Journal for Social Science Archives

Online ISSN: 3006-3310
Print ISSN: 3006-3302
Volume 3, Number 3, 2025, Pages 85 – 96
Journal Home Page
https://jssarchives.com/index.php/Journal/about

Impact of Activity Based Learning on Academic Achievement of Students at Elementary Level

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ARTICLE INFO

Article History:

Received:	*May*	*23, 2025*
Revised:	*June*	*24, 2025*
Accepted:	*July*	*06, 2025*
Available Online:	*July*	*17, 2025*

Keywords:

Academic, Learning methods, students, ABL

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ABSTRACT

The purpose of study was to examine the impact of activity based learning method on academic achievement of students at elementary level. Quasi-experimental as well as pretest & posttest were used in this study. A treatment for sixteen weeks was performed through activity based learning. The population of the study was all the students of 8th class in district Khanewal during the 2023-2024 academic years. Activity based learning method was used for experimental group and traditional teaching method was used for control group. Two intact classes which were made up of fifty one students (51) students treated as sample. The instruments for data collection were two achievement tests to measure the achievement of the student. These tests were developed by PEC. To measure the critical thinning, a test developed by Shaheen (2022) was used. Percentage, mean, standard deviations and T-test were used to analyze the data. Findings of this study were reveal that Activity Based Learning (ABL) and teaching method was viable in upgrading students' academic achievement.

Introduction

The growth of Pakistan's educational system is the primary goal of the country's national development. The general consensus is that the national education program has important goals and objectives. The government makes every effort to improve the quality of education in Pakistan through national development policies, which include: updating the curriculum over time, hiring better teachers, managing schools effectively, and ensuring that all educational facilities are available **(**Skulmowski, 2024**)**. While some of these efforts have produced positive results, they are insufficient. According to Anwer (2019), the government must now focus on all educational levels in order to achieve student learning outcomes.

Science is the primary subject that underpins science and technology in elementary schools. According to Sari, Ahda, & Fitria. (2019), science is the discipline that necessitates practical activity in order to better understand natural phenomena. Science is the primary subject taught in Pakistani elementary schools in order to help pupils improve their knowledge, abilities, and scientific values as well as their love and respect for Allah. Students should focus on activities because science is not a subject that is meant to be memorized, but rather provides an opportunity for them to observe their environment and validate these discoveries through experiments (Sukmana, 2018). Students should be encouraged to be intelligent and active by solving difficulties on their own and battling ideas to come up with better solutions for themselves.

The unfortunate truth is that science instruction in Pakistani elementary schools does not meet curriculum standards and is not up to par. In Pakistani elementary schools, science instruction consists solely of memorizing information, theories, and concepts rather than conducting scientific research. Students are not allowed to solve issues on their own or discover new things when studying science and this is not the learning objective. The only way for students to demonstrate their learning is by receiving high exam scores. The majority of pupils believe that science is an uninteresting topic. This is a result of the curriculum's lack of relevance to our daily lives and the subpar science teaching strategies employed in our schools. Therefore, the goal of science education that is, for students to be able to solve problems and comprehend their surroundings logically is not met. The fact that students merely participate in teacher-led science lessons and are not actively involved in our science learning system is one of the primary obstacles to reaching objectives. The learning process becomes dull because the teacher only imparts information that is found in textbooks and has nothing to do with the students' everyday issues. Only good students are given special attention in the classroom, and teachers do not involve all students in the learning process (Sari et al., 2019).

Constructivism-based learning, or activity-based learning (ABL), should be used to address the aforementioned issues since it takes time to get students actively involved in the learning process and raise educational standards. This modality's goal is to provide pupils with worthwhile educational experiences. Through teamwork, cooperative learning, personal experiences, and research, ABL empowers students to obtain knowledge and solve challenges on their own. Analytical thinking, problem-solving abilities, self-learning through firsthand experience, communication skills, and a thorough comp. Students should learn how to solve problems on their own in everyday life through inquiry-based learning. Thus, according to Malmia, Makatita, Lisaholit, Azwan, Magfirah, Tinggapi, & Umanailo (2019), the students not only comprehend the theory but also apply it to their own experiences through empirical learning (Zuryanty, Kenedi, Chandra, Hamimah, & Fitria, 2019).

