Effect of ICT Based Teaching on Attitude towards Learning Physics

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Abstract

This study examined the effect of ICT based teaching on attitude towards learning physics. The experimental method and Solomon four equivalent group design was used. A male 9th grade class was selected from two schools. The population consist of the 9th grade students studying Physics in public schools. The 160 students, 40 for each group, were selected by applying procedure of experimentation. The standardized attitude scale (Osgood et al., 1957) was adopted and used in pre and post-tests. The tool was validated and made reliability by pilot testing. The experimental procedure was carried out and post-test data was collected. After analysis, it was found that the students who received ICT based teaching have significant attitude towards learning physics than the students who received traditional teaching. It was recommended that teachers may utilize ICT tools in classroom to continuously stimulate students' behaviors towards the use of ICT as a tool for education and learning.

Keywords: *ICT based teaching, physics subject, secondary level, Solomon design*

INTRODUCTION:

The elements of education have been changing steadily over the past few years, implementing the current curricula in the face of changing circumstances will only result in the same results as before. Higher academic standards are largely a result of the growth of information and communications technologies (ICT). Therefore, it is essential to instruct students in effective ICT use. In addition to the fact that ICT has advanced and technology is now used in educational settings, it has become vital for societies to follow technological breakthroughs to self-adapt (Çelik & Gündoğdu, 2016).

Introducing new technologies into the classroom is a challenge, Davis et al. (2013) have shown crucial part the teachers play in integrating new technologies into the classroom. Teachers' beliefs on using ICT in the classroom changes students' attitude (Spiezia, 2011; Teo, 2009). Additionally, the way teachers use ICT based teaching in the classroom predicted attitude of students and they also reported significant change in attitudes (Çelik & Yesilyurt, 2013; Petko, 2012). Hill (2017) indicate a strong correlation between ICT and attitude. ICT based teaching raises educational standards by promoting learning through continuing discussion, self-directed learning, critical thinking, concentrated training, and data collection and analysis.

Numerous international researches on attitude were conducted. Assylzhanova et al. (2022) examined role of ICT in shaping students' attitude. They found that computer-aided blended teaching enabled positive attitude among students. In addition, Guillén-Gámez et al. (2020) examined the attitudes of students toward ICT. The findings showed that kids had better positive behavioural attitude scores. In addition, various regional researches like Ye et al. (2022) explored role of ICT in blended learning and its effect on attitude of students. They found that ICT teaching was a key determinant for attitude of students. Verma et al. (2020) studied role of ICT and mobile technology in predicting attitude of Indian students. The results indicated significant positive association between variables and ICT has significantly affected students' attitude.

Many of the researches as cited above investigated various aspects of ICT in education. They explored effects of ICT based teaching on attitude of students at international and regional level. Many scholars examined attitude of students using survey designs. As a result, the researcher decided to investigate the effect of ICT based teaching on students' attitude towards learning

physics. In Pakistan, this aspect was not investigated by any researcher using experimental design in subject of Physics at secondary level.

LITERATURE REVIEW:

According to Khattak and Jan (2015), communications are denoted as information and communication technology (ICT) use to get information in the form of satellite-based TV, radio, mobile phones, computers, and other devices, as well as the countless services and tools that come along with them, including online instruction and video conferencing. The school is the formal way of collecting information and knowledge. ICT is a driving force that helps to get updated information. When it comes to conveying information, teachers play vital role for educating students for benefit of society. ICT is a recent innovation that has not yet been fully incorporated into the educational systems of third-world and least-developed nations.

The way that teaching and education are conducted in the classroom has changed in some ways by using technology, especially information and communication technology (ICT). Ede (2012) said that the employment of information and communication technologies has come to define the school environment of the twenty-first century. Information and communication technologies include a variety of tasks, resources, and tools, including all the programs, information, and resources that are typically available and accessible through computers. ICT according to Mark (2017) is employed to gather, store, process, and communicate data in the form of voice, text, and images. They include computer hardware, software, the internet, and other networks and communication mediums.

