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IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON SECONDARY LEVEL STUDENTS' ACADEMIC PERFORMANCE IN BIOLOGY

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ABSTRACT

Main purpose of the study was to know the importance of information and communication technology in teaching of biology. So, the objective of the study was to examine the effect of using ICT on students' achievement in biology at Secondary level. To address the designed objective null hypothesis "There is no significant difference in the effect of using ICT on students' achievement in biology of control and experimental group at secondary level" was formulated. The study was delimited to students of Biology subject of class 9th. True-experimental "Pre-test post-test control group design" was used. The study was carried out in the government high school in Shakarghar, for six weeks. For pre-test and post-test, a test of 30 multiple-choice questions (MCQs) was developed according to first three levels of blooms taxonomy. The results depicted that ICT students performed in a very better way as compared to traditional lecture method students. So, it is recommended that Information and communication technology is very important in the teaching learning process, therefore, availability of ICT in all the public and private schools should be ensured for better achievement.

INTRODUCTION

Information and communication have a significance part in teacher education and training to enhance their digital skills and subject matter to perform well in schools. Innovative knowledge of ICT assists the teachers to formulate the

lesson plan which make the teaching learning productive. Connell, Donovan, & Chambers, (2016) views teacher as digital learner seeks the student's attention and motivate them to empowering them with knowledge. As it is the age of science and technology, a number of alterations are necessary in educational as well as teachers' professional development. So, it is time to make up the teachers with digital skills in changing world.

Ahmad, (2015) by gaining updated knowledge and well-developed teaching skills a teacher deals the digital problems while managing the classrooms. ICT is a set of digital tools utilized by teachers in education and trainings to increase the competencies. Teacher act as a trainer and builder for new generation and equip the students with digital knowledge that make them more challenging person of the society, but it is impossible for a teacher without commanding on digital knowledge. Digital knowledge keeps the teachers updated by using teaching methods supported by ICT. Now a day's ICT is the necessity for life as there is no field in which someone can pace with digital world without computer technology (Palvia, Baqir, & Nemati, 2018).

The use of ICT in professional development of teachers is a main pillar for learners in their learning. Use of ICT in education and teacher education has become a worldwide trend. Accessibility and utilization of ICT skills in teaching learning process is not enough teaching facility but for sequential use of this facility teacher teachers training is also required. Oyaid (2009) highlighted the utilization of technology by teachers in schools and universities on preliminary stage and demand the more and more teacher's trainings to overcome the challenges in class. Research also shows that it is impossible to achieve educational goals if a teacher is devoid of continuous professional development. A number of factors pointed out by the researchers that influence the ICT linkage with education. These factors are as:

- ✓ ICT structure
- ✓ Accessibility structure
- ✓ Required time
- ✓ Technical support
- ✓ Flexibility

Teachers should also well aware about the importance of ICT in professional development. A numerous challenges are faced by teachers like internet connection, poor speed, cost, lack of training. Mostly teachers depend on reading blogs, web browsing, journals reading etc. (Okoro, & Ekpo, 2016). Generally, ICT is a source of creating, storing, managing and disseminating data and information using electronic devices. Those computer technologies made information manageable and meaningful and aid the broadcasting.

ICT is a supplemented phrase used for information technology (IT) which emphasized on the part of integrated communications and the combination of telecommunications, computers and other essential program software. Remodeling of lifestyle and events of modern man especially in the age of globalization the appearance of ICT (Evey, et al. 2010). Now a days, ICT is

active in teaching and learning process is strongly supported nationally and internationally (Agrahari, & Singh, 2013).

There are two types of information and communication technological tools.

- i. Conventional ICT tools like radio, television and print media.
- ii. Modern ICT tools like internet, mobile, portal, call center, video etc.

