ACTIVITY BASED TEACHING AT SECONDARY SCHOOL LEVEL: INVESTIGATING THE PERCEPTIONS AND PRACTICES OF SCIENCE TEACHERS

By

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NATIONAL UNIVERSITY OF MODERN LANGUAGES

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THESIS/DISSERTATION AND DEFENSE APPROVAL FORM

The undersigned certify that they have read the following thesis, examined the defense, are satisfied with the overall exam performance, and recommend the thesis to the Faculty of Social Sciences for acceptance:

Thesis Title: **Activity Based Teaching at Secondary School Level: Investigating the Perceptions and Practices of Science Teachers**

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Candidate of Master **of Philosophy** at the National University of Modern Languages do hereby declare that the thesis **"Activity Based Teaching at Secondary School Level: Investigating the Perceptions and Practices of Science Teachers"** is submitted by me in partial fulfillment of MPhil degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in future, be submitted by me for obtaining any other degree from this or any other university or institution.

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DEDICATION

Dedicated to

My loving parents

Gohar Munir and Saima Rasool

Without whom I would have been nothing

ABSTRACT

Thesis title: Science Teachers' Perceptions and Practices about Activity-based Teaching at Secondary School Level

The research was designed to determine science teachers' perceptions and practices about activity-based at secondary school level. This study aimed to assess teachers' perception, practices and to explore the challenges of activity based teaching at secondary school level. A conceptual framework of this study was based on innovative teaching strategies given by Balasubramanian, Cios, and Wilson (2005). This model is based on constructivism theory consisting four activity based teaching strategies such as brainstorming, hands-on activity, project method, and experimental method and researcher added challenges to activity based teaching. For the current study quantitative research approach and descriptive research design was used. The population of the study was 380 male and female science teachers at secondary school level of Islamabad. A random sampling technique was used to select the sample. The sample size of the study was n = 191 male (90) and female (101). The research instrument activity based teaching strategies was self-developed consisting of four variables such as Brainstorming, hands on activities, project method, experimental method and had 4 open ended questions and part B with statement "To what extent these four activity based teaching practices are performed?" The data were analyzed through SPSS version 27^{th,} applying mean, frequency, percentage, and thematic analysis. The results showed that majority of the science teachers' had positive perception about activity based teaching strategies. Furthermore, it was found that teachers' responded positively towards the practices of activity based teaching which encourage student's motivation, conceptual understanding. Moreover, it was also found that teachers' generally support activity based teaching, its implementation is hindered by high workload, lack of teacher training. Moreover, time constraints, outdated teaching methods, frequent power outages further challenge its effectiveness. It was recommended that school heads may arrange professional development programs for science teachers to enhance their ability to engage students effectively. School administrators may arrange workshops to address teachers' issues and to plan teaching strategies by utilizing existing resources creatively for different science activities which require less time.

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List of abbreviation

Abbreviation	Terms
BS	Brainstorming
CS	Case studies
IMCB	Islamabad Model School for Boys
IMCG	Islamabad Model School for Girls
Fig	Figure
FDE	Federal Directorate of Education
IM	Inductive Method
PM	Project Method
EL	E-Learning methods
M	Mean
PM	Project Method
E	Experimental method
SA	Strongly Agree
SD	Strongly Disagree
UD	Undefined
A	Agree
D	Disagree
ABT	Activity based teaching
ABL	Activity based learning

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

Education is a main pillar to empower students with the right knowledge. This knowledge leads to learn various skills and competence that are essential for students and provide opportunity for students to influence society. However, the most significant factor to acquire these valuable competence is the teachers. Teachers ought to be competent and need to have the knowledge of their subject area. This knowledge need to transfer to students in more innovative and neutral way to make students able to build a vivid understanding alongside inspiring critical thinking skills (Anwer, 2019). Activity-based teaching is the foundation for creative and critical thinking skills development. Activity-based teaching work effectively if students are encouraged to accomplish their innate potential. The significant method to teach a complex concept is to involve students in interactive activities.

In present educational system, the main focus of education is on student's competencies to effectively cope with daily routine problem faced by them and by the capabilities self-sufficiently to manage and regulate their own learning process. Furthermore, main role of education is achieving the quality of learning and students' performance inside and outside of school, self-regulated learning or learning to gain skills has become one of the significant construct of education (Boekaerts & Cascallar, 2006).