ICT AND ATTITUDE

It is important to remember that implementation methods come before all innovations when discussing attitudes among teachers. Introducing new technologies into the classroom is a challenge, Davis et al. (2013) have shown how crucial part teachers play in integrating new technologies into the classroom. Studies have shown that teachers' beliefs on whether using ICT in the classroom enhances student learning outcomes and motivation affect their usage of ICT in the classroom (Spiezia, 2011; Teo, 2009; Venkatesh et al., 2003). Additionally, teachers' usage of computers in the classroom is predicted by their attitude toward how they use ICT in the classroom (Çelik & Yesilyurt, 2013; Petko, 2012). In terms of pedagogical and technical expertise, the instructors' self-reported skills have also been found to be a significant predictor of teaching-related ICT use (Herring et al. 2016). It becomes crucial to note the role of ICT in shaping students' attitude has academic importance. Moreover, instructional methods, which foster teaching materials, availability of infrastructure may affect students' attitude. This study was designed to introduce instructional method using ICT use as a tool for teaching material in a conducive environment.

The purpose of this true experimental Solomon four equivalent group research design is to examine the effect of ICT based teaching on students' attitude towards learning physics. The ICT based teaching (independent variable) determined effectiveness on attitude (dependent variable) of students. The scale determined their attitude towards physics learning. The personal characteristics were defined in the research, gender, treatment, control group, and institutional information of sample. The background of the participants was measured that is vital to know the difference in attitude after treatment.

RESEARCH HYPOTHESES:

The following hypotheses were formulated:

There is no significant difference in:

$H_0$1. pre-test scores of attitude towards physics between experimental and control groups (both with pre-tests);

$H_0$2. post-test scores of attitude towards physics of experimental and control group (both with pre-tests);

$H_0$3. pre-test and post-test scores of attitude towards physics of experimental group (both with pre-test);
$H_0$4. pre-test and post-test scores of attitude towards physics of control group (both with pre-test);
$H_0$5. post-test scores of attitude towards physics of two experimental groups (one with pre-test and other without pre-test);
$H_0$6. post-test scores of attitude towards physics of both control groups (one with pre-test and other without pre-test);
$H_0$7. post-test scores of attitude towards physics of experimental and control groups (both without pre-test).

RESEARCH METHODOLOGY

The following procedure was used during the research;

Research Design

The Solomon four equivalent group design was used in the current study. A male 9th grade class was selected from two schools. Both schools were equated on the availability of infrastructure required for implementation of ICT based teaching. Moreover, two groups, which were made equivalent in size, formulated from each school i.e. experimental and control groups. The first school students received pre and post tests while the other only received post-test. The experimental group received treatment of ICT based teaching while control group received traditional method for three months period. The volunteer teachers were targeted and those who implemented ICT based teaching approach were given the first week orientation to device the tool in class accordingly. Prior to the application, extensive planning for both groups were prepared and processing the same content for both groups which was taken into consideration.

Table 1

Solomon four group design

Test		Pre-test	Treatment	Post-test
a)	R	O1	X	O2
b)	R	O3		O4
c)	R		X	O5
d)	R			O6

Population and Sampling

The population consist of the 9th grade students studying Physics in public schools. The 160 students, 40 for each group, were selected by applying procedure of experimentation. The pre-test conducted to 80 students from one school to made groups using random sampling technique. The other school students were selected without pre-test to examine their attitude towards learning physics.

Research Instrument

The Attitude scale (Osgood et al., 1957) adopted which consist of five factors of attitude i.e. enthusiasm towards physics, physics learning, physics as a process, physics teachers, and physics as a future vocation. Each sub-category constituted eight items which were evaluated using 5 point Liker-scale.

Validity and Reliability

The standardized attitude scale was validated by experts to measure its consistency. Furthermore, pilot testing technique was administered to 30 non-sample students. The data was then entered and analysed in SPSS using Cronbach Alpha (α = .814).