Now a days, fundamental concept digital competences in research shows that what kind of skills and expertise citizen should have in community. To some extent it is a political concept showing the inclinations, beliefs and wishes of citizens about subsequent needs and anchored the economic fixture which has the technologies as an opportunity and problem-solving solution (Palvia, Baqir, & Nemati, 2018). As the digital competences are a new concept in research so, its use is very rare.

The word digital deals information in numerical form by using computer while the competences concern with the efficiency and successfulness of something. Hence the Concept digital competences commonly explain the capabilities and efficiency of citizens like students and teachers while using the information communication technology (ICT) in a special context (Rashid, & Asghar, 2016). This concept is a blend of knowledge, skills and attitude that fulfill the setting. In other practicable competencies, basic competences are the competencies that all citizens have to fulfill their needs, for their development, personal satisfaction, citizenship employment and society inclusion. Digital competences are the full-lengths use of information technology for information processing, communication and problem solving efficiently and critically in all aspects of life. Many of us explain it simply but as per the Digital Agenda Score board 2015, 40% people of EU have digital competences below the marked level, which in clued 22% people with no use of internet (OECD, 2010).

Digital competences are the newest concept that explains the technical skills. A number of denominations now a day are used for skills and competencies Like ICT skills, technology skills, IT skills, 21st century's skills, information literacy, digital literacy and digital skills. These concepts are also used as synonyms; e.g. digital competences and digital literacy (Kim, 2005). Sometimes this concept deviates to limited area of digital technology like internet skills and to sometimes broaden the term to media literacy as media literacy skills.

Moreover, new technologies are the agent for change in community and culture. Hope fully the ideas and scope continuously change, their policy papers recommended the strategies be dynamic and continuously reviewed with persistent change in technology and their use in society. As per the OECD recommendations governments should identify and conceptualize the updated skills and competencies and incorporate them in education (OECD, 2010).

Yet, there is no research-based confirmation and justification of this concept as Van Deursen and van Dijk (2009) stated the terms and provides a number of explanations regarding internet skills and digital skills. As there is lack of theoretical justification outcomes of different definitions are disregard the

fullest skills and depends on finite skills. Moreover, policy related digital skills and competencies used in normative ways how the objectives to be achieved. To conduct this research study a pre-test post-test control group design was used. The control group received instruction using the traditional lecture approach, while the experimental group received instruction utilizing ICT. This trial ran for a total of six weeks. Post-tests were administered to both groups after six (06) weeks. The results of the pre-test and post-test for both groups were then compared to determine whether the usage of technology by students in the experimental group had led to better results than those of the traditional group. The data analyzed and results are given below:

Table 1. Control group's pretest compared to those of the experimental group's

Pre-Test	Students	Mean Value	Std. Dev.	Significance level
Control Group	32	10.394	1.981	.582
Experimental Group	32	11.279	2.818	

Table 1 above highlights the result values regarding comparison of pretest between control vs experimental group. All of the pupils in both groups are at the same academic level, according to the data and facts in the table. So, the researcher would be confident on research experimentation results as both the groups are almost at the same level. Results narrate that students from control group in pre-test (M=10.394, SD=1.981) are nearly equal to the students of experimental group (M=11.279, SD=2.818). Furthermore, the significance level of .582 made it clear that the two groups do not significantly differ from one another. Keeping in view the mean values of both groups it is evident that before the experiment began, both group's participants were performing at the same academic level.

Table 2.: Results of the post-tests of control group compared with experimental group

Post-Test	Students	Mean Value	Std. Dev.	Significance level
Control Group	32	19.852	4.571	.001
Experimental Group	32	25.717	4.761	

Table 2 above highlights the result values regarding comparison of post-test between control vs experimental group. Facts and figures shown in the table depicted that students who were taught by traditional lecture method performed significantly lower in biology subject than other students who were taught by using information and communication technology. Results narrate that students from control group in post-test (M=19.852, SD=4.571) had very low performance than students of experimental group (M=25.717, SD=4.761). Furthermore, the significance level .001 clarified that the difference between both groups is significant. Keeping in view the mean values of control and experimental group, conclusion: Following the trial, participants in the control and experimental groups had dramatically different achievement levels. Therefore, the hypothesis “There is no significant difference in the effect of

using ICT on students' achievement in biology of control and experimental group at secondary level" was rejected.

