# Perspectives of Science Teachers on the Use of ICT Facilities in Secondary Schools Biology Teaching

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**Abstracts**

*Recently, the use of ICT tools in teaching-learning has increased rapidly. The main objective of the research focused on the perspectives of teachers on the use of ICT tools and their effects on biology teaching. This study followed a quantitative survey research design. Altogether 55 biology teachers were selected from all the community and institutional schools of Siraha district where the science stream is running in classes11& 12. The data were collected through closed questionnaires and analyzed by using SPSS software like t-tests, mean, standard deviation and significance level. The data showed that almost all schools had minimum requirements of ICT tools. Themajority of teachers had good knowledge about MS-applications, social sites and social media platforms, except one third didn't know about it. Although the majority of biology teachers had poor practice about the use of ICT integrated in the classroom and they didn't realize their pedagogical effects. Teacher's level of qualification, ICT qualification and style of teaching etc., the independents were significantly associated with teachers ICT knowledge and ICT effects dependent factors. It is expected that the outcomes of this research provide proper information and suggestions to those who are responsible for integrating new technologies in school teaching particularly biology subjects.*

**Key words:** Competency, Biology teachers, Information and Communication Technology, Quantitative, association, pedagogical effects

## Introduction

Nepal has a big multi-diversity in the fields of geographical distribution, social, cultural, languages, socio-economic, living status, educational practice point of views, etc. After federal system in the Nepal, the traditional patterns of teaching-learning practices are until in practice, which are dominated by recent pedagogy in teaching and learning in the field of biology education (Yadav, 2019). Biology covers all areas of our life & surrounding environment. Teachers always focus on change in the behavior of students through practical activities. Learning is one of the best mediums for positive motivation using different Information & communication technology (ICT) tools. The 20th century was accepted as the world of scientific age and the 21stcentury is the age of Science &Technology, which is upgrading through advanced ICT and their uses in all the areas of knowledge. In addition, biology education is one of them.

In the view of Gbamanja (1999), traditionally, biology teaching was dull, unimagined and lacking in vigor. Vigor teacher dispensed knowledge, while the learners learnt mostly by using memorization. Students were passive learners. This scenario will certainly not encourage and motivate interest in biology learning that is a major key to the use of ICT tools in classroom

teaching.

Journal of Science and Technology (2012), a 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.

In our nation, ICT education is also being popular to increase for the effective teaching-learning procedure in biology education. Our science education curricula also include the “Science for All” movement in the higher-level curriculum. The teachingof science requires a special ability, intelligence, appropriate use of teaching method & relevant need base instructional materials effective through the use of ICT tools.It is necessary to understand the relationship between the material, scientific methods, and technology in order to become efficient and effective science teachers, mainly in biology (Yadav, 1919).

To make school science teaching more effective, ICT is being challenged because the innovations of theories of scientific methods, principles directly influence the use of ICT tools. This is because of the innovation of science teaching and the influences of ICT tools science teacher should be well equipped with knowledge and skills used in classroom as well as virtual theories and practical classes; she/he should be updated to adopt ICT tools in his/her teaching performance to make his/her profession quite effective and for better adjustment of his/her learners.

The purposeful integration of ICT can also improve the science teaching and learning process. As a result, ICT may be very useful in supporting science learning in areas like measuring, exploring, researching, analyzing, and interpreting. Numerical simulations also can be utilized when such a activity is not possible in a science lab. Learners can use the Internet to access information and participate in problem-solving activities. Learners gain skills in a vast scope of ICT applications while using ICT, which could serve them well in the future. As a result, the new Science Curriculum emphasizes the use of ICT as part of the science teaching technique whenever possible (Tshewang, 2019). For successful integration of technology in teaching-learning processes, it has been suggested that change must begin with teachers, including pre-service teachers (Diem, 2000; Schibeci et al., 2008).

In a study of Ozdamli and Uzunboylu, (2015) as cited in Tshewang, (2019), teachers had a positive perception of teaching using mobile technologies although there were not enough skills for the technology. The attitudes of teachers about the use of technology in education are positive. This is true even if adoption is modest. Having a positive mindset is not enough to achieve high levels of adoption. The conclusion from the literature study applies to Bhutan as well. The amount and scope of ICT use by instructors is a significant consideration. This component is an incorporated factor in all of the study’s research questions and is examined using some variables.

