Vol.3, No.1, November 2021

Teachers' Perception on Effects of ICT Tools in Teaching Science at Secondary Level

Rajeswar Prasad Yadav *
rajeshweryadav@gmail.com

Reviewed on August 05, 2021 *Revised on August 20, 2021* *Accepted on September 02, 2021*

Abstract

In this digital era, the use of ICT tools in teaching learning has been increasing day by day. This study, therefore, focuses on teachers' perception on effects of ICT tools in science teaching classes. The objectives of the study were to identify the existing situation of the use of ICT tools in science teaching and to find perceptions of teachers towards effects of ICT tools in effective classroom teaching in both public and private schools. 12 science teachers one from each school and 12 secondary schools: six public and six private of Siraha district were selected randomly as population of the study. This study followed quantitative survey research design. The data were collected through questionnaire, observation and group discussion. The data showed that the teachers used various ICT tools but they have to face various challenges due to poor infrastructure, limited accessibility, poor network connection, insufficient technical support and lack of effective training. It was found that private school teachers had higher perspectives than public school teachers due to age factor and competency of ICT knowledge and practice. This project is hopeful to provide proper information and suggestions to those who are responsible for integrating new technologies in science teaching.

Keywords: *Teachers' perception, information and communication technology, challenges, focus group discussion.*

Introduction

Nepal is a hilly country of south Asian region. It is small but diverse in the fields of geographical distribution, social, cultural, languages, socio-economic, living status, educational practice point of views. After federal system in Nepal, traditional pattern of teaching–learning practices are still in practices, which are dominating recent pedagogy in teaching and learning in the field of science teaching.

In common view, science is the systematic study of knowledge. Teachers always focus on changes in the behavior of students through practical activities.

* Mr. Yadav is a reader of Biology department at S.S.M.Y.M. Campus, Siraha.

Science learning is one of the best medium for positive motivation using different Information & communication technology (ICT) tools. The 20th century was accepted as the world of scientific age and the 21st century is the age of Science & Technology, which is upgrading through advanced ICT & their uses in all the areas of knowledge.

Nowadays, learning paradigms are undergoing with the progress of ICT day to day. Since 1980, regarding the development of ICT & the people's awareness of the value of integrating ICT in education, a number of countries have carried out many initiatives to introduce ICT in their educational systems (Goktas, 2013; Liu & Pang, 2014). ICT integration is the topical needs of everyday life & plays an important role in global society.

According to Fensham (2008), the curricula that set this very high level science learning as expected for all students must be a factor in learning the serious decline ofinterest in science. In the view of Gbamanja (1999), traditionally, science teaching was dull, unimagined & lacking in vigor. The teacher dispensed knowledge, while the learners learnt mostly by use memorization. Students were passive learners. This scenario will certainly not encourage & motivate interest in science learning that is a major key to use of ICT tools in classroom teaching.

According to ICT in Science Teaching Technical Report (2003), following fields of applications are used in impact of science teaching:

- Practicing problem solving through ICT access,
- Providing tutorial instruction both for science teacher & students,
- Making use of integrated learning system,
- Making use of simulation virtual classroom learning in specific science lessons,
- Use as modeling, data bases & spread sheet & data-logging, Graphing, controlling & monitoring of experiments,
- Presenting, sharing & communication of related information with peers, teacher-students, expertise, related persons etc.

According to improving scientific literacy among Secondary School Students through the Integration of Information & Communication Technology, Journal of Science &Technology (2012), report of the Federal Republic of Nigeria, included the ICT into the school system in the 4th edition of the national policy on education. The policy stated that ''Government shall provide necessary infrastructure & training for the integration of ICT in the school system in recognition of the role of ICT in advancing knowledge & skill

in the modern world.

Objectives of the study:

- to find out the teachers perceptions towards the use of ICT tools in effective classroom teaching.
- to identify the challenges of using ICT tools in science teaching.

