Effectiveness Of Techno-Pedagogy On Attitude Towards Ict And Achievement In Physics Among Standard Ix Students

Enid Ruth[1] , Dr. S. Chamundeswari (Corresponding Author)[2]

[1]Ph.D. Research Scholar
[2]Principal N.K.T. National College of Education for Women, Chennai
rajchamu2006@yahoo.co.in

Abstract

The present study investigates the effectiveness of techno-pedagogy on attitude towards ICT and achievement test in physics among standard IX students. Experimental method is used to select a sample of 64 students from standard IX students. The research tools used was Attitude towards ICT (Constructed by the Investigator) and achievement test in physics. The results of the statistical analyses show a significant correlation of attitude towards ICT and achievement test in physics. A significant difference was found between the independent variable attitude towards ICT and the dependent variable achievement test in physics, which suggests that students with more positive attitude toward ICT had better performance in the achievement test. This implies that these factors play a crucial role in students' achievement in physics.

Keywords: Techno-pedagogy, attitude towards ICT and achievement test in physics.

1. Introduction

The teaching and learning effectiveness gets enhanced by involving the students, beginning with what the student knows, moving from simple to complex or from concrete to abstract. Accommodating the students preferred, allowing immediate pedagogical application of knowledge into execution by proper planning of periodical tests. The characteristic of good teaching involves students to erudite in a relevant and meaningful manner. It has to bridge the gap between theory and practice. It means, listening, processing,

questioning, being responsive and remembering that each student in the class is different and appropriate teaching technique has to be involved inside the classroom.

The most effective teaching style will reflect a combination of in depth teaching techniques, knowledge of the subject into practice and planning for periodical tests. Teaching involves making students to learn in a relevant and meaningful manner. The most effective teaching methodology will reflect a combination of teaching tools, knowledge of the subject and psychological attributes of the learners. Hence, developing effectiveness in teaching is essential right from teaching the pre-primary to students of doctoral programme. Bertrand Russell has defined education as the cultivation of intelligence he says, teaching involves the techniques to erudite the students to learn in a relevant and meaningful manner. Updating the classroom with the emergence of various ICT tools will help the students to acquire a significant improvement in the scholastic performance. The researcher has thus selected the interactive whiteboard for the investigation.

2. Need for the Current Research

Technology is reshaping the destiny of education. In 1970s technology was considered only as a subject to be studied about machines. Then technology was adopted as a supplement to teaching and learning process. But now the concept has been changed and there is a flawless integration of technology into the educational system. The success of this integration depends upon the extent to which future teachers use technology in teaching their subjects for the benefit of the students. Training must be provided to teachers in the use of these technologies and must be coordinated with concepts taught in their classes.

The era of digital revolution has brought its amazing change in almost all fields and the field of education is found to be the most leisurely one. In recent times, many research studies points out the need for the effective teaching methodologies to be implemented inside the classroom. This century demand the teacher to be skilled enough to incorporate and infuse technology into their instruction and make the learning process effective. The efficient use of interactive whiteboard helps in the increase of attainment towards the students. The students are able to erudite the concepts taught which they

learn through the multi-sensory organs thereby inculcating a positive attitude towards the ICT. The students expect the teachers to be technologically skilled so that they could effectively use the data and integrate different aspects to provide the necessary experience in a multi sensory mode which replicate the real learning environment.

3. Review of Related Literature

Studies reviewed pertaining to the present study have been compiled and presented below under appropriate headings.

3.1 Studies Related to attitude towars ICT and achievement test in physics

Bindu (2017) studied the Attitude Towards, and Awareness of Using ICT in classrooms: A Case of Expatriate Indian Teachers. The findings of the study, through the analysis of both quantitative and qualitative data, revealed that teachers had a positive attitude towards using ICT irrespective of their gender and age. However, the ICT awareness of teachers is at the average level and is influenced by their gender and age.

