely intertwined with the fourth theme, motivation changed. Whilst pupils associated using ICT with difference, fun, enjoyment, challenge and the removal of the constraints related to manual tasks, they also pointed to attenuated personal satisfaction when automated processes removed the opportunity for their active involvement with the task in hand. Similar reservations were identified within the first theme, where pupils felt that output uniformity detracted from individual creative expression. The motivation was also reduced where inadequate technical skills inhibited pupils' participation in computer-based activities. I think they are interested in using ICT tools for science classrooms, but there are fewer ICT tools, and teachers are less familiar with ICT tools, so they do not construct the science knowledge through ICT tools.

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