The use of knowledge and skills of ICT essential in enhance of school teaching learning (Dhital, 2018) was the study done by the Ministry of Education ( MoE), Nepal. So far, ICTs have not been used as a way of acquiring new knowledge and skills in schools of Nepal due to inadequacy of curriculum content and limited access to ICTs. MoE has introduced ICT into the school sector by establishing computer labs in selected schools and internet connectivity in District Education Offices (DEOs) and schools. MoE, emphasizedalthough there had been a few studies on information, abilities, demeanors, and recognition of utilizing ICT in schools, there

had been for all intents and purposes no investigation related to schools of Siraha district. This research was the first attempt to fill this gap. How this gap was tended to by this research has been depicted by proposing aims and research questions.

**Objectives of the study**

The main objective of this research was to find out the perspective of secondary biology teachers towards the integration of ICT in biology teaching and the relationship of ICT knowledge and its pedagogical effects with teachers' personal independent variables.

**Methodology**

Quantitative research designed utilizes processes and techniques usually decides what to study; asks specific, closed questions, collects quantifiable data from participants; analyses these numbers using statistics; and conducts the inquiry in an unbiased, objective manner (Creswell et.al.,2011).Total 16 science stream both community and institutional schools, there conducting in 11 and 12 grade and their entire 55 biology teachers of Siraha District (District Education Coordination Unit[DECU], 2019) were selected as a sample of the study. The data were analyzed by applying SSPS 20 version statistical software. The collected quantitative data were analyzed and discussed by using the statistical tools like percentage, dependent variable Likert-scale compute and convert into sum of the total score through mean, standard deviation with descriptive statistics test. Find out the correlation coefficient and significant value by the use of t-test(Muijs,2014) and other aspects were discussion narrative.

**Result and Discussions**

The research focused on secondary school Biology teachers' demographic questionnaires on type of schools, gender,age, and level of education, ICT qualification, teaching experience and their pattern of teaching competency of respondents. These factors directly or indirectly affected the competencies of ICT in teaching skills.

Table 1, *Demographic descriptions of Biology Teachers*

| Factors | Descriptions | Frequencies | Percenage |
|---|---|---|---|
| Types of Schools | Community | 22 | 40.0 |
| | Institutional | 33 | 60.0 |
| Gender of teachers | Male | 42 | 76.4 |
| | Female | 13 | 23.6 |
| Age of teachers | Upto 35 yrs | 24 | 43.6 |
| | Age 36 to 45yrs | 26 | 47.3 |
| | Age 46 and above | 5 | 9.1 |
| Level of Education | Diploma | 11 | 20.0 |
| | Master Degree | 40 | 72.7 |
| | Above Master Degree | 4 | 7.3 |

| | | | |
|---|---|---|---|
| ICT Training or qualification | Without ICT qualification | 41 | 74.5 |
| | With ICT qualification | 14 | 25.5 |
| Teaching experiences | Up to5 yrs experience | 21 | 38.2 |
| | 6 to 10 yrs experience | 28 | 50.9 |
| | 11 & above yrs experience | 6 | 10.9 |
| Pattern of teaching | The traditional pattern of teaching | 36 | 65.5 |
| | Modern pattern of teaching | 19 | 34.5 |

Field Survey, 2021

The table 1 represented the demographic situations of participants among entire seven communities and nine institutional secondary schools' biology teachers. All together totals55 Botany, Zoology and lab teachers were respondents who responded to the questions, 43.6% of them were the age group of less than 35 years and rest 47.3% were above 36-45 years respectively but only9.1% teachers were more senior above 45 years. Among them 76.4% were male and only 23.6% were female, however the rate of female teachers was more in institutional school than community school. The data also represented that most teachers 41(74.5%) had a lack of ICT qualification only 14(25.5%) teachers had ICT qualifications. It is major factor for competency of ICT in teaching learning. The age, gender and ICT qualification factors also had role of perspectives in ICT integrated teaching learning process (table 5).