Stephen (2017) investigated the pre-service teachers' attitude towards information and communication technology usage: A Ghanaian survey. The findings revealed that the following: (1) leadership support significantly influenced perceived ease of use; (2) job relevance significantly influenced perceived usefulness; (3) perceived usefulness significantly influenced attitude towards use; (4) perceived ease of use significantly influenced attitude towards use (5) the TAM is significant for pre-service teacher education context except the relationship between perceived ease of use and perceived usefulness.

According to the series of models by Martinez et.al (2020) found that information and communication technologies (ICT) are being used more and more as part of teaching processes in both formal and informal settings. In this regard, it was important to understand university students' attitudes towards using ICT as they shortly formed a part of the productive sector of society. The aim of the study was to analyze student attitudes during their final years pursuing various degrees at a university in Costa Rica. The researcher used a non-experimental transactional design and probabilistic sampling that involved 1187 students. He used a questionnaire containing a Likert-type scales to measure attitudes, which was

structured according to affective, cognitive, and behavioral components. The results showed positive attitudes in general, with higher scores in the cognitive and behavioral components, moderate scores in the affective component. In addition, he found differences in attitudes according to gender, prior training in technology and academic performance.

Evaluation

Numerous studies have been conducted in the area of attitude towards ICT of students and teachers and these studies identify and analyze the number of factors that affect the academic performance of the student at school, college and even at university level. Their finding identify students' learning preferences, their attitude in using ICT, behaviour, level of process skills in Science and student's academic performance. These include continuous professional development for teachers, investing in robust ICT infrastructure and fostering a school culture that supports innovation and technology use. Additionally, the integration of ICT should be aligned with the curriculum and pedagogy to ensure it enhances learning rather than serving as a distraction

However, as academic achievement is a broad topic, several books have focused mainly on selected aspects of academic achievement, such as enhancing academic achievement or specific predictors of academic achievement. A thorough, short, and informative overview of academic achievement has been provided in Spinath (2012). Spinath (2012) emphasized the importance of academic achievement with regard to different perspectives. Furthermore, the influence of technology on academic performance has been investigated in a number of studies with widely differing conclusions. Technology impacts students' daily lives and certainly plays an important part in developing students' positive and negative attitudes Volk, et.al. (2003). The lack of computers in Iraqi classrooms has led most of the students to become unfamiliar with using them and to have low behavioral attitudes toward using computers (Muslim, 2010, Martinez et.al (2020)). Hence, there is a need to look at students' attitudes toward information technology whether negatively or positively. If attitude influences the use of information technology in the daily lives or whether is it used to get information or just for entertainment. The Regional Ministry of Higher Education in Kurdistan Region of Iraq has actively encouraged lecturers to integrate technology into the

curriculum especially the Microsoft PowerPoint presentation which every lecturer has required using it to improve the quality of teaching and learning process. While ICT offers substantial benefits for enhancing learning outcomes, its integration is complex and requires addressing various challenges through strategic planning and support. The continuous evolution of ICT necessitates ongoing research and adaptation ensure to meet the educational needs of the 21st century. The dearth of studies in the Indian context has necessitated further investigation of the contribution of the variable, attitude towards ICT to the achievement of Physics in students.

3.2 Studies Related to interactive whiteboard in classrooms and academic achievement in physics

Mata et al. (2016) aimed at the Effects of study levels on students' Attitudes towards Interactive Whiteboards in Higher Education". The study emphasize on exploring the effects of the study levels of the participants involved in the research on the students' attitudes towards interactive whiteboards (IWB) in higher education. A questionnaire with 28 items was distributed in April–May 2013 in order to determine the students' attitudes towards interactive whiteboards. 210 students who had been in their undergraduate studies, 24 in their master's studies and 12 in their doctoral studies had responded to the survey. The questionnaire divide in to four 4 sections, which focused on the availability of use of IWB and the components of pedagogy, psychology and group interaction. The methodology used involved a multiple response set format in order to identify the percentage of choices for each category of issues, to determine the differences researcher used the Kruskal Wallis, Jonckheere–Terpstra and Mann–Whitney U tests were used to determine differences. The obtained results showed that there were relevant differences between students at different study levels regarding the attitude towards certain factors which define pedagogical, psychological, group interaction and availability of use of IWB factors. A big effect induced by higher study levels was observed at the availability of use of the IWB factor at the perception on using IWB in the educational process. Although there are some positive interactions regarding interactive whiteboards, students accept only gradually the introduction of the new technologies, along with the progression in study level.