Different types of learning activities demonstrate how engaged students are in the process. Physical activities involve students physically, while psychological activities involve students mentally. It can be challenging to gauge how engaged students are in psychological activities. During the learning process, all information should be gathered from personal experience, with all technical and scientific comfort created by you (Trianto, 2010). Scientific learning cannot be accomplished without activity, thus instead of just listening to the teacher and taking notes, students should participate in the activity process. Students participate in a wide variety of activities at school and throughout their institutions. Diedrich, Jauk, & Salivia (2018) has classified learning activities into eight categories: a). Visual pursuits include reading, observing experiments, exhibits, and demonstrations, as well as observing other people at work or play, b) Oral actions such as posting facts, relating such events, asking questions, offering guidance, voicing opinions, conducting interviews, having conversations, and interrupting others. b) Listening exercises,

including speeches, music, dialogues, dictations, and so on, d) Writing assignments, including essays, stories, reports, quizzes, questionnaires, and copying. e) Drawing exercises, including sketching, creating maps, graphs, diagrams, patterns, and so forth, f) Hands-on activities such as conducting experiments, building structures, playing models, gardening, raising animals, and so forth g) Cognitive activities such as reflection, memory, problem-solving, analysis, relationship analysis, decision-making, and so on; emotional activities such as curiosity, boredom, excitement, boldness, calmness, nervousness, and so forth (Trianto, 2010).

Five actions are taken into consideration in this study. All of the aforementioned actions are connected to one another. Every motor skills task, for instance, involves unique emotions that are connected to cerebral activity. There are several activities in each unit. Nonetheless, the students' assignments are chosen based on the subject matter. Therefore, it is evident that the tasks assigned to the pupils should be difficult and time-sensitive. Without this, learning objectives and accomplishments are not met. Students who participate in practical work are more adept at comprehending and resolving issues than those who do not. According to Muttaqin, Raharjo, & Masturi (2018), student activities are crucial because without active participation, no goal can be accomplished to its full potential.

His learning outcome is a change in human behavior, including habits, thoughts, motor skills, understanding of different things, and social, emotional, behavioral, and attitude changes, among other things. Any behavioral change indicates that a person is going through a learning process. The learning outcome is the primary metric that is assessed through tests and non-tests alike. The application of learning outcomes in everyday life is demonstrated by the attitudes of students, the development of certain abilities (Edwards, Kupczynski, & Groff (2019). The application of learning outcomes in everyday life is demonstrated by the attitudes of students, the development of certain abilities, and the comprehension of concepts. Any improvement in student conduct or academic achievement is considered a learning outcome. The attainment of learning objectives indicates whether or not a certain degree of achievement has been attained. According to Amini, Setiawan, Fitria, and Ningsih (2019), learning outcomes that can be attained include changes in attitude, understanding, values, and capacities.

It is believed that this study will assist instructors in providing better understanding for the advancement of scientific education in schools by describing how increasing activities might boost attainment of learning outcomes at the primary level. As a result of this research, improved educational policies are created and science education concepts are developed to improve the quality of human resources in schools and related organizations (Kamaruddin, Hussain, & Nizam, 2018).

Both students and their parents place a great deal of importance on their grades and accomplishments since they serve as indicators of future success. Teachers experiment with novel teaching techniques to improve the learning process. For instance, they use group teaching techniques for cooperative learning, which has shown positive outcomes globally. Students that use the activity-based learning (ABL) approach learn by doing. According to Harfield, Davies, Hede, and Panko Kenley (2007), "students learn by doing and become active rather than sit as passive listeners" when using the activity-based learning (ABL) teaching approach. The learner can apply this knowledge in various scenarios if they gain knowledge from real-life events and turn it into their own personal experiences.

Activity-based learning differs from traditional teaching techniques. 1) Students actively participate in the educational process 2) The pupils' collaboration. Learning that involves students actively participating in the process is known as activity-based learning. They state that the use of

manipulative materials is "frequently involved in the Activity-Based Teaching (ABT) method." Learning that has purpose is a fun pastime. Through ABL, students were able to gain control of their skills and solve difficulties on their own. Through ABL, students have the independence to analyze learning objectives and work through issues independently. In addition to listening to the teacher follow the curriculum, the student also learns how to solve difficulties. They are able to follow the information after they are able to solve their concerns. In order to teach complicated subjects effectively, it is crucial to involve students in interactive activities. This is where student motivation comes in. Explaining complicated ideas requires a variety of tasks.