The interest is in encouraging the student to take control of their education through engagement and engagement of their senses and cognitive abilities, hence developing their

own independence and autonomy. Skills and attitudes that support individual problem solving and continuous education are of focus. Prioritizing the needs of the students, it considers their voice as vital to the educational process and overall experience (Okoye & Osuafor, 2021). The activity-based strategy increases interest, fosters retention and recall, and ultimately leads to positive success.

The significance of an activity-based approach and illustrative diagrams in enhancing science achievements cannot be exaggerated, as they enable students to gain broad understanding through all learning receptors, including the eyes, ears, skin, and so on, while also developing in them the ability to inquire into the scientific process. This includes allowing students to observe, describe objects and events, ask questions, construct explanations, test and validate those explanations against current knowledge in science, and share their ideas with others (Nnorom & Ejezube, 2021). To this aim, it becomes essential to maximize the effectiveness of the activity-based approach.

Science is generally important for improving people's living conditions and for understanding the natural world, according to a large number of secondary school students who took part in the PISA 2006 Science Literacy Assessment survey. But just half of them thought science was especially significant to them personally, and even less said they were interested to work in science. As a result, neither do students select science as a subject in school nor do they favor careers in science and technology. Scientific research is widely considered to be one of the best methods for teaching science, particularly when it comes to letting students learn science through practical experience (Hodson 2014).

Although John Dewey (1859–1952), an American, is recognized with developing this didactic approach in the early 20th century, scientific research did not begin having a significant role in proposals for science education in the USA until the early 1960s.

Scientific research is widely considered to be one of the best methods for teaching science, particularly when it comes to letting students learn science through practical experience. It is said that there is a trend in Pakistan that studying is usually based on rote

memorization or remembering information. Regrettably, lectures are the primary method of instruction for science and other courses (Bakhru & Mehta, 2020).

Without a deep understanding of scientific concepts, observations, and beliefs, rote learning is promoted. A teacher must employ the standard teaching method if they have insufficient resources. It results from teachers' uncertainty, insufficient supplies, problems managing their materials, uneasiness, time constraint, lack of experience using experiential methods for teaching science, and dependency on textbooks. A number of activity-based teaching methods exist. This straining needs to be enhanced by experiments or activities. When students are given the freedom to reason and resolve issues on their own, long-term learning takes place said by (T Kurnaisih et al., 2022).

It is essential to keep in mind that activity-based learning puts the student first and encourages self-learning. Moreover, one should learn at their own speed. By utilizing activity-based learning, students can actively tackle problems. Students creative side is enhanced through it. They also help in learning process. All materials are used in this learning approach. It gives students a broad span of chances to help them develop their knowledge, capabilities and morale (pulling et al., 2021). It also improves their self-esteem and help students understand the concepts. Students take interest and spirit of enquiry arises with positive interaction. What students understand is deliver through activities. One of the finest instructional techniques are where learner participate actively.

In our educational system, activity-based teaching has always been one of the most significant teaching methods. This strategy is multi-faceted and focuses on activities done in classroom. Students may acquire knowledge via their senses. As a result, students may utilize their senses to learn via personal conduct and experience, as well as develop their ideas. Learners can comprehend depending on their own ideas and experiences. Activity-

based teaching strategies might assist kids in acquiring more information. Activity-based teaching involves an extensive number of activities that engage students toward performing activities and reflecting on what they are practicing.

Students engagement and participation in the instructional process is a vital part of learning that are based on activities (Prince, 2004). The activities that are performed in class are considered to be activity based learning. The various activity-based instructional methods exist. This education ought to be supported by experiments or activities (Mustapha et al., 2021).

Learning through activities that incorporate the subject or task to be learnt is known as activity-based learning. It offers a structure for the conventional idea of "learning by doing." Learners are prepared to be independent, critical thinkers, and knowledge developers in an activity-based environment for learning After following activity based instruction multiple times students can solve queries constructively. According to Willingham (2017) "Thinking successfully involves knowledge of facts, and that's true not only because you need something to ponder about. "Factual information which is stored in memory over time (not just found in the environment) is intimately intertwined with the very processes that teachers care about most—critical methods of thinking such as reasoning and problem-solving" (Willingham, 2018)

Activity based teaching support learning. Every available resource is use in this teaching strategy. It offers students a range of opportunities to help them develop their knowledge, skills, and beliefs (Pulling, 2021). It enhances conceptual knowledge and raises children's self-esteem. It promotes engagement and constructive connections and is applicable to all topics.