Review of related literature

Any philosophy must be supported by any theory for its pedagogical implementations. Likewise, the use of ICT is supported by many theories. Here, I will be discussing in brief about these theories.

The Constructivist theory of learning believes that the knowledge can be developed within the classroom, different teaching learning activities, using different learning tools (ICT tools) through different process. The guideline principle of constructivist learning theories is the learners own active initiative and control in learning, and personal knowledge construction that is self-regulation of learning (Chan, 2002, p. 3).

The constructivist classroom student try to find the solution of the problems by learning in a group where students are motivated to do their work themselves and find the solution and teacher work is just to facilitate the student. By using ICT tools in classroom, students develop their knowledge by visualizing and here teachers role is just a fascinator for sharing their ideas, expanding their knowledge through use of ICT tools (Tyler, 2002).

According to Mortimer and Scott (2003), that learning requires active intellectual involvement of students, and that the students' prior knowledge influences subsequent learning of scientific concepts.

Vygotsky (1978) introduced the term zone of proximal development (ZPD), which may be understood as the distance between what an individual can manage on its own, and what the individual can manage with support from other and more competent persons.

In this 21st century, collaborative approaches in science as well as in other subjects are also very essential and it helps to promote learning and creating easy environment with learner and teachers because it is more closely with group work activities and adult learning (Tobin, 1993 p.108.)

Piaget also advocates that learning is the active participation of learner not the passive receiving of facts. Collaboration is more in collaborative classroom where students are encouraged and motivated to learn and involve in many activities. BECTA (2003) states that by using ICT in pairs or groups, teachers are able to gain deeper insights into students

understanding and progress. Thus, ICT resource helps to understand and learn from such collaboration.

In this case, there are not enough related research works in our Nepalese context. Only very few researches have been carried out on the effective use of ICT tools in science teaching at secondary level. Taylor (2001) expresses his opinion "Information & Communication Technologies have been instrumental in social transformations – from the industrial society of the 20th century to the "Network Society" of the digital age.

Ibrahim (2010), talks about the impact of ICT as:

The ICTs put forward influential base for efficient education. Now, we need the modern technologies for better-blended method of delivery to create apt teaching techniques to enhance to process of learning. ICTs are very motivating, because it helps the learners to learn carefully to meet the prescribed goals.

Swank, (2011), stressing the effectiveness of visual materials in learning estimated that about 40% of our concepts are based upon visual experience, 25% upon auditory, 17% on tactile, 15% upon miscellaneous organic sensation and 3% upon test smell. The above data also declared that audio-visual materials are important in teaching learning process, which is being fulfilled by use of ICT tools.

According to Acharya, C.P.(2013), in his research " Use of ICT & WEB tools in English language teaching" address 90% teachers working in higher secondary school preferred ICT tools in Kathmandu valley but only 35% of the teachers teaching with Networked Computer & 20% Digital video recording uses in specific topics. In his study finding, the integration of ICT/WEB tools in ELT made classroom teaching more practical & sustainable.

It helps to change the traditional way of teaching, collaborate with students & teachers & create student-centered teaching. These tools are carrying out effective pedagogical implications in the classroom. It helps to promote easy motivation of learners. Their study is necessary to create ICT culture in Nepalese context for professional & qualitative teaching learning practices.

Methodology

In this study, quantitative survey research design is used. Science teachers of selected schools were taken as primary sources of data. School records, district education office records were taken as secondary sources. Data was collected from teachers & administrators by using tools like questionnaire, focus group discussion, and observation form.

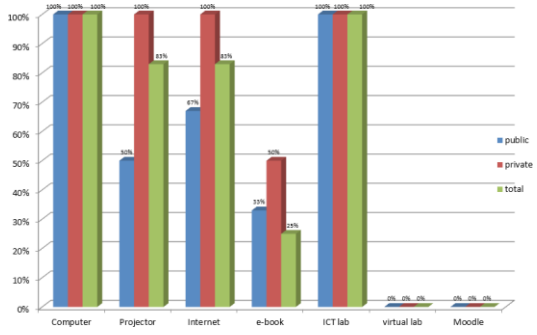
District was selected purposefully and schools were selected by using sample random method. Among selected schools: six were community schools and six were private schools. Number of science teacher in each school was one, so 12 science teachers were the participants.