One type of constructivist learning theory that is a subset of cognitive learning theory is activity-based learning (ABL). Constructivist learning theory states that every student should build their own knowledge and concepts from their own experiences. This theory states that learning occurs when personal experiences and cognitive concepts interact. To build learners, the classroom should be filled with a variety of activities. Active learning and an active classroom are essential components of constructivism. Because constructivist classes demand firsthand personal experiences, traditional teaching approaches are inappropriate. According to constructivism, meaningful learning occurs when students need their own experiences rather than the instructor's expertise (Domin, 2007). Students in our educational system are unable to apply the knowledge they learn from their teachers and the curriculum to real-world situations. The primary cause is that students are not actively engaged in the classroom. Contextualizing our teaching and learning process is necessary. Stößlein & Changchun (2009) asserts that this transforms our conventional teaching approach and enables pupils to study in the way that best suits them. According to him, ABL is an effective teaching strategy for science in our classrooms. Through successful activities, we foster cooperative learning, good ideas, communication, management, leadership, and problem-solving skills in kids. Students solved real-world challenges using their own experiences, which will benefit them in the future. Teachers who use an activity-based teaching and learning style serve. Teachers who use an activity-based teaching and learning style serve as friends, mentors, guides, and facilitators. They are not in charge of the class; rather, they serve as a source of motivation for the students. Students always recall the work they perform with their hands, according to the well-known adage regarding their success. Studies demonstrate that students who are inactive in the learning process will acquire less knowledge and be unable to remember it for an extended period of time. The "Dale's cone of experience" illustrates this.

Effective learning is critical to student retention. Teachers should adapt their teaching strategies to meet the needs of their pupils and make learning engaging for them. Activity-based learning (ABL), which is described as a learning process where students learn by doing, is one of these approaches (Kamaruddin, et al., 2018).. Students that participate in activity-based learning are not passive learners. The student is actively participating in the educational process. The activity-based learning approach differs from traditional teaching techniques in the following ways: (A) The student is participating fully in class. (a) Students work in group learning settings. The two aforementioned principles are crucial for developing students' character and creating a positive learning environment in the classroom. Students benefit greatly from activity-based learning.

Science instruction in elementary schools is crucial to contemporary development. The government of Pakistan places a high priority on science instruction at the primary school level and has implemented numerous reforms to raise the standard of science instruction. Every educator, learner, and administrator wants to achieve the greatest amount of success in this area. Understanding the natural environment is the national objective of science education. Students' knowledge and accomplishment level are naturally raised by factors such as their family, school, surroundings, and teachers (Slavin, 2020).

Science is the empirical, theoretical, and applied study of the natural world. The scientific method includes observation, idea generation, theory building, and experimentation to validate the theory. People are constantly curious about their surroundings. Human minds that are imaginative and inquisitive react to nature differently. One of the traditional answers is to pay close attention to nature, look for anything significant, create a new practical tool, and develop a conceptual knowledge of the environment. Science is this inquisitive aspect of human nature (Skulmowski, 2024).

Science is the growing corpus of information derived from novel encounters. How does one define knowledge? How is it produced? Furthermore, what is scientific knowledge? The scientific method provides satisfactory answers to all of the aforementioned queries. The scientific process consists of several interconnected steps, including observation, hypothesis formation based on observation, theory development, hypothesis testing through experimentation, and the derivation of laws and principles from these theories and principles. There is no set plan for carrying out these actions. A new experiment may occasionally be required by a theory, while other times a new theoretical model may be required by an experiment. While observation and conjecture are valuable, pertinent experimentation is necessary for scientific theory. According to Rillero, Thibault, Merritt, & Silva (2018), the rules of science are always viewed as provisional and subject to change in light of fresh experiments and investigations.

We can obtain national goals through activity-based learning. While textbooks articulate goals at the state and national levels, neither the teacher nor the students are attempting to meet these goals in the classroom. The tasks demonstrate concepts and ideas presented in the textbook rather than serving as a vehicle for unstructured research. According to Anwer, (2019), students are unable to take competitive tests with standard classroom instruction, despite the widespread belief that activity-based learning is a time-consuming.

Concerns around expenses and costs are equally crucial in activity-based learning. The majority of elementary schools lack a well-equipped laboratory. It takes time to create inexpensive or nonexistent activities, so teachers should attempt to use the resources that are currently available. The teacher should select a teaching strategy based on the student's cognitive capacity. Students' attention should be piqued and the learning process should be made simple for them by the teaching methodology. In the teaching and learning process, a variety of methods are employed, including inductive, deductive, synthesis, and analysis. Other methods include the activity-based approach, the lecture technique, and the child-centered approach (Wu, Wang, Wang, Chen, Yang, Ni, & Hu, 2018).

Elementary school pupils go through the crucial stages of mental development known as operational and concrete operational stages. At this point, the learner needs learning that is engaging and enjoyable. If done correctly, activity-based learning produces excellent results. Activities ought to be carefully planned and organized. It affects the ability of students to learn. Various educators, including Rousseau, Davey, and others, advocate for an activity-based learning method (Saleh, Ahda, & Fitria, 2020).

There may be or may not be connection between activity based learning and academic achievement. It is possible that activity based learning may increase the academic achievement of students in the subject of science at elementary level. Present study explored the impact of activity based learning on academic achievement of the students.