Cabus et al. (2017) investigated on Smart in Mathematics: Exploring the Effects of Smart Class Level differentiation using Smart Board on Math Proficiency. The research revealed the effects of class-level differentiation by making innovative use of an interactive whiteboard (Smart Board) on math proficiency, use of Smart Board in class, combination with teacher training, using a randomized field experiment among 199 pre-vocational students in VII grade in the Netherlands. During 6 weeks, Experimental students were in the intervention group participated in math classes in which the Smart board was used to apply level differentiation. The specific training given to the particular class teachers (Technological Pedagogical and Content Knowledge - TPACK) in using the Smartboard in class. Traditional classes were taught by teachers with traditional method of teaching. The results showed that level differentiation in class, which was possible because of the efficient use of the Smart Board, significantly increased math proficiency by 0.25 points.

Shi et al. (2017) conducted a study on Interactive Whiteboard-Based Instruction Versus Lecture-Based Instruction for College Students' Academic Self-efficacy and Academic Press. The purpose of the study was to investigate the effects of interactive whiteboard (IWB) based instruction on students' academic self-efficacy and academic press. Methods were used was quasi-experiment. A sample of 103 was taken from a university in central China. While students in one class employed the IWB-based instructional approach, students in the other class employed the traditional lecture-based instructional approach. Students in both classes studied English for 3 months. The pre-and post- surveys showed that the students with the IWB-based instructional approach had a higher level of academic self-efficacy and academic press than the students with the lecture-based instruction approach. So, study indicated that the use of IWB can increase students' self-efficacy and academic press when cooperated with an appropriate instructional approach.

Evaluation

Although there are some positive interactions regarding interactive whiteboards, students accept only gradually the introduction of the new technologies, along with their progression in study level. According to Beeland (2002) and Kumari et al. (2014) findings, technology lead to improved learning environment. Student feedback on the relative

advantages and disadvantages of traditional blackboard and technology- based instruction is suited to transmission of basic facts and information. The classroom experience of students is very different for the two types of instruction. The relative benefits of the two types of instruction depend strongly on the students' learning preferences and personal circumstances Marcellus and Ghrayeb (2002). In addition to student learning, observations indicate that designing lessons with interactive white boards can help educators streamline their preparation and be more efficient in their ICT integration. There is no much research in India on using the interactive white board as it is a blooming concept in the Indian education system. Therefore the researcher has taken interactive white board as an intervention for the present experimental study.

4. Statement of the Problem

The review done from the available relevant literature, relating to the present research area, led the investigators to conceptualize the problem in an attempt to fill in the lacunae found.

Thus the problem is stated as here under:

Effectiveness of Techno-Pedagogy on Attitude towards ICT and Achievement Test in Physics among Standard IX Students

5. Objectives of the Study

The major objectives of the present study are as follows:

1. To prepare a plan of action to teach using Interactive Whiteboard in classrooms;
2. To investigate the possible relationship between the independent variable, attitude towards ICT and the dependent variable achievement in Physics;
3. To investigate the possible significant difference between the pre and post-test scores of attitude towards ICT among standard IX students in Experimental and Control Groups;
4. To investigate the possible significant difference between the pre and post-test scores of achievement test in Physics among standard IX students in Experimental and Control Groups;
5. To investigate the possible significant difference between the gain scores of attitude towards ICT

among standard IX students in Experimental and Control Groups;

6. To investigate the possible significant difference between the gain scores of achievement test in Physics among standard IX students in Experimental and Control Groups.

The major objectives thus extrapolated were examined with the major assumptions hereunder.