According to Rahmah (2022), perception is the process of a certain information being absorbed by receivers, or the senses. A sense is a bodily function that connects an individual to the outer world. Perception comes in two senses: internal and external. The amount of effort or perceptual focus used to perceive something affects how we perceive it. Emotion conveys how someone is feeling at the moment, which affects how they see, react to, and remember. The environment is one illustration of external perception. Being aware of someone through their senses is also perception. According to Rahmah (2022), visual discernment is the capacity to perceive information through one's eyes. The capacity to acquire information through one's ears, commonly referred to as auditory discernment.

1.2 Rationale of the Study

Activity-based science teaching influence students' academic achievement, attitude, conceptual understanding of the students (Geletu , 2022). The researcher further highlighted that activity-based science teaching may improve the students' educational achievement, attitudes toward learning science, and conceptual understanding. The research indicates that activity-based teaching may be an effective way for science teachers to involve students in the process of learning and increase their overall learning outcomes.

In numerous schools' science is taught through lecture, which promotes rote learning lacking in-depth understanding of scientific concepts, observations, and theories (Zhou & Luh, 2021). In past few years, it is an ongoing discussion over the effectiveness of activity-based teaching approaches as opposed to traditional teaching approaches. The major task that teachers challenge is that how can teachers prepare aspiring, encouraged students for the well-being of the society. So, teachers need to adopt effective teaching strategies to encourage active participation in the classroom. Through this, teachers will

focus on understanding of knowledge, promote problem-solving and critical-thinking abilities (Younis, 2018).

Actively engaging in the learning process, as opposed to only listening, promotes student learning. Passive seating in the classroom will decrease attention and focus. Many tools, such as open-ended question approaches, group discussions, personal discovery, critical reasoning, role playing, experiments, presentations and debates may be used to engage students actively. There are several strategies that instructors may employ while studying to make sure that whatever students learn will help them in real world. The most effective from these methods is activity-based learning. Accordingly, Bhalli et al., (2016) the most effective education and teaching strategies are those that encourage active participation of students in classroom. The impact of activity-based teaching on the motivation, accomplishment, and attitudes of students towards science. The research supports the use of activity-based teaching in science, emphasizing its potential to improve learners' interest and attitudes toward science. Lodhi, et al,. (2023) analyzed teachers' perceptions and beliefs regarding activity-based teaching. Thus, still in Pakistan science is taught through old traditional methods.

Despite the growing recognition of activity based teaching worldwide, its practical implementation in schools remain limited. While previous researches has explored teachers' perceptions of this approach there is a lack of focus on the real world challenges they face in integrating these strategies. This gap motivated the researcher for conducting research in this area. This study was conducted to find the views of secondary school science teachers on activity-based teaching. On the basis of teachers' perception, the researcher gave recommendations. This study aimed to investigate science teachers'

perception and practices as well as challenges faced during the implementation regarding activity based teaching at secondary school level.

1.3 Statement of the problem

Traditional instructional strategies have been considered ineffective for numerous students. Students failed to considered real life implication of science in their life. Active participation has been proven to be an effective way for students to learn, as demonstrated by various studies. Activity-based teaching is a form of teaching that involves students taking an active role in their learning and gaining knowledge through actions. This study aimed to assess science teachers' perception and practices and to explore challenges towards activity based teaching.

1.4 Objective of the study

The following objectives were formulated:

1. To assess science teachers' perception about activity based teaching strategies at secondary school level.

1a. To assess science teachers' perception regarding brainstorming at secondary level.

1b. To assess science teachers' perception regarding hands on activities at secondary school level

1c. To assess science teachers' perception regarding project method at secondary school level.

1d. To assess science teachers' perception regarding experimental method at secondary school level.

2. To assess science teachers' activity based teaching practices at secondary school level.

3.To explore challenges faced by science teachers in implementing activity based teaching at secondary school level.

1.5 Research Question

Q1. What are science teachers' perceptions about activity based teaching strategies at secondary school level?

Q1a.What are science teachers' perceptions about brainstorming at secondary School level?

Q1b.What are science teachers' perceptions about hands on activities at Secondary School Level?

Q1c.What are science teachers' perceptions about project method at Secondary School Level?