Objectives

Objectives of this research were followed as:

1. To presume learning of the students thought activity based learning.
2. To measure the academic achievement of the students.
3. To investigate the impact of activity-based learning on academic achievement of students.

Hypothesis of study

The hypothesis of the study was:

Ho: Activity-based learning has no discernible effect on pupils' academic performance.
H1: Activity-based learning significantly affects students' academic performance.

Significance of the Study

It is anticipated that this study will have a significant positive impact on the advancement of science instruction in elementary schools, and that instructors will be able to employ the ABL learning modality and incorporate additional science-related activities into their lessons. The findings of this study are highly beneficial for improving scientific concepts and for implementing high-quality science education in the development of human resources. Teachers who wish to incorporate inexpensive activities into their lessons may also find this research to be very beneficial. For all scientific professors in both public and private universities, this study is extremely important. Both the value of activity-based learning and the relevance of Bloom taxonomy levels and their application would be understood by the teachers. The study's findings will give elementary school instructors recommendations on how to improve their scientific instruction. Future studies that want to test activity-based learning for different subjects and levels will find it helpful.

Activity-based learning has the potential to improve critical thinking, academic achievement and creativity. When it comes to activity-based learning, student motivation is crucial. For the ABL teaching approach to be effective, students must be inspired to work to the best of their abilities. Activity-based learning is the best way to teach complicated concepts and ideas where students may encounter difficulties. Students should participate in interactive exercises and make sense of what they are learning. Using activity-based learning in the classroom can help students' critical thinking abilities, academic performance, and creativity (Mulyani and Ashadi, 2015). Teachers should incorporate activities in the classroom that are relevant to everyday life. Activity-based learning is one type of cognitive learning that supports students' positive learning.

Research Methodology

An analytical and methodical approach to study was known as a research technique. The study used a quasi-experimental design and included pre- and post-tests. This design established a cause-and-effect relationship between the independent and dependent variables. Two pre-existing groups were chosen for this design. Prior to the treatment, both groups were non-randomly built, with one serving as the experimental group and the other as the control group. This study demonstrates that while both the experimental and control groups perform similarly on the pre-test, the experimental group outperforms the control group on the post-test.

All eight-grade kids in the Khanewal district made up the study's population. In Khanewal district, there were 7746 females and 8231 boys enrolled in grade 8. According to the results of comparing equal marks, twenty-six eighth-grade students from Government Girls Middle School Balocha

were randomly selected as the experimental group and twenty-five students from Government Girls Middle School Mankot as the control group. The students were then given a pre-test to place them in either the experimental group or the control group.

The data was collected through 8th grade Achievement Test (AT) constructed by Punjab Examination Commission PEC. The test was MCQs based containing 25 multiple choice questions. The Data was collected with the help of pre-test and post-test. The students of Experimental group were treated through teaching and learning by ABL technique. Treatment continued four months and 52 activities were completed with students. Data was analyzed with the help of SPSS.

Data Analysis

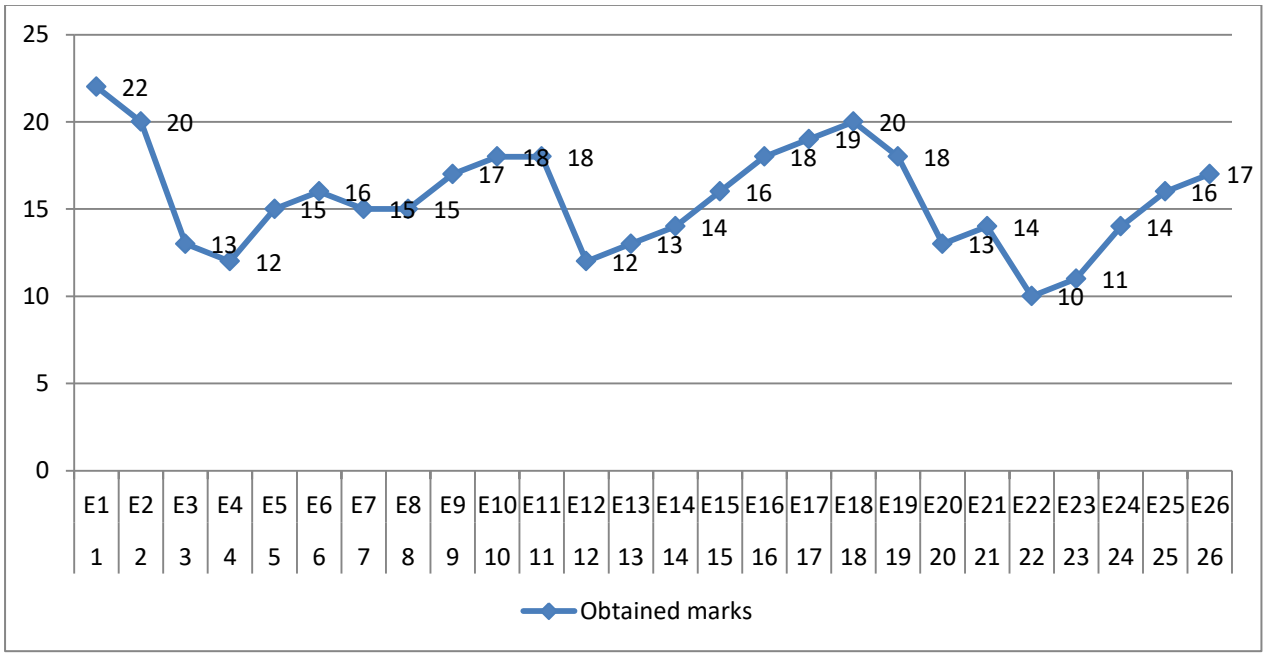
Demographic data is the information expressed in a statistically socioeconomic format. Demographic information includes things like population, race, income, education, and occupation. Demographic data refers to all of the information that is related to time and a certain location.