6. Hypotheses

The present research investigation is having the following assumption:

1. There will be a significant relationship between the independent variables, attitude towards ICT and the dependent variable achievement in Physics;

2. There will be no significant difference between the pre and post-test scores of attitude towards ICT among standard IX students in Experimental and Control Groups;

3. There will be no significant difference between the pre and post-test scores of achievement test in Physics among standard IX students in Experimental and Control Groups;

4. There will be no significant difference between the gain scores of attitude towards ICT among standard IX students in Experimental and Control Groups;

5. There will be no significant difference between the gain scores of achievement test in Physics among standard IX students in Experimental and Control Groups.

7. Method of Investigation

The present study deals with the analyses of pre and post test scores of the experimental and control groups where the intervention is given to the experimental group for a period of 30 days and traditional method of instruction to the controlled group with respect to attitude towards ICT and achievement test of Physics for IX standard students.

7.1 Population and Sample Characteristics

The investigator selected Government-aided Girls Higher Secondary School, Chennai district for the experimental study (32 students as experimental group and 32 students as control group). The English medium students of standard IX following the Tamil Nadu state board syllabus were selected. For validation of the tools the investigator selected experts from various field. The experts include teacher educators, science teachers from higher secondary and secondary school teachers, from government, aided and unaided sectors; comprise both male and female experts.

7.2 Tools used for the Study

The research tools used for the present study to analyze the attitude towards ICT, and achievement test in physics among standard IX students are as follows:

The tools selected to be used for assessment of the variables are as follow:

- Attitude towards ICT (Constructed by the Investigator)
- Achievement Test in Physics

The tools chosen were found to be suitable, workable, reliable and valid.

8. Analyses of Data

The results of the analyses of data collected are compiled and presented in tables below:

Table-1: Simple Correlation Matrix between the Select Independent Variables and Achievement Test in Physics among Standard IX students (N= 64)

Variables	Attitude towards ICT	Achievement Test in Physics
Attitude towards ICT	1	0.679**
Achievement Test in Physics	X	1

***significant at 0.05 level**

****significant at 0.01 level**

In the above table, it is seen that there is significant correlation between all select variables, namely, independent variables, attitude towards ICT and the dependent variable, achievement test in physics among standard IX students.

Table-2: Statistical Analysis of Means of Pre-test Scores of Attitude towards ICT, and Achievement Test in Physics among Standard IX Students in Experimental and Control

Variables	Groups	Sample Size	Mean	SD	SEM	SED	CR	Level of Significance
Attitude towards ICT	Experimental Group	32	140.16	18.28	3.23	3.77	1.31	0.200^{NS}
	Control Group	32	145.09	17.23	3.05			
Achievement in Physics	Experimental Group	32	29.03	5.80	1.03	1.18	0.24	0.813^{NS}
	Control Group	32	28.75	3.18	0.56			

****significant at 0.01 level**

On comparing the pre-test scores of the experimental and control groups of standard IX students it is seen that the pre-test scores of the experimental group and control group are found to be not significant for the independent variable attitude towards ICT and the dependent variable, achievement test in physics. The lack of significant difference indicates that both the experimental and control groups had comparable levels of knowledge and attitudes related to ICT and achievement in physics before the intervention. This is important as it establishes that any changes observed after the intervention can be more confidently attributed to the experimental treatment, not pre-existing differences.

Table-3: Statistical Analysis of Means of Pre and Post-test Scores of Attitude towards ICT and Achievement Test in Physics among Standard IX Students in Experimental Group

Variable	Pre and Post Test Scores	Sample Size	Mean	SD	SEM	SED	CR	Level of Significance
	Pre-test	32	140.16	18.28	3.23	3.09	6.99	0.001**

Attitude towards ICT	Post-test	32	161.75	4.49	0.80			
Achievement in Physics	Pre-test	32	29.03	5.80	1.03	1.41	3.92	0.001**
	Post-test	32	34.56	5.63	1.00			

****significant at 0.01 level**

The table above has indicated a significant relation between the independent variable attitude towards ICT and achievement test in physics among standard IX students.