Q1d.What are science teachers' perceptions about experimental method at Secondary School Level?

Q2. What are the science teachers' practices about activity based teaching at secondary school level?

Q3. What are the challenges faced by science teachers in implementing activity based teaching at secondary school level?

1.6 Conceptual Framework

This research study was based on the model by Balasubramanian, Cios, and Wilson (2005), which outlines innovative teaching strategies to guide active student learning. These strategies are innovative methods in schools that align teaching with the development of students' creative skills. Additionally, the Vygotsky's Social Constructivist Theory Vygotsky (1978) and Constructivist Learning theories of Brunner (1960;1966) constitute the main underpinning for the activity-based learning approach. Bruner's

emphasis on discovery learning aligns with the hands-on, exploratory nature of activity based teaching, fostering active student engagement and the development of non-cognitive skills. Vygotsky's focus on social interaction and the Zone of Proximal Development highlights the importance of collaborative learning environments, where students learn through peer interactions and guidance. These theories collectively support the framework by promoting active, inquiry-driven learning that encourages both individual and social cognitive development.

The model consists of four main teaching techniques for activity based teaching: brainstorming, hands on activities, project method, experimental and challenges to activity based teaching were added to the model.

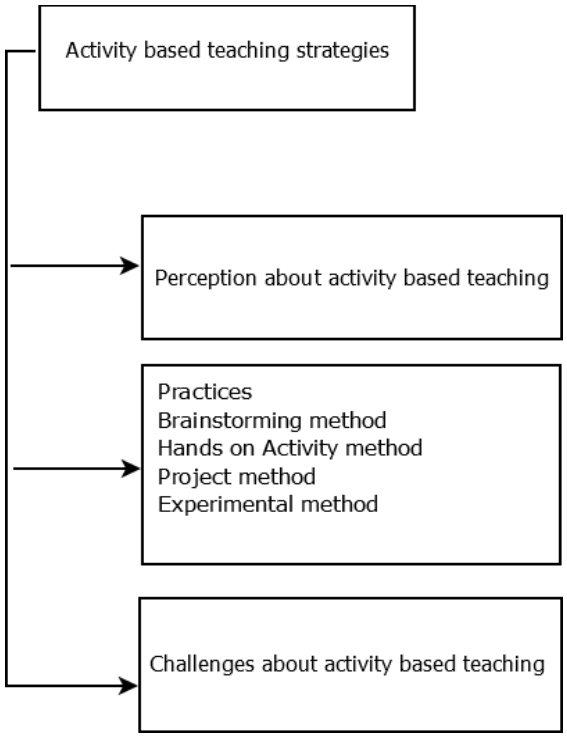


Fig 1.1 Conceptual Framework of teacher perception, practices and challenges about activity based teaching

Perception about activity based teaching: It refers to the opinion of teachers about activity based teaching.

Practices: It refers to practices of modern teaching strategies using by science teachers during instructional process.

Brainstorming method: Brainstorming is an activity which promotes imaginative thinking and contributes to creativity and innovation by gathering all ideas into a solution-bank for further stages of the process.

Hands on Activity method: Learning by doing is known as hands on activity or hands on learning. Hands-on learning is a type of learning that occurs through doing hands-on activities like coin flipping or dice rolling have long been considered an important part of the statistics educators' toolbox.

Project method: The Project Method is an active and meaningful learning technique. Project-based teaching is student-centerer learning. This technique replaces the use of a teacher-centred to student centre which makes students more active than before.

Experimental method: Experimental design is the method of organizing and carrying out scientific experiments to test a hypothesis or research question.

Challenges about activity based teaching: It refers to hurdle to teacher during instructional process using activity based teaching.

1.7 Significance of Study

This study benefits society by developing active members who contribute to the improvement of societal norms and values.

This research result would be helpful for the students as they learn new ways of learning and implement in their daily life. Further it would also be helpful for the policy

makers as they would make integrated policies regarding outcome of activity based teaching on student's achievement. It would also motivate teachers as they will learn new strategies to engage students in instructional process. It may determine strategies to improve the quality of education. It would be also beneficial for the curriculum reformer as would add it in the curriculum

1.8 Methodology

This section of the study was comprised of brief discussion of research approach, research design, population, sampling technique, sample size, instrumentation, data collection, and data analysis.