Experimental Procedure

After pre-test, the four groups with pre and no pre-test were taught 9th grade physics book using same content for each group for three months duration. Before implementation, proper guidance of teachers and lesson planning for each class were carried out under the guidance of supervisor. The selection of teachers for each group was taken care by minimizing experimenter effect by hiring volunteer teachers and capacity of teachers by matching teachers' qualification and experience. The researcher carefully looked into the utilization of resources and lesson planning by concerned teachers in whole experimentation. After treatment, each group was given post-test.

Data Collection and Analysis

The data was collected by pre and post-test of attitude scale. Afterwards, the data analysed in SPSS by comparing their means of each group.

RESULTS

The tables were formulated according to research hypotheses of study;

Table 2

Comparison of attitude scores between experimental and control group before treatment (both with pre-tests)

Groups	N	M	SD	SEM	t-value	Sig.	Cohen'd
Exp	40	143.42	12.699	2.0079	1.252	.214	.280
Control	40	140.07	11.177	1.7673			

Not Significant at p > .05

The table 2 displayed the comparison between experimental and control group before treatment of students (with pre-test groups) regarding attitude scores in which there is non-significant difference can be seen for experimental (*N*=40, *M*=143.42, *SD*=12.69, *SEM*=2.00) and control group (*N*=40, *M*=140.07, *SD*=11.17, *SEM*=1.76), *t*(78) = .214, *p* > .05, d = .064. Thus, the researcher failed to reject the null hypothesis ($H_0$1).

Table 3

Comparison of attitude scores between experimental and control group after treatment (with pre-test groups)

Groups	N	M	SD	SEM	t-value	Sig.	Cohen'd
Exp	40	164.3250	13.17026	2.08240	6.771	.000	1.514
Control	40	141.9000	16.28717	2.57523			

Significant at p < .05

The table 3 exhibited the comparison between experimental and control group after treatment of students (with pre-test groups) regarding attitude scores in which there is significant difference can be seen for experimental (*N*=40, *M*=164.32, *SD*=13.17, *SEM*=2.08) and control group (*N*=40, *M*=141.90, *SD*=16.28, *SEM*=2.57), *t*(78) = 6.771, *p* < .05, d = 1.514. Thus, the researcher failed to accept the null hypothesis ($H_0$2).

Table 4

Comparison of attitude scores of experimental groups before and after treatment (both with pre-test) (N = 40)

Groups	M	SD	SEM	Correlation	Paired Differences			t-value	Sig.
					M	*SD*	*SEM*		
Before	143.42	12.69	2.00	.559	-20.9	12.15	1.92	-10.87	.000
After	164.32	13.17	2.08						

Significant at p < .05

The table 4 exhibited comparison of attitude scores of experimental groups before and after treatment (with pre-test groups) (*N* = 40), before treatment (*M* = 143.42, *SD* = 12.69 and *SEM* = 2.00) have lower mean score than after treatment (*M* = 164.32, *SD* = 13.17 and *SEM* = 2.08).

Furthermore, there is significant correlation found between groups (*a* = .559). The paired differences shown (*M* = -20.9, *SD* = 12.15, *SEM* = 1.92), *t*(39) = -10.87, *p* < .05. The researcher failed to accept the null hypothesis ($H_0$3).

Table 5

Comparison of attitude scores of control group before and after treatment (with pre-test) (N = 40)

Groups	M	SD	SEM	Correlation	Paired Differences			t-value	Sig.
					M	*SD*	*SEM*		
Before	140.07	11.17	1.76	.404	-1.82	15.59	2.46	-.740	.464
After	141.90	16.28	2.57						

Not Significant at p > .05

The table 5 showed comparison of attitude scores of control group before and after treatment (with pre-test groups) (*N* = 40), before treatment (*M* = 140.07, *SD* = 11.17 and *SEM* = 1.76) have slightly lower mean score than after treatment (*M* = 141.90, *SD* = 16.28 and *SEM* = 2.57). Furthermore, there is significant correlation found between groups (*a* = .404). The paired differences shown (*M* = -1.82, *SD* = 15.59, *SEM* = 2.46), *t*(39) = -.740, *p* > .05. The researcher failed to reject the null hypothesis ($H_0$4).