Table-4: Statistical Analysis of Means of Pre and Post-test Scores of Attitude towards ICT and Achievement Test in Physics among Standard IX Students in Control Group

Variable	Pre and Post Test	Sample Size	Mean	SD	SEM	SED	CR	Level of Significance
Attitude towards ICT	Pre-test	32	145.09	17.23	3.05	3.86	3.32	0.002**
	Post-test	32	132.28	12.95	2.29			
Achievement in Physics	Pre-test	32	28.75	3.18	0.56	0.65	1.84	0.076^{NS}
	Post-test	32	27.56	1.92	0.34			

****significant at 0.01 level**

On comparing the pre and post-test scores of the control group of standard IX students it is seen that the means of pre-test scores of the control group are found to be higher in the independent variable attitude towards ICT and the dependent variable achievement test in physics. There is a significant difference found in the attitude towards ICT there is no significant difference between the dependent variable achievement test in physics among the pre and post-test scores of the control group.This result implies that for variable like attitude intervention might be needed to maintain or enhance positive outcomes.

Table-5: Statistical Analysis of Means of Post - test Scores of Attitude towards ICT and Achievement Test in Physics among Standard IX Students in Experimental and Control Groups

Variable	Groups	Sample Size	Mean	SD	SEM	SED	CR	Level of Significance
Attitude towards ICT	Experimental Group	32	161.75	4.49	0.79	2.36	12.49	0.001**
	Control Group	32	132.28	12.95	2.29			
Achievement in Physics	Experimental Group	32	34.56	5.63	1.00	0.99	7.10	0.001**
	Control Group	32	27.56	1.92	0.34			

****significant at 0.01 level**

On comparing the post-test scores of the experimental and control group of standard IX students it is seen that the mean of post-test scores of the experimental and control groups are found to be higher in the independent variable attitude towards ICT and the dependent variable achievement test in physics. It is also found that all the independent and dependent variables are found to be significant at 0.01 level. The intervention applied to the experimental group had a positive and significant effect on the students' attitude towards ICT and their achievement test in physics. The control group also showed improvements, the differences between the two groups were significant, emphasizing the effectiveness of the intervention.

Table-6:Statistical Analysis of Means of Gain Scores of Attitude towards ICT and Achievement Test in Physics among Standard IX Students in Experimental and Control

Variable	Groups	Sample Size	Mean	SD	SEM	SED	CR	Level of Significance
Attitude towards ICT	Experimental Group	32	21.59	12.81	3.09	4.37	7.87	0.001**
	Control Group	32	12.81	21.82	3.86			
Achievement in Physics	Experimental Group	32	5.53	7.98	1.41	1.53	4.4	0.001**
	Control Group	32	1.19	3.66	0.65			

Groups

On comparing the gain scores of independent variables namely attitude toward ICT and the dependent variable achievement test in physics it is seen that the mean scores of experimental group are found to be higher when compared to the mean score of control group. There is a significant difference found between the independent variables attitude towards ICT and the dependent variable achievement test in physics. The experimental group showed higher achievement test in physics compared to the control group, indicating that the intervention was effective. Attitude toward ICT is found to have a significant positive impact on achievement test in physics, suggesting that these factors are crucial in enhancing student performance in this subject. This highlights the importance of integrating ICT-related attitudes in educational strategies to improve student outcomes in physics.

9. Discussion

Abdullah et al. (2015) investigated the underlying factors of attitudes towards information technology and the relationship with academic achievement among students, through a self-developed questionnaire. The attitudes of the respondents were assessed in terms of three dimensions; namely affection, behavior, and belief. The results revealed a statistically significant difference between Arts and Science students in terms of their attitude towards IT in favor of Science students, and also proved that there was no statistically significant correlation between students' academic achievement and their attitudes towards IT. While students at the medium level of academic achievement tended to score higher on the affection toward IT comparing with students at the satisfactory level of the academic achievement. The results of the study provided information for policy makers, and the researchers who were interested in understanding the factors that affect technology used by students in their learning.