1.8.1 Research Approach

The research approach of the study was quantitative. Researcher chooses quantitative approach because the data is collected in structured form, it is feasible and reveals the fact. The researcher chose this approach to identify the problem and generate beneficial data. It uses quantifiable data to draw conclusions, revealing various research patterns.

1.8.2 Population

The population of the research included all science teachers of secondary schools (female and male) of public sectors of Islamabad city. According to Federal Directorate of Education (2023) there was 37 secondary schools, further in which 14 schools are of boys and 23 are of girls. Among these 37 secondary schools 380 science teachers are serving. In which 178 are male and 202 are female science teachers. The following table shows the population of the research study.

Table 1.1

Population of the study

Sr. no.	Population of science teacher	n
1.	Male	178
2.	Female	202
	Total	380

1.8.3 Sampling technique

The significant aim of sampling is to select the respondents from which the researcher is interested to obtain data. In most of the researches where population is large in size and it is hard for the researcher to obtain data from the overall population. By keeping in view the nature and large population size, the researcher adopted random sampling technique for the purpose of data collection for this study.

1.8.4 Sample size

The population of the present study was divided into two categories using Islamabad Model Schools for Girls (IMSG) and Islamabad Model Schools for Boys (IMSB). The Federal Directorate of Education (FDE) 2023 https://fde.gov.pk/ recognized 23 IMSG and 14 IMSB public schools in Islamabad City as offering secondary education. According to Morgan table (1970) if the population is beyond 380 than 191 considered as the perfect sample size. Keeping in view this point researcher selected 191 science teacher as a sample of this study.

Table 1.2

Sample size

Sr. No	Group	Population N	Sample n
1	Male	178	90
2	Female	202	101
3	Total number	380	191

1.8.5 Instrumentation

The Data was collected through questionnaire. The research questionnaire was self-developed. This tool had four variables brainstorming, hands on activates, project method, Experimental method. Brainstorming and Hands on activities had 6 items each whereas project method had 7 items and Experimental method had 5 items. The statements were based on five points Likert scale:

1. Strongly agree (SA)
2. Agree (A)
3. Undecided (UD)
4. Disagree (DA)
5. Strongly Disagree (SDA)

For challenges there were four open ended questions. Total item number of questionnaire was 24 dealing with the strategies that were used. By keeping conceptual framework into consideration given in this study, the questionnaire was developed.

Furthermore to check the practices followed by teachers' questionnaire part B was used using statement "To what extent these four activity based teaching practices are performed?" the statement was based on five point Likert scale :

1. Never
2. Rare
3. Sometimes
4. Often
5. Always

1.8.6 Data collection

The data was collected through questionnaire. The researcher visited each school personally for data collection. The researcher distributed questionnaire among science teachers by herself and request them to fill the questionnaire.

1.8.7 Data analysis

The data was collected with the help of questionnaire and then analyzed by using statistical package for social sciences SPSS 27th version. To analyze the data accurately mean was applied for objective 1. Whereas for objective 2 frequency and percentage was calculated. It is frequently used in questions to see if a procedure or treatment truly affects the population of interest. For the 3rd objective thematic analysis was used. Although they are not the main focus of the study, the open-ended thematic questions are probably used to offer more background information or insight. Since the goals of the study are probably centred on the characteristics of quantitative research, the entire research design was considered quantitative, with the open-ended thematic questions acting as an add-on to offer more information.

1.9 Delimitation of the study

This study was delimited to:

- Only public sector secondary school teachers in Islamabad.
- Only science subject teachers were considered.

1.10 Operational definition

1.10.1 Science

It’s a widely recognized understanding or set of knowledge that everyone agrees on, especially when proven through scientific research.

1.10.2 Science teachers

Students learn the basics of the scientific method and important science concepts from a skilled teacher. Science teachers focus on general scientific topics to help students understand and spark their curiosity.

1.10.3 Activity Based Teaching

A teacher might use activity-based teaching, where learning is hands-on, and students are fully involved. This method helps students stay engaged and understand effective ways to learn by actively participating both mentally and physically.

1.10.4 Perceptions

Perception is how a teacher thinks and feels about activity-based teaching. It’s the way they see, understand, and interpret it.

1.10.5 Practices

These are the activities that teachers guide during a lesson. Instead of focusing on beliefs, it’s about putting theories or practices into action.