Major Findings and Discussions

Existing situation of Common ICT Tools

In the research, study tools like questionnaire, survey and focused group discussion findings describes that the existing use of common ICT tools and related situation in public and private schools are as follows:

Chart 1 Available Common ICT Facilities in School

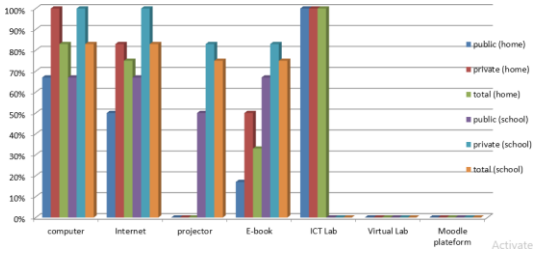


The chart 1 shows that, almost all schools had mobiles, computer and laptop facilities. Total 50 percent public and all private schools had projectors facilities. Similarly, only four schools among 6 public schools had connected Wi-Fi / Internet facilities, but such facilities were available in all private schools.

Available of Common ICT Tools

Study focused six common ICT tools and they were used in teaching purpose at home and classroom time because timing factors are also vital for teaching-learning practice, shows under the following chart:

Chart 2 Practice of Common ICT Facilities and their Use in Teaching at School/Home



The chart 2 shows that about 83% teachers had been using of Computers/ Laptops at schools and home. Only 33% public teachers had not used these tools in school and home. The data interpreted that, they had lack of sufficient skills and practice about handling these ICT tools. However, these tools were available in all schools.

Teacher's Perceptions towards Knowledge of ICT Tools in Teaching

In this table, study focused on measurements of perceptions through existing knowledge of school science teachers as follows:

Table 1: Teachers' perceptions towards knowledge of ICT tools in teaching learning

SN	Fields of ICT Tools / Facilities	Good			Moderate			Poor			Very Poor		
		Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)
1.	Knowledge about fundamental ICT tools (computer, internet, projector)	3(50)	5(83)	8(67)	1(17)	1(17)	2(17)	1(17)	0	1(8)	1(17)	0	1(8)
2.	Knowledge for handling the ICT Tools	3(50)	4(67)	7(58)	1(17)	2(33)	3(50)	1(17)	0	1(8)	1(17)	0	1(8)
3.	Knowledge about the Ms office application package												
	i. Ms. Word	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	1(17)	0	1(8)
	ii. Ms. Excel	2(33)	4(67)	6(50)	2(33)	1(17)	3(50)	1(17)	0	1(8)	1(17)	0	1(8)
	iii. Ms. PowerPoint	3(50)	4(67)	7(58)	1(17)	1(17)	2(17)	1(17)	1(17)	2(17)	2(33)	0	2(17)
	iv. Web browser	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	1(17)	0	1(8)
4.	Knowledge about social sites												
	i. Facebook	6(100)	6(100)	12(100)	0	0	0	0	0	0	0	0	0
	ii. Messenger/vibers	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	1(17)	0	1(8)
	iii. E-mail	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	1(17)	0	1(8)
	iv. Whatsapp	2(33)	4(67)	6(50)	2(33)	2(33)	4(33)	0	0	0	0	0	0
5.	Knowledge about wifi / internet for integrated in teaching learning	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	1(17)	0	1(8)
6.	Knowledge about websites as learning resources	3(50)	5(83)	8(67)	1(17)	0	1(8)	1(17)	0	1(8)	0	0	0
7.	Knowledge about learning management facilities												
	i. E-books	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	0	0	0
	ii. E-Library	2(33)	4(67)	6(50)	0	1(17)	1(8)	2(33)	1(17)	3(50)	2(33)	0	2(17)
	iii. Virtual Lab	1(17)	3(50)	4(33)	0	1(17)	1(8)	2(33)	1(17)	3(50)	3(50)	1(17)	4(33)
	iv. Moodle site	1(17)	2(33)	3(25)	1(17)	1(17)	2(17)	0	2(33)	2(17)	4(67)	1(17)	5(42)
8.	Knowledge about how to edit, design, attached, animation of slides for teaching	2(33)	4(67)	6(50)	1(17)	(17)	2(17)	1(17)	1(17)	2(17)	2(33)	0	2(17)
9.	update of knowledge to teach with modern teaching technique	2(33)	4(67)	6(50)	1(17)	2(33)	3(50)	1(17)	0	1(8)	2(33)	0	2(17)