Mundilarto and Ismoyo (2017) studied physics achievement and critical thinking of students when taught with problem-based learning approach. The research included quasi experimental pretest-posttest control design . The sample was drawn from senior high school in Indonesia. Data analysis was done using MANOVA. The results revealed that experimental group students perform better in achievement and critical thinking than control group students.

In the present investigation, investigating the intervention of interactive whiteboard in classrooms in developing the attitude towards ICT and achievement test in physics it is found that there is no significant difference in the pre-test scores of students in both groups experimental and control groups. After exposing the standard IX students in the experimental group to teaching of physics using interactive whiteboard, the students were again tested with the same attitude, behaviour, science process skills and achievement test and the post-test scores were coded systematically. The standard IX students in the control group were exposed to the regular traditional teaching method. Finally the students were again tested with the same attitude towards ICT and achievement test in physics tools and the data served as post-test score. The interpretation that the pre-test scores of the experimental group and control group are found to be not significant for the independent variable attitude towards ICT and the dependent variable achievement test in physics suggests that both groups started from a similar baseline before any intervention or experimental treatment was applied. It is Here are some reasons and explanations to support this interpretation:

- **Initial Equivalence of Groups:** The lack of significant difference indicates that both the experimental and control groups had comparable levels attitudes related to ICT and achievement in physics before the experiment. This is important as it establishes that any changes observed after the experiment can be more confidently attributed to the experimental treatment, not pre-existing differences.
- **Validity of the Intervention:** When the pre-test scores are not significantly different, it helps validate the experimental design, suggesting that random assignment or other matching techniques were effective in creating equivalent groups. This strengthens the internal validity of the study.
- **Fair Comparison:** If both groups were starting at different levels (i.e., with significant differences), it would be difficult to determine if the intervention was truly responsible for any post-test differences. Similar pre-test scores allow for a fair comparison of the impact of the treatment.
- **Controlling for Confounding Variables:** By showing that there were no significant pre-test differences in the independent variable and the dependent variable, it suggests that potential confounding factors that might affect the outcome such as prior knowledge or experience with ICT equally distributed across both groups.

When comparing the pre and post-test of the experimental group of standard IX students The results indicate that the intervention or treatment provided to the experimental group of standard IX students has had a positive impact. The post-test scores for the experimental group are higher across the independent variable attitude towards ICT as well as the dependent variable, achievement in physics, compared to their pre-test scores. This suggests that the intervention improved students' attitudes related to ICT leading to better performance in physics. The significant difference between the pre- and post-test scores highlights the effectiveness of the intervention in enhancing students' learning outcomes.

When comparing the pre and post-test scores of the control group of standard IX students the pre-test mean scores for the control group are higher than the post-test scores, indicating that, initially, the students in the control group had a more positive attitude towards ICT. The significant difference between the pre-test and post-test scores suggests that there was a decline in the students' attitude towards ICT from pre to post-test. This may imply that, without intervention or guidance, their positive attitude towards ICT weakened over time.

The mean pre-test scores for the achievement test in physics are higher, but there is no significant difference between the pre-test and post-test scores, indicating that students' performance in physics did not change notably over time without intervention. This suggests that without specific educational interventions or changes in teaching strategies, the control group maintained a consistent level of performance in physics.

The post-test scores of the experimental group and the control group of Standard IX students were compared on attitude towards ICT (independent variables), and achievement test in physics (dependent variable). The mean scores of both the experimental and control groups were higher on all independent and dependent variable after the intervention or treatment, indicating an improvement in these areas for both groups. The results showed a statistically significant difference between the groups for all variables at the 0.01 level. This means there is a high probability (99%) that the observed differences in post-test scores between the experimental and

control groups are not due to random chance. The intervention or treatment likely had a meaningful impact on the outcomes.