Table 1: Sample of the study

Sr. no	Groups	No. of Students	%Age
1	Experimental Group	26	51
2	Control Group	25	49

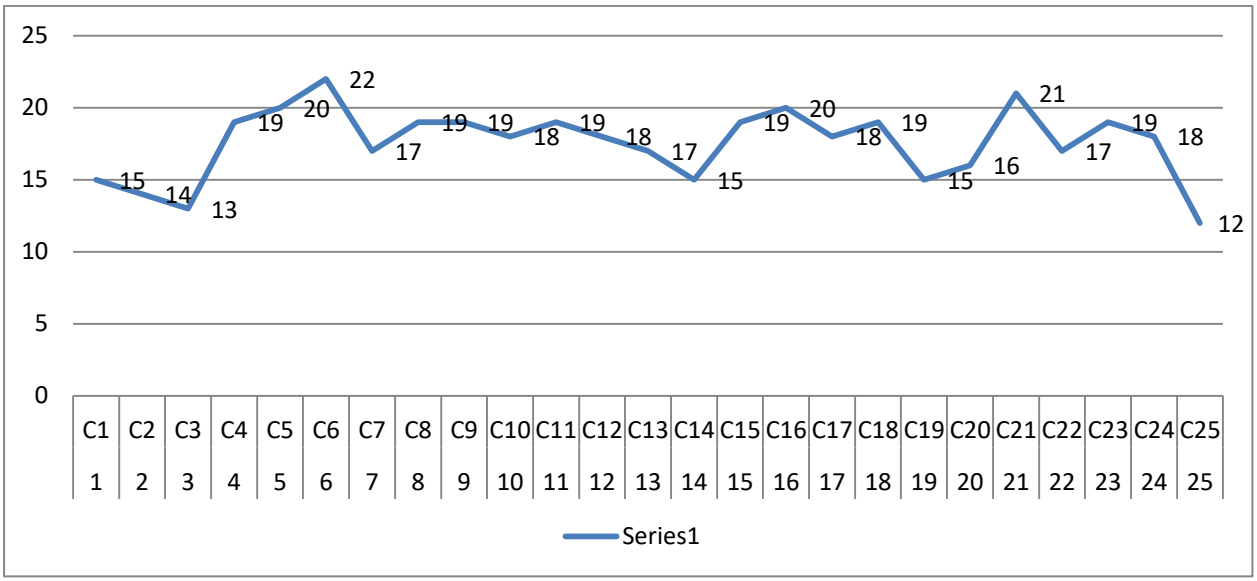
In the above table, sample size of two groups the experimental group and the control group is mentioned. The experimental group consists of 26 students and the control group consists of 25 students as well as 51% and 49% respectively.

Graph 1: Marks of Experimental Group in the test of Academic Achievement (Pretest)