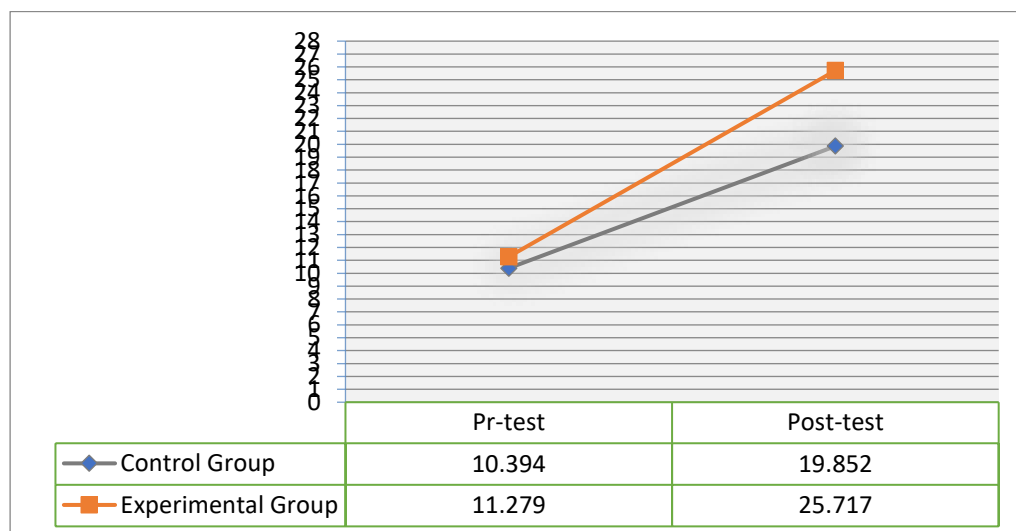


Fig. I: Comparison of the control and experimental groups' pre- and post-test results

Comparison of the control between pre-test vs post and comparison between pre-test vs post of experimental groups is shown in the graph above for more clarity.

Table 3. Results from the control groups' pre- and post-tests are compared

Control Group	Students	Mean Value	Std. Dev.	Significance level
Pre-test	32	10.394	1.981	.000
Post-test	32	19.852	4.571	

The results values for the control group's comparison of pre-test and post-test are highlighted in table 3 above. Facts and figures shown in the table depicted that students who were taught by traditional lecture method also had better achievement in biology subject. Results narrate that students from control group in pre-test (M=10.394, SD=1.981) had very low performance but in post-test (M=19.852, SD=4.571). Furthermore, the significance level .000 clarified the difference between both tests is significant. The traditional method is also valuable for the teaching and learning processes, it may be inferred from the mean values of both tests of control group.

Table 4. Experimental groups' pre- and post-tests results

Experimental Group	Students	Mean Value	Std. Dev.	Significance level
Pre-test	32	11.279	2.818	.000
Post-test	32	25.717	4.761	

The results of experimental group's comparison of both tests are highlighted in above table. Facts and figures shown in the table depicted that students who were taught by using Information and Communication Technology had very high achievement in biology subject. Results narrated that students from ICT group in pre-test (M=11.279, SD=2.818) had low performance but in post-test (M=25.717, SD=4.761) is high. Furthermore, the significance level .000 also clarified the difference between both tests is significant. It is clear from ICT group's both tests mean values that ICT is highly effective for the teaching of biology.