Table 1 shows that 67% science teachers had expressed that they had good knowledge about fundamental ICT tools like computer, internet, projectors, etc. However, this knowledge had been higher in private teachers than public teachers. Similarly, rest teachers had moderate knowledge. They used MS-word, Excel, Power point and Web browsers, but only 50% teachers were able to express their knowledge. Remaining teachers had no adequate knowledge about these skills. However, almost all teachers expressed higher knowledge about facebook, messengers and E-mails although 33% public teachers were out of reach from

these facilities. According to focused group discussion, the majority of teachers (83%) had good knowledge about Wi-Fi/ Internet facility. These private teachers were clear about the use of website for learning in ICT. At last, only 50% teachers had good knowledge about how to make, edit, design, attach and animate the slides and update the knowledge for teaching with modern ICT based teaching techniques.

The study result of the above table cleared that half of the total teachers did not have sufficient knowledge about use of ICT teaching tools. Due to lack of friendly environment and traditional style of teaching, they were not updated. These results were better in private teachers than public teachers.

ICT Facilities and their Use in Teaching

Table2: ICTs and their use

SN	Items	Uses Of ICT Facilities in Teaching														
		Always			Often			Sometimes			Rarely			Never		
		Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)
1.	Mobile	6(100)	6(100)	12(100)	0	0	0	0	0	0	0	0	0	0	0	0
2.	Computer	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	0	0	0	0	0	0
3.	Laptop	2(33)	4(67)	6(50)	1(17)	1(17)	2(17)	1(17)	1(17)	2(17)	0	0	0	2(33)	0	2(17)
4.	Projector	0	0	0	2(33)	2(33)	4(33)	1(17)	3(50)	4(33)	0	0	0	3(50)	1(17)	4(33)
5.	Digital Board	0	0	0	0	0	0	0	0	0	0	0	0	6(100)	6(100)	12(100)
6.	Digital Camera	0	0	0	1(17)	2(33)	3(25)	2(33)	3(50)	5(42)	1(17)	0	1(8)	2(33)	1(17)	3(25)
7.	Internet / Wi-fi	4(67)	5(83)	9(75)	0	1(17)	1(8)	0	0	0	0	0	0	2(33)	0	2(17)
8.	App. Software	2(33)	4(67)	6(50)	2(33)	2(33)	4(33)	0	0	0	0	0	0	2(33)	0	2(17)
9.	E-library / Book	0	0	0	0	2(33)	2(17)	2(33)	1(17)	3(25)	0	0	0	4(67)	3(50)	7(58)
10.	Virtual Lab	0	0	0	0	0	0	0	0	0	0	0	0	6(100)	6(100)	12(100)
11.	Power Supply	2(33)	5(83)	7(58)	0	0	0	0	0	0	0	0	0	4(67)	1(17)	5(42)
12.	Technical Manpower	4(67)	6(100)	10(83)	0	0	0	0	0	0	0	0	0	2(33)	0	2(17)
13.	ICT Lab	2(33)	4(67)	6(50)	2(33)	2(33)	4(33)	0	0	0	0	0	0	2(33)	0	2(17)
14.	Science ICT Lab	0	0	0	0	0	0	0	0	0	0	0	0	6(100)	6(100)	12(100)
15.	Moodle	0	0	0	0	0	0	0	0	0	0	0	0	6(100)	6(100)	12(100)