**Present Situation of ICT Facilities available and Access of Biology Teachers in Schools**

Only sixteen secondary schools having running science stream 11& 12 class in Siraha district(District Coordination Unit Siraha, DCU, 2020). Majority of schools have available minimum requirements of ICT facilities. Equipment numbers were more in community schools but rate of utilization increase in institutional schools inSiraha district. The data showed that more than 80% teachers had facilitated of computer / laptop in school hours. Similarly, now a day's all teachers have Android mobile phone except 1(1.8%) who was senior aged. One of the positive finding, every secondary science schools were connected to Wi-Fi facilities but due

to technical error slow speed and minimum capacity were common problems in majority of schools.

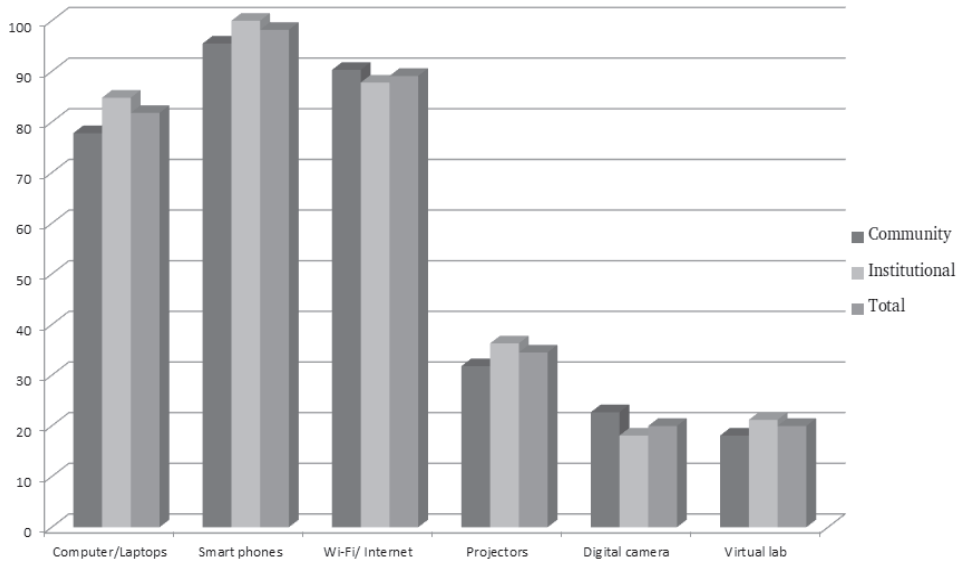


Figure 1, Existing ICT Facilities Available in schools' Biology Teachers Field Survey, 2021

Figure 1 shows that very few numbers of projectors and digital cameras were available in those schools. Similarly, Virtual science lab managements were also very poor in every school. The result interpreted that majority of younger teachers, females and ICT skilled science teachers were found in institutional than community schools but senior teachers were found in community schools that had inadequate ICT Access. But they had also tried to create ICT access friendly.

**Biology Teachers' knowledge about ICTs**

Table 2 reported on ICT applications items that comprised teachers knowledge about ICT software applications were measured using 3 Likert's rating scale that ranged from 0 (Not at all), 1(Fair) and 2 (Good) range. Altogether 5 parameters were included in knowledge-based ICT questions.

Table 2, *Existing ICT Knowledge in schools' Biology Teachers*

| S.N. | Descriptions | Good | | Fair | | Not at all | |
|---|---|---|---|---|---|---|---|
| | | Freq. | In % | Freq. | In % | Freq. | In % |
| 1. | Knowledge of Application Package | | | | | | |
| i. | Ms- Words | 28 | 50.9 | 23 | 41.8 | 4 | 7.3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ii. | Ms-Access | 14 | 25.5 | 22 | 40.0 | 19 | 34.5 |
| iii. | Ms-PPT | 26 | 47.3 | 15 | 27.3 | 14 | 25.5 |
| iv. | Ms-Browser | 14 | 25.5 | 19 | 34.5 | 22 | 40.0 |
| 2. | Knowledge of Social Sites | | | | | | |
| i. | Face-Book | 55 | 100 | 0 | 0.0 | 0 | 0.0 |
| ii. | Viber/Imo/Whatsapp | 4 | 7.3 | 15 | 27.3 | 36 | 65.5 |
| iii. | Twitter | 2 | 3.6 | 15 | 27.3 | 38 | 69.1 |
| iv. | Email | 55 | 100.0 | 0 | 0.0 | 0 | 0.0 |
| 3. | Knowledge of Learning Managements | | | | | | |
| i. | E-Books | 18 | 32.7 | 27 | 49.1 | 10 | 18.2 |
| ii. | E-Library | 17 | 30.9 | 17 | 30.9 | 34 | 61.8 |
| iii. | Moodle /Ms-Team/ Google Classroom | 1 | 1.8 | 9 | 16.4 | 45 | 81.8 |
| iv. | Virtual Science Lab | 4 | 7.3 | 11 | 20.0 | 40 | 72.7 |
| 4. | Social Media Platform(You-Tube) | 46 | 83.6 | 9 | 16.4 | 0 | 0.0 |
| 5. | ICT Integrated in Sc. Teaching | 8 | 14.5 | 31 | 56.4 | 16 | 29.1 |