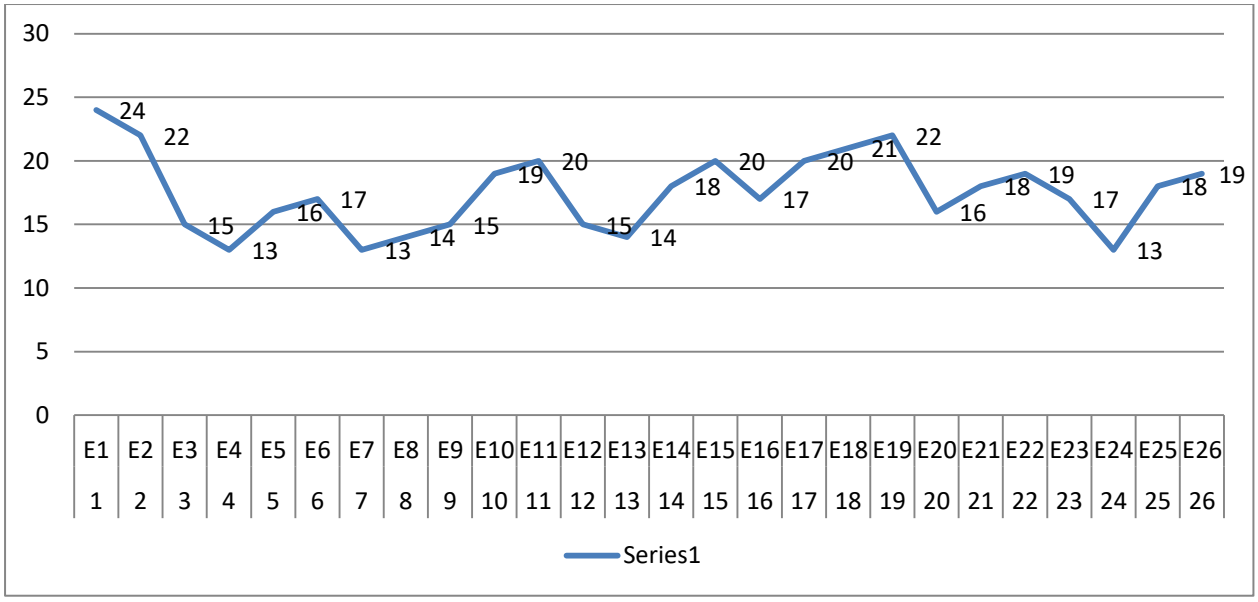
The marks of all students (Experimental Group) in pretest have been shown in the above table. The total marks of the test are 25. Student E22 obtained the lowest marks 10 and E1 obtained the highest marks 22.

Graph 2: Marks of Control Group in the test of Academic Achievement (Pretest)



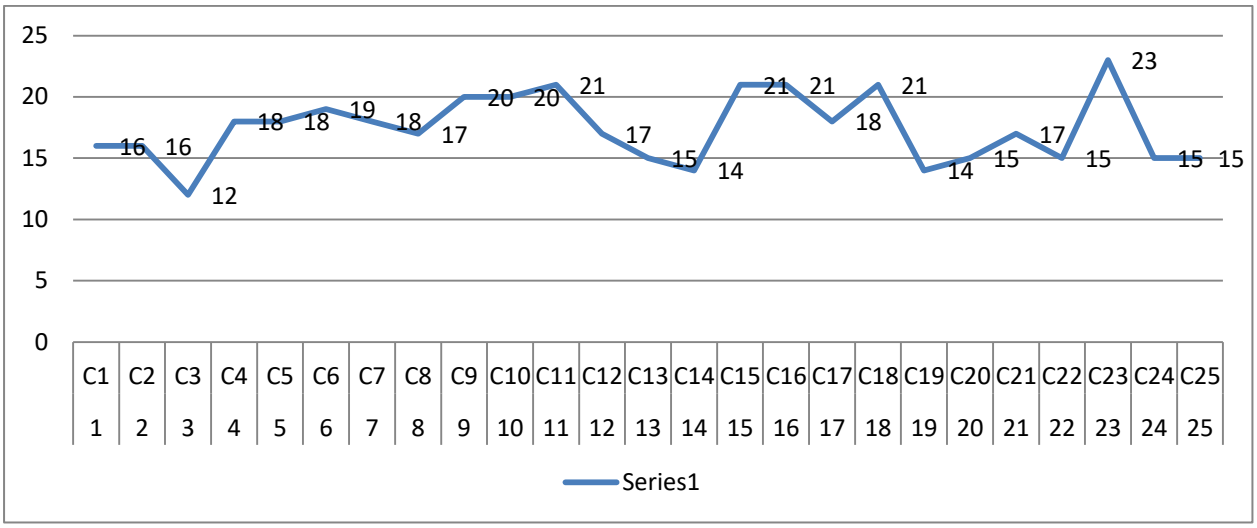
The marks of all students (Control Group) in pretest have been shown in the above table. The total marks of the test are 25. Student C25 obtained the lowest marks 12 and C6 obtained the highest marks 22.

Graph 3: Marks of Experimental Group in the test of Academic Achievement (Posttest)



The marks of all students (Experimental Group) in posttest have been shown in the above table. The total marks of the test are 25. Student E24 obtained the lowest marks 13 and E1 obtained the highest marks 24.