The students in the control group showed a decline in attitude towards ICT but the change was not statistically significant. Their achievement in physics remained consistent with no significant gains or losses. This result implies that for variables like attitude the intervention might be needed to maintain or enhance positive outcomes. The intervention or teaching method applied to the experimental group using the interactive whiteboard had a positive and significant effect on the students' attitude towards ICT and their achievement in physics. The control group also showed improvements, but the differences between the two groups were significant, emphasizing the effectiveness of the intervention.

Educational reform calls for a shift away from organizing instruction around time devoted to lecture or practicing discrete skills in specific academic disciplines toward an emphasis on engaging students in long-term, meaningful projects. Technology can enhance student acquisition through drill and practice. From the beginning of the computer age, educational researchers and practitioners have told us that for technology use to be successful in our schools it needed to be closely tied to school reform. The impact of technology on student learning is growing rapidly. The integration of technology within education increases student stimulation and comprehensive interaction while enabling a differentiation in teaching methodologies.

The evolution of education requires technology integration with new pedagogical approaches with psychological attributes. The movement from traditional learning styles to a newer progression of interrelated teaching methodologies is progressively changing the face of education. Today, education is much more than drill and development of basic skills. Students growth in acquisition and complex reasoning is a driving force to enable academic enhancement. Technology can assist with some of these expectations and make teachers and their students more successful.

According to Demesa (2009), further research studies are needed, emerging trends indicate that, under the right conditions, technology: accelerates, enriches, and deepens basic skills; motivates and engages students in learning; helps

relate academics to the practices of today's workforce; increases economic viability of tomorrow's workers; strengthens teaching; contributes to change in schools; Connects schools to the world. Both academically and professionally, society has become dependent on technology. As technological development progresses, education must make adjustments to remain current. Instruction, assessment, and teaching abilities must adapt to technology, influencing a positive change in academic progression.

In the present investigation it is found that the gain scores of attitude and achievement test in physics of students in experimental group are found to be significantly better than the gain scores of students in control group. This is because of the exposure of the students to teaching using interactive whiteboard in classrooms, which the students in control group have been deprived of.

A significant difference was found between the independent variable attitude towards ICT and the dependent variable achievement test in physics, which suggests that students with a more positive attitude toward ICT had better performance in the achievement test. This implies that these factors play a crucial role in students' physics achievement.

10. Conclusion

The study underscores the necessity of improving the quality of Science subject by leveraging modern tools such as interactive whiteboard and focusing on pedagogical approaches that foster positive student attitudes. The independent variables attitude towards ICT play a critical role in shaping students' learning experiences and outcomes.

Students who have a positive attitude towards ICT (Information and Communication Technology) tend to embrace digital tools more effectively. In this context, the interactive whiteboard serves as a catalyst for engagement, allowing students to interact with content visually and kinesthetically. This interaction not only aids comprehension but also makes learning more dynamic, improving their overall attitude towards subjects and Physics. This empowers them to tackle complex learning and grasp scientific concepts more effectively. The achievement test in Physics highlights how interactive teaching methods can significantly improve student performance. When interactive whiteboard are used in

classrooms, they facilitate a deeper understanding of abstract concepts by providing visual aids, simulations and interactive demonstrative activities. This helps students retain information better, leading to higher scores in achievement tests.

In conclusion, the study reveals that incorporating technology in education, supported by a positive attitude towards ICT can greatly enhance student achievement in physics. Interactive whiteboard, as a modern educational tool, should be more widely adopted in schools to not only improve academic performance but also to foster a more positive learning environment. Sulaiman et al. (2012), Agarwal et al. (2013), Hussein (2011). This holistic approach is essential for the country's educational development and the overall empowerment of students. The ultimate goal is to cultivate a generation that is well-equipped with a erudite knowledge in physics, critical thinking and scientific literacy, which are essential for national progress and technological innovation.