1.10.6 Challenges

The challenges and difficulties that come up during teaching.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The implementation of science activities at the secondary level is examined from a variety of angles in this literature review. It looked into how activity-based teaching methods are implemented and how it affects secondary school science students' capability to learn. The results of the study led to the conclusion that teaching science via activities enhances learning. Numerous subjects have been covered in the literature review. The study of the literature looked on how learning activities affect students' success, involvement, and ambition. This study also looked at potential solutions for addressing the obstacles and difficulties educators have when putting scientific activities into practice.

2 .1 Science

Science is any field of study that is concerned with actual objects and their phenomena, implying accurate observations and deliberate experimentation. The pursuit of knowledge about universal truths or the application of fundamental principles is commonly science.

Though for science teachers, scientific talents are practices of mind, or activities that regularly engage them in while working. But, these teaching processes are not spontaneous and carefully considered and examine at all times. The teacher-centered approach is frequently utilized to teach science in educational environment. Students are demotivated during the process of teaching and learning, one of the issues facing teachers today is to motivate students to study science. Students must investigate their learning through science experiments (Triana et al., 2020).

In this globalization world it is very important to find the most effective strategies which engages students actively in the learning process in order to provide competing, excited students who are ready for the work in real life, due to this teacher must have an eye for the best strategies in the instructional process in which learner actively engage. The purpose behind teaching students the scientific approach is to foster the growth of their ability to think critically, learn, solve problems, and make decisions. Science is social contact that imparts dedication and fortitude(Oudbier et al., 2022).

Younis (2018) states that activity-based instruction can support teachers in developing critical thinking and problem-solving skills while also highlighting student understanding of the information being taught. Administrators ponder upon the ways how to inspire learners to move forth with authentic answers to search for as compare to only submissive gathered information (English & Kitsantas, 2013). There are two ways for one to learn in a classroom: the first is purposefully, and the other is quietly. The quiet ones pick up knowledge by acting as carriers for data, which means students are not given any opportunity. While, students who participate in the instructional process perform better then only listening to the lecture. In a traditional classroom setting students interest and attentiveness are distracted. To make students actively engage throughout the class and make it meaningful, successful learning must be emphasized. If teacher want students to enjoy the course, then she must be flexible enough to change the classroom environment according to students need. Activity-Based teaching can also be referred as an educational procedure in which students are continuously involved, is one such approach (Panko et al., 2007).

The primary factor of any society which can power to significantly alter the norms and morals of its citizens is education. There are two fundamental components to the

educational process that we encounter while defining the term education. These two facets include teaching and learning. These two aspects are connected with each other. They are like a coin both sides (Akben, 2018). Which means learning is not possible until there is better teaching and teaching can't be productive or useful if there is no eager to learn. Traditional methods were not based on modern psychology which stresses on the student understanding thinking feelings and emotions during teaching process. According to the modern psychology the key role is of students first then teachers. Research on a number of psychologists has demonstrated that activity-based learning is much more intimate with students' conscious, stimulating their enthusiasm for efficient learning.

A particular kind of academic teaching methodology is the activity-based approach. Its fundamental theories include the need that students should learn through practical work and from activities. The core concept of activity base teaching is the idea that students should be active learners rather than passive recipients of information. If a learner is given the chance, they will be joyful to practically do it and have lasting memories. With the help of this method, the students actively engage in activity-based learning, both consciously and subconsciously. In activity base teaching student is a guide of himself. It gives students the adaptable and flexible learning methods they need to be prepared for (Höttecke & Allchin, 2020).

Instead of expanding, now classrooms are becoming more and more supportive of the abilities that students must acquire. With an open mind and an awareness of how humans learn, creativity in the classroom is promoted and developed. The design of an active learning environment is of the utmost importance since researches shows that the physical environment of the classroom affects students' behavior. Teachers try to work hard to instill a love of learning and a drive to learn in their students, strive to find ways to

improve student's critical thinking abilities so they can solve problems on your own. Students must learn the skills necessary for this era so as to successfully adjust and live better (Duan, 2021).

One should also be aware of how active learning in the classroom can help students succeed and encourage them to participate more fully in the learning process development. As several decades ago, numerous educationalists have presented different kinds of teaching techniques. One of the renowned researchers, Aristotle was the first one to introduce the dialogue system in students learning to convey his message in his school of philosophy (Wu et al., 2019). Popular philosophers such as the Muslim, Greeks and Romans bestow their expert opinions on a range of methods for imparting knowledge to students. Modern psychology has demonstrated that learning by doing increases willingness and motivation, which in fact increases learners' interest in embracing new ideas.