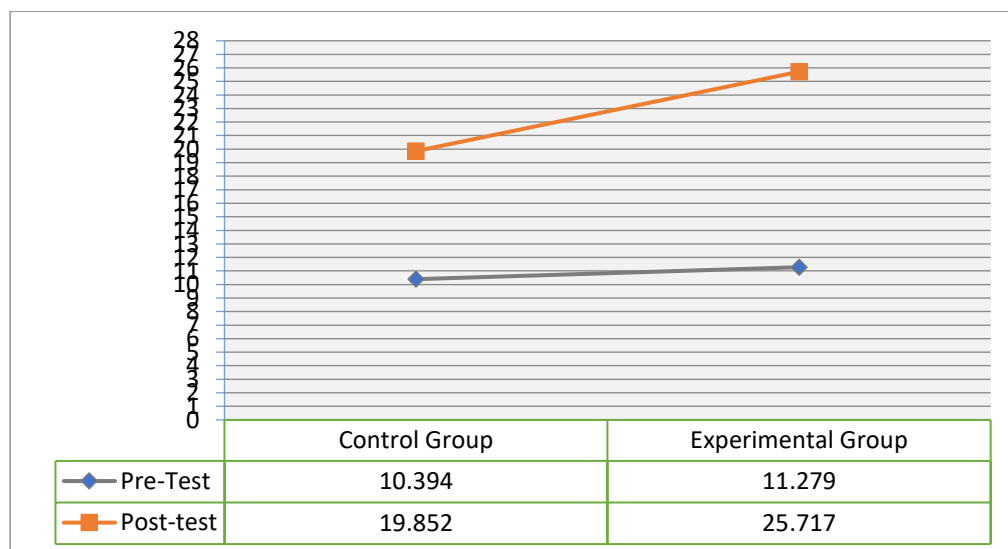


Fig. II: Comparison of the control and experimental groups' pre- and post-test results

Comparison of the pre-test between control group vs experimental group and post-test between control group vs experimental group is shown in the graph above for more clarity.

Table 5. Results of the ICT group's low achievers' pre and posttest comparisons

Experimental Group	Students	Mean Value	Std. Dev.	Significance level
Pre-test	14	10.182	2.291	.001
Post-test	14	16.291	3.891	

Table 5 above highlights the result values regarding both tests results of low achiever students in ICT group. Facts and figures shown in the table depicted that low achiever students who were taught by using Information and Communication Technology also had high achievement in biology subject. Results narrate that low achiever students from ICT group in pre-test (M=10.182, SD=2.291) had low performance but in post-test (M=16.291, SD=3.891). Additionally, the significance level.001 made it clear that low achiever pupils' pre-test and post-test outcomes differed significantly. A conclusion that can be drawn from the ICT group's both tests mean values is

that information and communication technologies can be useful for teaching poor achiever students about biology.

Table 6. Results from the ICT group's high achievers' pre-test compared with and post-test

Experimental Group	Students	Mean Value	Std. Dev.	Significance level
Pre-test	14	10.992	2.315	.000
Post-test	14	28.984	4.716	

Table 6. above highlights the result values of pre-test results with the post-test results of high achiever students in experimental group. Facts and figures shown in the table depicted that high achiever students who were taught by using Information and Communication Technology had very high achievement in biology subject. Results narrated that high achiever students from ICT group in pre-test (M=10.992, SD=2.315) had low performance but in post-test (M=28.984, SD=4.716). Additionally, the significance level of .000 made it clear that there is a substantial difference between both tests scores of high achiever kids. Considering the ICT group's both tests mean values, it can be said that high achiever students benefit much from ICT in the teaching learning process for biology.