Field Survey, 2021

Table 2, the entire result showed that knowledge of MS Office application package possessed by up to 50.9 % science teachers had good knowledge than knowledge of social sites, social media plate form (You-tube) 83.6% and ICT integrated teaching up to 14.5%, but knowledge of learning management (LMS), E-learning sources and presentation of slides were poor knowledge about 10 to 26% ICT access. The table also highlighted that majority of teachers had moderate knowledge. However, this knowledge had been unknown to 29 to 81.8% teachers in specific indicators. The result specially indicated that majority of teachers could not gain knowledge about use of E-library, Moodle as learning platform and use of ICT equipmentand software as integrated in teaching biology classroom for effective modern teaching learning practice.

**Teachers' ICTs Knowledge Associated with Independent Variables**

Table 3 expressed the correlation between teachers ICT knowledge (independent variable) and other 7 dependent variables like types of school, age, gender, level of education, ICT

qualification, teaching experiences, of teacher and teaching pattern of teachers by the applied oft-tests statistical (Muijs, 2014) methods.

Table 3, *Descriptive Statistics of Total Score of biology teachers ICT knowledge*

| Description | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Total score Knowledge of ICT | 55 | 17.00 | 5.00 | 22.00 | 12.2727 | 4.68826 |
| Total score of Effects of CT | 55 | 18.00 | .00 | 18.00 | 9.2909 | 5.50311 |

Field Survey, 2021

Table 4, *T- test correlation between different independent variables with total score of ICT Knowledge*

| Dependent Variable | Independents Variables | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|
| | | t | df | Sig. (2-tailed) | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Total score of ICT Knowledge | Types of Schools | .349 | 53 | .728 | -2.15497 | 3.06406 |
| | Gender of teachers | -.909 | 53 | .367 | -4.34461 | 1.63399 |
| | Age of teachers | 1.166 | 37.951 | .251 | -1.18202 | 4.39356 |
| | Level of Education | -6.519 | 36.925 | .000 | -7.83511 | -4.11944 |
| | ICT Training or qualification | -7.007 | 53 | .000 | -9.51234 | -5.27860 |
| | Teaching experience of teachers | 1.011 | 47 | .317 | -1.36594 | 4.12785 |
| | Pattern of teaching | -6.783 | 53 | .000 | -8.62866 | -4.69005 |

Field Survey, 2021

The result showed that the types of school, gender, age and teaching experience of teachers had not correlation with ICT knowledge due to values of significances (p) as 0.728, 0.367, 0.251 and 0.317 respectively. Also, the result obtained was not significant as p was $p>0.05$. Similarly, the level of education, ICT qualification and Pattern of teaching had highly correlation due to obtained values of p was 0.000 i.e.($p<0.05$). The result hence explained that knowledge of ICT had strong association with teachers' level of education, ICT qualification and practice of ICT experience and modern pattern of teaching. Thus, improvement of traditional pattern of teaching practice is required.

**Pedagogical Effects of ICT on teaching-learning**

The table 5, total 9 statements regarding class 11 and 12 biology teachers perceived pedagogical effects of use of ICT on themselves. These statements were measured by using a three-point Likert's rating scale (2=Agree, 1=Least agree, 0=Don't Know).