Graph 4: Marks of Control Group in the test of Academic Achievement (Posttest)



The marks of all students (Control Group) in posttest have been shown in the above table. The total marks of the test are 25. Student C3 obtained the lowest marks 12 and C23 obtained the highest marks 223

Table 2: Academic Achievement of the Experimental and Control Groups (Pretest)

Groups	Total Marks	Mean	S.D
Experimental	406	15.61	3.008
Control	439	17.56	2.467

In the above table the mean and standard deviation of both Experimental and Control group in pretest are calculated and the total marks are also mentioned in the table. Experimental group's total marks are 406, mean and standard deviation were 15.65 and 3.046 respectively. Control group's total marks, mean and standard deviation were 439, 17.56 and 2.468 respectively.

Table 3: Academic Achievement of the Experimental and Control Groups (Posttest)

Groups	Total marks	Mean	S.D
Experimental	484	17.50	3.036
Control	436	17.44	2.785

In the above table the mean and standard deviation of both Experimental and Control group in posttest are calculated and the total marks are also mentioned in the table. Experimental group's total marks are 484, mean and standard deviation were 17.69 and 3.159 respectively. Control group's total marks, mean and standard deviation were 436, 17.44 and 2.785 respectively.

Table 4: Comparison of performances of Experimental Group in pretest and posttest of Academic Achievement

Groups	N	Mean	S.D	t	Df	Sig
Experimental (pretest)	26	15.61	3.008	-3.941	25	.001
Experimental (posttest)	26	17.50	3.036			

Paired t-test was applied to compare the performances of Experimental group in pretest and posttest for Academic Achievement. The values of mean and standard deviation were 15.61 and 3.008 for Experimental group in pretest and values of mean and standard deviation were 17.50 and 3.036 of Experimental group in posttest. The value of t-test -3.941 at level of significance is 0.05. The lower the value of t-test shows that there is no significance difference between the performances of Experimental in pretest and posttest of academic achievement.

Table 5: Comparison of performances of Control Group in pretest and posttest of Academic Achievement

Groups	N	Mean	S.D	t	Df	Sig
Control (pretest)	25	17.56	2.467	0.287	24	.776
Control (posttest)	25	17.44	2.785			

Paired t-test was applied to compare the performances of Control group in pretest and posttest for Academic Achievement. The values of mean and standard deviation were 17.56 and 2.467 for Control group in pretest and values of mean and standard deviation were 17.44 and 2.785 of Control group in posttest. The value of t-test 0.287 at level of significance is 0.05. The lower the value of t-test shows that there is no significance difference between the performances of Control group in pretest and posttest of academic achievement.

Conclusion

The above study shows the following conclusion

As comparing the Experimental and Control groups, the students of the Control group shows better results on the pretest of Academic Achievement. Similarly the students of Experimental group show better result posttest of Academic Achievement. The value of t-test shows that there is no significance difference between the performances of Experimental in pretest and posttest of academic achievement as well as the performances of Control group in pretest and posttest of academic achievement. If we compare the results of pre and posttests of Experimental group, students shows a notable improvement in results but Control group shows no improvement in results of the students in posttest

The aforementioned study demonstrates Activity Based Learning (ABL) and teaching approach is helpful in improvement of students' Academic Achievement. Students' academic performance is improved when the ABL teaching approach is used. Learning by doing, or Activity Based Learning, has a positive effect on students' comprehension in the subject of science as compared to more traditional teaching approaches at elementary level.

Discussion

Meta-analyses have shown that ABL is highly effective for student learning and has a positive impact on students' academic achievement and results (Slavin, 2020; Festus, 2013). By using the ABL method of instruction, students' active engagement, logical reasoning, critical thinking, and peer tutoring all contribute to improved learning results.

The standard classroom arrangement needs to be replaced with a constructivist one in order to enhance the learning process in the classroom. This study demonstrates that student motivation in activity-based learning is highly successful in raising students' academic achievement, which is why it is so crucial (Anwer, 2019). Applying ABL greatly enhances academic success and learning outcomes (Zuryanty and Kenedi, 2019). In a study published in 2021, Fadilla et al. demonstrated that students' motivation in learning is increased academic achievement when they collaborate with

one another to address real-world challenges, which in turn boosts. Furthermore, it has been shown that ABL enhances students' academic performance in the classroom. Amini, Setiawan, Fitria, and Ningsih's (2019) found that ABL significantly affects students' academic performance.

Recommendations

On the basis of findings and conclusions, following recommendations were drawn:

1. Teachers should employ the ABL technique while teaching science at the elementary school level
2. The administration of the school should make sure that the activities in the textbook are carried out.
3. Future scholars should to look into a wider population and geographic area.