In this study, the researcher included 15 indicators were analyzed to their use in school teaching . The majority of teachers (83%), access to practice of Ms Office packages but they were used only in computer classes and administrative purposes rather than in Science teaching/ learning activities. Similarly, e-library, virtual lab and moodle learning software management facilities were not available in any schools. However, about 17% public school teachers could not handle these

tools in their classroom. The study also showed that about 17% schools did not have projector facilities; consequently, they entirely adopted the traditional ways of teaching. They seem to be less collaborative and somehow careless in daily classroom teaching.

Teachers Perceptions towards the effects of ICT tools in classroom teaching

The following table shows the descriptive statistics the teachers' perspectives in effecting ICT tools in classroom teaching among schoolteachers.

Table 3

Teacher's perspectives towards the effect in classroom

SN	Impact of ICT tools in classroom teaching	Strongly Agree			Agree			Least Agree			Not respondents		
		Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)
1.	Motivate in teaching biology	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	0	0	0
2.	Increase interest in the classroom	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	0	0	0
3.	Control & concentrate in learning	2(37)	4(67)	6(50)	2(37)	2(37)	4(33)	0	0	0	2(37)	0	2(17)
4.	Understand more easily when the learn	4(67)	4(67)	8(67)	1(17)	2(37)	3(25)	1(17)	0	1(8)	0	0	0
5.	More engaged & less disturbing in classroom	2(37)	4(67)	6(50)	2(37)	2(37)	4(33)	0	0	0	2(37)	0	2(17)
6.	Feel more autonomous in learning activities	2(37)	4(67)	6(50)	2(37)	2(37)	4(33)	0	0	0	2(37)	0	2(17)
7.	Feel passive learners change to active learning	4(67)	6(100)	10(83)	1(17)	0	1(8)	1(17)	0	1(8)	0	0	0
8.	Increase cooperation and collaboration work in learning	2(37)	4(67)	6(50)	2(37)	2(37)	3(25)	1(17)	0	1(8)	2(37)	0	2(17)
9.	Increase problem solving base learning	2(37)	4(67)	6(50)	2(37)	2(37)	4(33)	1(17)	0	1(8)	1(17)	0	1(8)
10.	Improve self learning environment	2(37)	6(100)	8(67)	2(37)	0	2(17)	1(17)	0	1(8)	1(17)	0	1(8)

According to table 3, the entire result showed moderate level. Among them only 67% public teachers expressed strongly yes while all others private teachers expressed first choice. The study also focused on pedagogical effects from the use of ICT tools in classroom teaching learning "passive learner change to active learner". All private teachers expressed strongly yes, but for the same statement, only 67% public teachers expressed the same effects. They could not understand about the terms cooperative & collaborative methods of teaching due to anagogical science background.

The above data interpreted that majority of school teachers felt the use ICT tools showed positive effects. It helps in both teaching learning and establishing self-learning environment. Although some senior teachers had no time to update, so they were not using ICT tools in classroom as well as lab works. Therefore, they could not find their positive effects however, they also realized it.