Table 5, *Effects of ICT on Teaching Biology*

| Descriptions | Agree | | Least Agree | | Don't Know | |
|---|---|---|---|---|---|---|
| | Frequency | In % | Frequency | In % | Frequency | In % |
| Increase Motivation | 15 | 27.3 | 31 | 56.4 | 9 | 16.4 |
| Increase Interest | 16 | 29.1 | 30 | 54.5 | 9 | 16.4 |
| Feel understand more easily | 14 | 25.5 | 28 | 50.9 | 13 | 23.6 |
| Increase engaged in classroom | 12 | 21.8 | 30 | 54.5 | 13 | 23.6 |
| Passive students change into active | 13 | 23.6 | 28 | 50.9 | 14 | 25.5 |
| Increase problem solving | 9 | 16.4 | 29 | 52.7 | 17 | 30.9 |
| Help H.W. & Cooperative works in teaching | 5 | 9.1 | 28 | 50.9 | 22 | 40.0 |
| Improve Self learning Environment | 22 | 40.0 | 21 | 38.2 | 12 | 21.8 |
| Update teachers' Quality teaching | 26 | 47.3 | 22 | 40.0 | 7 | 12.7 |

Field Survey, 2021

As indicated, more than 25 to 47%of biology teachers' responses, the use of ICT and their positive effects in update of teachers and helping in increasing quality of teaching, improve self-learning environment, increasing motivation, active learning etc. But very few (9.1 to 16.4%) teachers could understand that it helped in Home assignments and problem-solving in teaching-learning although more than one third of teachers were unknown about effects of ICT. So, they tried to change our dogmatic style of teaching-learning in science than other fields.

**Biology Teachers, Effects of ICT association with different affected Factors**

The table also found effects of ICT correlated to different independent factors like types of school, age, gender, level of education, ICT qualification, teaching experiences of teachers and teaching pattern of teachers by the means of the applied oft-tests statistical tools.

Table 6, *Correlation between different independent variables with total score of ICT Knowledge*

| Dependent Variable | Independents Variables | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|
| | | t | df | Sig. (2-tailed) | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Total score of ICT Effects | Types of Schools | -.467 | 53 | .643 | -3.77243 | 2.34819 |
| | Gender of teachers | -.241 | 53 | .810 | -3.95910 | 3.10928 |
| | Age of teachers | .219 | 37.316 | .828 | -2.95863 | 3.67658 |
| | Level of Education | -4.108 | 49 | .000 | -9.75104 | -3.34442 |
| | ICT Training or qualification | -5.519 | 53 | .000 | -10.31096 | -4.81448 |
| | Teaching experience of teachers | .733 | 47 | .467 | -2.03628 | 4.36961 |
| | Pattern of teaching | -5.654 | 53 | .000 | -9.52886 | -4.53839 |

Field Survey, 2021

Table 6 indicated that the types of school, gender, age and teaching experience of teachers had not correlated with ICT knowledge due to values of significances (p) as 0.643, 0.810, 0.828 and 0.467 respectively. Also, the result obtained was strongly not significant as p was $p>0.05$. Similarly, the level of education, ICT qualification and Pattern of teaching had high correlation due to the fact that obtained values of p was 0.000 i.e. ($p<0.05$). The result hence explained that the effects of ICT had a strong association with teachers' level of education, ICT qualification and modern pattern of teaching. It also indicated that good confidence of ICT based skills significantly assisted to deliver positive effects of teaching biology.

**Conclusions**

ICT is an important aspect of current biology education. One of the most significant components for the gradual improvements of teaching learning activities is ICT qualifications, teaching experience, and a modern teaching pattern. However, it is reported that the majority of teachers dislike and are embarrassed of ICT in the classroom.It indicates that the teaching-learning environment can't attract them towards science and therefore their performance in this subject is being poor day by day (Koirala and Acharya, 2021). Almost all schools have computers / laptops, Wi-Fi/internet. However, projectors, Digital cameras and virtual lab facilities existed in less than 19 percentages in both schools. The school Biology teachers had and their own concept about ICT infrastructure, facilities and their uses, the role for enhancing teachers' quality. ICT helps for achieving the learning outcomes to improve the teaching learning. Therefore, it can be concluded that teachers with traditional teaching pattern need

getting minimized and try to adopt the modern pattern of biology teaching. Level of education, ICT qualification and pattern of teaching are independent variables that have positive roles to strong correlation and significance (Mains, 2014) of effects on teaching-learning.

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