References

1. Amini, R., Setiawan, B., Fitria, Y., & Ningsih, Y. (2019). The difference of students learning outcomes using the project-based learning and problem-based learning model in terms of self-efficacy. *Journal of Physics: Conference Series*, 1387(1), 012082
2. Annafi, N., Ashadi, A., & Mulyani, S. (2015). Pengembangan Lembar Kegiatan Peserta Didik Berbasis Inkuiri Terbimbing Pada Materi Termokimia Kelas XI SMA/MA. *Inkuiri*, *4*(3), 21-28.
3. Anwer, F. (2019). Activity-based teaching, student motivation and academic achievement. *Journal of Education and Educational Development*, *6*(1), 154-170.
4. Diedrich, J., Jauk, E., Silvia, P. J., Gredlein, J. M., Neubauer, A. C., & Benedek, M. (2018). Assessment of real-life creativity: The Inventory of Creative Activities and Achievements (ICAA). *Psychology of Aesthetics, Creativity, and the Arts*, *12*(3), 304.
5. Domin, D. S. (2007). Students' perceptions of when conceptual development occurs during Laboratory instruction. *Chemistry Education Research and Practice*, *8*(2), 140-152.
6. Edwards, D. J., Kupczynski, L., & Groff, S. L. (2019). Learning styles in problem-based Effectiveness of Guided Inquiry Learning Model and Problem Based Learning Model on Thematic, 1(2), 257–264.
7. Festus, A. B. (2013). Activity-based learning strategies in the mathematics classrooms. *Journal of Education and Practice*, *4*(13), 8-14.
8. Harfield, T., Davies, K., Hede, J., Panko, M., & Kenley, R. (2007). *Activity-Based Teaching for Unitec New Zealand's Construction Students*. Auckland: New Zealand.
9. Kamaruddin, K., Hussain, M. S. H., & Nizam, M. M. (2018). Human resource development and employees' character development: A preliminary study. *Voice of Academia (VOA)*, *13*(2), 85-97.
10. Malmia, W., Makatita, S. H., Lisaholit, S., Azwan, A., Magfirah, I., Tinggapi, H., & Umanailo, M. C. B. (2019). Problem-based learning as an effort to improve student learning outcomes. *Int. J. Sci. Technol. Res*, *8*(9), 1140-1143.
11. Muttaqin, M. F., Raharjo, T. J., & Masturi, M. (2018). The implementation main values of character education reinforcement in elementary school. *Journal of Primary Education*, *7*(1), 103-112.
12. Rillero, P., Thibault, M., Merritt, J., & Jimenez-Silva, M. (2018). Bears in a boat: Science content and language development through a problem-based learning experience. *Science Activities*, *55*(1-2), 28-33.
13. Saleh, A., Ahda, Y., & Fitria, Y. (2020). Improving science learning activities and outcomes by using problem based learning model at elementary school. *Jurnal Basicedu*, *4*(4), 1388-1397.Pengembangan Lembar Kegiatan Peserta

14. Sari, R. N., Ahda, Y., & Fitria, Y. (2019). Effectiveness of guided inquiry learning model and problem based learning model on thematic integrated learning competency. *International Journal of Educational Dynamics*, *1*(2), 257-264.
15. Skulmowski, A. (2024). Learning by doing or doing without learning? The potentials and challenges of activity-based learning. *Educational Psychology Review*, *36*(1), 28.
16. Slavin, R. E. (2020). How evidence-based reform will transform research and practice in education. *Educational Psychologist*, *55*(1), 21-31.
17. Stößlein, M., & Changchun, P. R. (2009). Activity-based learning experiences in quantitative research methodology for (time-constrained) young scholars-course design and effectiveness. In *POMS 20th Annual Conference, Orlando, Florida. USA*.
18. Sukmana, R. W. (2018). Implementasi Pendekatan STEM (Science, Technology, Engineering and Mathematics) untuk Meningkatkan Keterampilan Berpikir Kritis Siswa di Sekolah Dasar. *Primaria Educationem Journal*, *1*(2), 113-119.
19. Trianto. (2010). *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta: KENCANA.
20. Wu, A. M., Wang, K., Wang, J. S., Chen, C. H., Yang, X. D., Ni, W. F., & Hu, Y. Z. (2018). The addition of 3D printed models to enhance the teaching and learning of bone spatial anatomy and fractures for undergraduate students: a randomized controlled study. *Annals of translational medicine*, *6*(20).
21. Zuryanty, Kenedi, A. K., Chandra, R., Hamimah, & Fitria, Y. (2019). Problem based learning: a way to improve critical thinking ability of elementary school students on science learning. *Journal of Physics: Conference Series*, 1424(1), 012037).