Teachers Facing the Challenges of Implementing ICT Tools in Teaching-Learning

Table 4: Teacher facing the challenges of implementing ICT tools in teaching

S. N.	Statements	Strongly Agree			Agree			Least Agree			Not respondents		
		Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)	Public (n%)	Private (n%)	Total (n%)
1.	Insufficient numbers of computer	4(67)	2(33)	6(50)	2(33)	3(50)	5(42)	0	1(17)	1(8)	0	0	0
2.	Inadequate & slow speeds of Internet	6(100)	6(100)	12(100)	0	0	0	0	0	0	0	0	0
3.	Poor ICT infrastructure	6(100)	2(33)	8(67)	0	2(33)	2(17)	0	2(33)	2(17)	0	0	0
4.	Poor ICT lab management	4(67)	0	7(58)	2(33)	3(50)	5(42)	0	0	0	0	0	0
5.	Poor power supply management	6(100)	4(67)	10(83)	0	0	0	2(33)	2(33)	0	0	0	0
6.	Unable to time management to use of ICT tools in teaching	6(100)	4(67)	10(83)	0	2(33)	2(17)	0	0	0	0	0	0
7.	Lack of technical support to use of ICT tools in teaching	4(67)	2(33)	6(50)	2(33)	2(33)	4(33)	0	2(33)	2(17)	0	0	0
8.	Lack of update of knowledge to use of ICT tools in teaching	6(100)	4(67)	10(83)	0	0	0	0	2(33)	2(17)	0	0	0
9.	Inadequate administrative support	6(100)	4(67)	10(83)	0	0	0	0	2(33)	2(17)	0	0	0
10.	Traditional style of teaching	5(83)	3(50)	8(67)	1(17)	2(33)	3(25)	0	1(17)	1(8)	0	0	0
11.	Inadequate ICT friendly environment	6(100)	6(100)	12(100)	0	0	0	0	0	0	0	0	0

Every schools was connected with Wi-Fi/ Internet facility but they faced slow speed problem due to poor infrastructures. Insufficient capacity and poor lab management was major problems. All teachers expressed they could not update ICT capacity building due to lack of time management. All public schools teachers needed support from administration or others but they were not getting these kinds of support. Similarly, more public teachers expressed they were suffering from traditional style of teaching and had no friendly environment.

The analysis interpreted that all schools teachers were facing different types of ICT related problems. However, majority of private teachers were managing the problem by self. Same were the condition of public teachers due to lack of awareness.

Major findings

i. The result concluded that age factors also influenced modern ICT technology based teaching learning activities.

ii. The computers, projectors, internet, etc were used by 83% teachers. Among them one third of public teachers were found not using it due to insufficient skills & only half of the teachers had sufficient knowledge of handling and using ICT tools.

iii. More than 80% both public and private teachers "strongly agreed" towards student motivation, increase interests, passive learners change into active learners etc were impact of

ICT Tools & they understood about terms cooperative and collaborative methods of teaching and pedagogical related effects.

iv. Majority of teachers felt use of ICT tools result as positive effects but could not found these effects due to inadequate ICT based teaching-learning environment.

v. Majority of both types of teachers expressed that they suffer from traditional style of teaching, due to lack of knowledge and skills & they could not create self-learning managing environment. They had an adequate administrative support for conducting awareness program.

Conclusion

The study emphasizes on teachers knowledge towards handling the common ICT tools and their uses in classroom as well as in science lab. This study also recognizes the effectiveness of the extent of ICT tools in supporting classroom teaching and learning. Based on study it was found that identifying the average level of the perceptions in implementing ICT tools on teaching and high level of challenges of using these tools in teaching and learning in classroom among both public and private schools teachers.

The result of the study showed that high-level perceptions occurred in private teachers than public teachers due to friendly age factors towards ICT integrated activities. The study finds that most science teachers are concerned on ICT interrelated teaching-learning activities but they lack ICT friendly environment. The teachers are gaining positive perception day by day. This study also identifies that young generation teachers are rapidly replacing traditional pattern of teaching by ICT based teaching. However, all teachers are feeling that e-resources are necessary to meet new generation students.

Recommendations

- The policy makers should make policies based on modernized ICT base teaching rather than traditional one.
- Every public and private school administrators should manage rich ICT infrastructure.
- The government and Educational Institutes should provide One-teacher One-Laptop and conduct ICT skills based trainings.
- Every teacher should obey the ICT-friendly environment in classroom teaching.
- Every school teachers should learn skills about the use of e-library, virtual lab, moodle site as learning management application system.

- Allteachers, administratorsand donor agencies should manage appropriate environment for minimizing the ICT related issues.
- The proper stakeholders should think about the further research with respect to the digitalized age of ICT around the world.

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