Table 6

Comparison of attitude scores between two experimental groups after treatment (one with pre-test and other without pre-test groups)

Groups	N	M	SD	SEM	t-value	Sig.	Cohen'd
Exp (with pre)	40	164.32	13.17	2.082	.475	.636	.106
Exp (without pre)	40	162.92	13.20	2.087			

Not Significant at p > .05

The table 6 represented the comparison between two experimental groups after treatment of students (with and without pre-test groups) regarding attitude scores in which there is non-significant difference can be seen for experimental (with pre-test) (*N*=40, *M*=164.32, *SD*=13.17, *SEM*=2.08) and experimental group (without pre-test) (*N*=40, *M*=162.92, *SD*=13.20, *SEM*=2.08), *t*(78) = .475, *p* > .05, d = .106. Thus, the researcher failed to reject the null hypothesis ($H_0$5).

Table 7

Comparison of attitude scores between two control groups after treatment (one with pre-test and other without pre-test group)

Groups	N	M	SD	SEM	t-value	Sig.	Cohen'd
Control (with pre)	40	141.90	16.28	2.575	-1.979	.061	.342
Control (without pre)	40	149.97	20.01	3.165			

Not Significant at p > .05

The table 7 illustrated the comparison between two control groups after treatment of students (with and without pre-test groups) regarding attitude scores in which there is non-significant difference can be seen for control (with pre-test) (*N*=40, *M*=141.90, *SD*=16.28, *SEM*=2.57) and control group (without pre-test) (*N*=40, *M*=149.97, *SD*=20.01, *SEM*=3.16), *t*(78) = -1.979, *p* > .05, d = .037. Thus, the researcher failed to reject the null hypothesis ($H_0$6).

Table 8

Comparison of attitude scores between experimental and control group after treatment (both without pre-test groups)

Groups	N	M	SD	SEM	t-value	Sig.	Cohen'd
Exp	40	162.92	13.203	2.0876	3.415	.001	.764
Control	40	149.97	20.019	3.1654			

Significant at p < .05

The table 8 demonstrated the comparison between experimental and control group after treatment of students (without pre-test groups) regarding attitude scores in which there is significant difference can be seen for experimental (*N*=40, *M*=162.92, *SD*=13.20, *SEM*=2.08) and

control group (N=40, M=149.97, SD=20.01, SEM=3.16), $t(78) = 3.415$, $p < .05$, d = .705. Thus the researcher failed to accept the null hypothesis ($H_0$7).

DISCUSSION AND CONCLUSION

The results show that, in comparison to conventional teaching techniques, ICT-based instruction significantly affects students' attitudes towards physics subject. Students have opportunities for active participation, abstract idea visualization, and interactive learning when ICT tools and resources are used in the classroom. These elements provide better learning results, a more upbeat attitude about physics, and higher motivation. Arslan Raheem et al. (2021) reported about students' attitude that was significantly affected by ICT-based teaching. Moreover, Lydiah et al. (2015) explored students' attitude towards ICT teaching. They have also found same results as this study found.

There are a number of benefits that ICT-based teaching methods have over conventional teaching strategies. For instance, students can study physics concepts in a dynamic and visually stimulating form through internet resources, virtual simulations, and multimedia presentations. Students' curiosity is aroused, their comprehension of challenging topics is deepened, and they are encouraged to have a positive attitude toward the subject matter by this interactive learning environment. Moreover, individualized learning experiences are made possible by the adaptability and accessibility of ICT technologies. In order to accommodate a variety of learning preferences and methods, students can participate in self-paced learning, work with peers, and use internet resources. Students who get this individual approach foster sense of ownership and have a favorable attitude towards learning physics.

RECOMMENDATIONS

The following recommendations were made based on the conclusion of research;

i. Teachers may utilize ICT tools in classroom to continuously stimulate students' behaviors towards the use of ICT as a tool for education and learning.

ii. Promoting interactive environment by the use of ICT tools is the need of time. Teachers may incorporate strategies which influence the use of ICT gadgets such as mobile phones and multimedia.

iii. The refresher courses may be introduced for science teachers who have responsibilities to foster ICT tools in classroom.