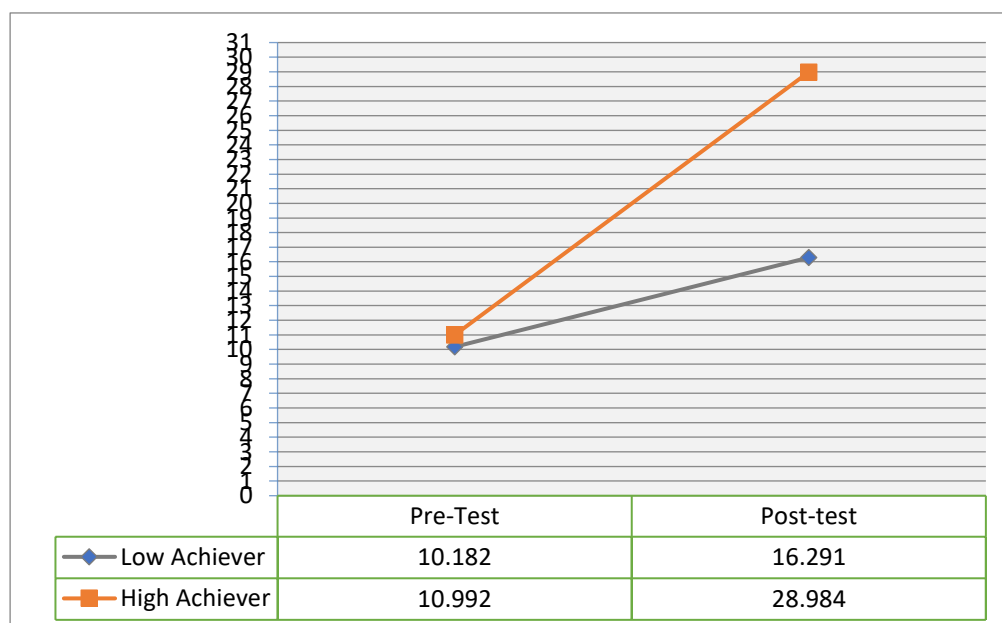


Fig. III: Low achiever and high achiever pupils in the experimental group were compared before and after tests

Comparison of the low achievers between pre-test vs post-test and high achiever between pre-test vs post-test is shown in the graph above for more clarity.

FINDINGS:

The study aimed to assess the impact of Information and Communication Technology (ICT) on students' achievement in biology at the secondary level. The research included a control group taught using traditional methods and an experimental group exposed to ICT-based teaching. The pre-test results showed no significant difference between the two groups, indicating that both were at similar academic levels before the experiment. However, after the intervention, the experimental group outperformed the control group significantly in the post-test. The mean scores for the experimental group were substantially higher, indicating the effectiveness of ICT in enhancing students' biology achievement. The findings were consistent for both low and high achievers within the experimental group, highlighting the benefits of ICT for students across different proficiency levels.

CONCLUSIONS:

The research findings demonstrate that integrating Information and Communication Technology into biology instruction at the secondary level positively impacts students' academic achievement. The experimental group, which received ICT-based teaching, exhibited significantly higher post-test scores compared to the control group taught using traditional methods. This suggests that ICT can be an effective tool in enhancing learning outcomes and catering to students' diverse needs. Moreover, the positive results were evident for both low and high achievers, indicating the inclusive potential of ICT in education. The study underscores the importance of integrating technology in the teaching process to promote better academic performance and engagement among students in the biology domain.

RECOMMENDATIONS:

1. Educational Institutions and policymakers should prioritize the integration of Information and Communication Technology (ICT) into biology curricula at the secondary level. Providing access to modern technological resources and tools will empower educators to create interactive and engaging learning experiences, fostering improved academic performance and interest among students.
2. Professional development programs should be implemented for biology teachers to enhance their ICT skills and pedagogical approaches. Equipping educators with the knowledge and confidence to effectively use technology in the classroom will maximize the benefits of ICT-based teaching, ensuring a more inclusive and effective learning environment for all students.
3. Further research should be conducted to explore the long-term effects of ICT integration in biology education. Comparative studies across diverse student populations and geographical regions can offer valuable insights into the scalability and sustainability of ICT-based approaches. This ongoing research can inform evidence-based decisions, helping to refine and optimize the integration of technology in biology instruction for future generations of learners.

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