Reference

1. Abdulla, Z.D., Ziden, A.B.A., Aman, R.B.C. and Mustafa, K.I. (2015). Students' Attitudes towards Information Technology and the Relationship with their Academic Achievement. 6(4), 335-358.
2. Agarwal, P.K., Bain, P.M. and Chamberlain, R.W. (2013). The Value of Applied Research: Retrieval Practice Improves Classroom Learning and Recommendations from a Teacher, a Principal, and a Scientist. Educational Psychology Review, 24(3), 437–448.
3. Beeland, W.D. (2002). Student Engagement, Visual Learning and Technology: can Interactive Whiteboards Help?.
4. Bindu, M.P. (2017). Contextual Teaching and Learning: a Pedagogical Approach for Multicultural Education. Handbook on Perspectives of Inclusive Education, 137-150.
5. Cabus, S. J., Haelermans, C., and Franken, S. (2017). Smart in Mathematics: Exploring the Effects of in-Class-Level Differentiation using Smart Board on Math Proficiency. British Journal of Educational Technology, V48(1), pp. 145-161.
6. Demesa, A.L. (2009). Technology Skills Sparks Success: A Study of Best Practices for Teachers and the Effective

Integration of Technology in the K–12 Classroom Environment, Capella University.

7. García-Martínez, J.A., Fuentes-Abeledo, E.J. and Rodríguez-Machado, E.R. (2020). Attitudes towards the use of ICT in Costa Rican University Students: The influence of sex, academic performance, and training in technology. Sustainability, 13(1), 282.
8. Hussein, H. B. (2011). Attitudes of Saudi Universities Faculty Members towards using Learning management system (JUSUR). Turkish online Journal of Educational Technology, 32(3), 303- 317.
9. Kumari, P., Arora, S.K. and Tiwari, S. (2014). Impact of Inquiry-Based Teaching Model on Academic Achievements in Social Science Subject of 9th Class Student of Secondary Schools Located in Urban Area. International Journal of Recent Research Aspects, 2(4), 154-158
10. Marcellus, R. and Ghrayeb, O. (2002). Effects of Smart Classrooms on Learning and Teaching Effectiveness: the Students' Point of View. Presented to the ASEE Annual Conference and Exposition, Montreal, Canada.
11. Mata, D.A., Ramos, M. A., Bansal, N., Khan, R., Guille, C., Di Angelantonio, E. and Sen, S. (2016). Prevalence of Depression and Depressive Symptoms among Resident Physicians: A Systematic Review and Meta-Analysis. Survey of Anesthesiology, 60(4), 146.
12. Mundilart, P. and Ismoyo, H. (2017). Effect of Problem-Based Learning on Improvement Physics Achievement and Critical Thinking of Senior High School Student. Journal of Baltic Science Education, 16(5), 761-779
13. Muslim, I.M. (2010). The influence of CALL on students attitudes toward comprehension. College of Education for Women, 21(3), 743-749.
14. Shi, Y., Peng, C., Wang, S. and Yang, H.H. (2017). The Effects of Smart Classroom-Based Instruction on College Students' Learning Engagement and Internet Self-Efficacy. In Blended Learning. Enhancing Learning Success: 11th International Conference, ICBL 2018, Osaka, Japan, July 31-August 2, 2018, Proceedings 11, 263-274. Springer International Publishing.
15. Spinath, B. (2012). Academic Achievement. In Encyclopedia of Human Behavior. 2d Ed. Edited by Vilanayur S. Ramachandran, 1–8.
16. Stephen, R.M. (2017). Hispanic Students' Perceptions of Success: A Phenomenological Study on the Impact on K-12

Academic Achievement. Liberty University ProQuest Dissertations and Theses.

17. Sulaiman V,R., Hall, A., Kalaivani, N.J., Dorai, K. and Reddy, T.S.V. (2012). Necessary, But Not Sufficient: Critiquing the Role of Information and Communication Technology in Putting Knowledge into Use. The Journal of Agricultural Education and Extension, 18(4), pp. 331–346.
18. Volk, K., Yip, W.M. and Lo, T.K. (2003). Hong Kong Pupils' Attitudes Toward Technology: The Impact of Design and Technology Programs. Journal of Technology Education, 15(1), 48-63.