REFERENCES

[1] Arslan Raheem, M., Khalid, M., Shah, M. A. U. H., & Zahid, M. (2021). Impact of ICT on Academic Achievement of Students. *Elementary Education Online, 20*(2), 460-460.

[2] Assylzhanova, D., Seisenbek, N., Uzakbaeva, S., & Kapalbek, B. (2022). The effect of ICT enhanced blended learning on elementary school students' achievement in English and attitudes towards English Lesson. *International Journal of Education in Mathematics, Science and Technology*, *10*(3), 632-649.

[3] Çelik, B., & Gündoğdu, K. (2016). The effect of using humor and concept cartoons in high school ICT lesson on students' achievement, retention, attitude and anxiety. *Computers & Education*, *103*(1), 144-157.

[4] Çelik, V., & Yesilyurt, E. (2013). Attitudes to technology, perceived computer self-efficacy and computer anxiety as predictors of computer supported education. *Computers & Education, 60*(1), 148–158.

[5] Davis, N., Eickelmann, B., & Zaka, P. (2013). Restructuring of educational systems in the digital age from a co-evolutionary perspective. *Journal of Computer Assisted Learning*, *29*(5), 438-450.

[6] Ede, E. O. (2012). Hindrance to the implementation and communication technologies in the teaching and learning of technical drawing in Nigeria University. Enugu. *Nigeria Vocational Journal,* 14(l), 60-78.

[7] Guillén-Gámez, F. D., Romero Martínez, S. J., & Ordóñez Camacho, X. G. (2020). Diagnosis of the attitudes towards ICT of education students according to gender and educational modality. *Apertura (Guadalajara, Jal.)*, *12*(1), 56-71.

[8] Herring, M. C., Koehler, M. J., & Mishra, P. (Eds.). (2016). *Handbook of technological pedagogical content knowledge (TPACK) for educators* (Vol. 3, pp. 189-200). New York: Routledge.

[9] Hill, R. J. (2017). Attitudes and behavior. In *Social psychology* (pp. 347-377). Routledge.

[10] Khattak, R., & Jan, R. (2015). The impacts of ICT on the students' Performance: A Review of Access to Information. *Research on Humanities and Social Sciences*, *5*(1), 85-94.

[11] Lydiah, N., Wilson, S., & Pachomius, W. (2015). Students' Attitude Towards' Use of Information and Communication Technology (ICT) in Teaching and Learning in Public Secondary Schools: A Case of Kieni East Subcounty, Nyeri County-Kenya. *International Journal for Innovation Education and Research*, *3*(1), 127-139.

[12] Mark, O. O. (2017). Utilization of information communication technology (ICT) in teaching and learning technical drawing and mechanical designs in Nigerian schools system. *Gombe Technical Education Journal*, *10*(1), 7-15.

[13] Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *The measurement of meaning* (No. 47). University of Illinois press.

[14] Petko, D. (2012). Teachers' pedagogical beliefs and their use of digital media in classrooms: Sharpening the focus of the 'will, skill, tool model and integrating teachers' constructivist orientations. *Computers & Education*, *58*(4), 1351-1359.

[15] Spiezia, V. (2011). Does computer use increase educational achievements? Student level evidence from PISA. *OECD Journal: Economic Studies*, *2*(1), 1-22.

[16] Teo, T. (2009). Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education, 52*(2), 302–312.

[17] Venkatesh, V., Morris, M. G., Davis, F. D., & Davis, G. B. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478.

[18] Verma, C., Illés, Z., Stoffová, V., & Singh, P. K. (2020). Predicting attitude of Indian student's towards ICT and mobile technology for real-time: preliminary results. *IEEE Access*, *8*(2), 178022-178033.

[19] Ye, L., Kuang, M., & Liu, S. (2022). ICT Self-Efficacy, Organizational Support, Attitudes, and the Use of Blended Learning: An Exploratory Study Based on English Teachers in Basic Education. *Frontiers in Psychology*, *13*(1), 1-11.