Ahlfeldt et al., (2005) studied his colleagues said that it would be an old technique if the teacher just deliver all the knowledge to some passive learners. The purpose of the new teaching approaches is to give the students an environment where they are able to interact with the learning materials and one another.

Likewise, Benson & Blackman (2003) said that if students do not take interest in class and don't participate actively then all the knowledge is in vain and there's no learning. They continued by saying that it is challenging for a teacher to inspire and motivate learners to study by doing practical's because mostly students like to participate in activities due to some psychological factor. Regarding the benefits of experiential learning, Petress (2008) found that learners who are actively taking part in various activities are considered to be having following traits.

Students as an active learner are constantly on the lookout for questions to ask so that there is no ambiguity. Such students will be able to question the subject matter, the instructional strategies, and the core concepts. They will be able to relate new information to previous experience. These students are able to evaluate their learning as they develop different talents. They will always be eager to learn and share what they have learned with others.

It is clear from a comparison of conventional and contemporary activity-based learning methods that learning by doing is an easier and advantageous approach than the more outdated traditional methods. The rationale is that contemporary activity-based learning is fascinating compared to the one-way education of traditional instruction, developed to each individual's needs where students are passive (Ewan & McGrath, 2011).

Gleaason (2011) suggested some activity based strategies related to learning like students giving presentations, Socratic questioning. Another strategy named “think pair share” where students are given a specific problem. They have to think alone to find the solution of the problem and then share with the whole class.

An educational reformer john Comenius placed a strong emphasis on hands-on learning. His goal behind this statement of experience knowledge from the 20th century was to keep the natural world research in mind.

Similarly, Mohamed (2006) described scientific creativity are basically scientific activities that involve tackling scientific challenges based on prior knowledge, establishing theories in this area, and producing new items using innovative concepts. Different Studies in past shows that in activity base teaching toys are also used in classrooms to teach science (Thananuwong, 2015). Jarrett, Bulunuz (2020) added that toys are used in the classroom

to introduce science ideas and to increase students' creative skills and creativity. One of the most essential 21st Century abilities that students need to master in order to be adaptable in the future is creative thinking.

Activity Base Teaching is a technique that focuses on the idea or concept that students must be engaged in different tasks. In this approach, the teacher aids and directs the learners. Such a sort of system can reuse a variety of tasks and duties, allowing students to actively engage in their education rather than remaining on the sidelines. For any instructor, the primary objective of activity-based teaching method is to actively include students in a class so they become participants to their own learning. Many traditional educational approaches rely on the teacher as an informed professional who only imparts knowledge to students. The students receive an education where there is no focus on activities and participating (Chauca et al., 2021).

Activity base teaching has lately been introduced for current educational studies and is recognized as a superb instructional approach in the field of science. At its core, this sort of pedagogy offers a strategy for blended or mixed learning within the context of the learners' past knowledge and via exposure to a number of exercises aiding in their learning. To execute the activity base teaching, one need to be a real mentor by inspiring, reducing complexities, and sharpening in place of rote delivering facts and figures didactically. Implementing a creative pedagogical approach is only beneficial when specific equipment's and teaching environment are planned. A varied pedagogical approach has to be carefully taught in this way (Noreen & Rana, 2019).

It refers to a situation where learners are actively engage in the training process as opposed to passively listening. The authors stress that the two ways in which active learning differs from traditional teaching methods are the active participation and

engagement of learners in the learning environment, student's collaboration in a classroom. Students can actively participate in several exercises, including discussions, speeches, role-playing, open-ended inquiries, personal enquiry, critical analysis, and experimentation. To make sure that the learners gain the desired knowledge and abilities required to ready for real life situations, teachers can use variety of strategies inside classroom. One of these methods that works the best is activity-based learning (Anwer, 2019).

Bell & Kahrhoff (2006) came to the conclusion that "every instructor believe that an atmosphere of active learning is more favorable than a passive one. There are several methods students may use to develop conceptual knowledge and fundamental abilities that will help them in the future.

According to Sola et al., (2007) the lecture approach in schools is inappropriate given the nature of science and the maturity level of the students since it prevents their active engagement in the process of learning. Researchers and educators from all over the world have criticized the approach as unsuccessful. This suggests that pupils may not learn science effectively if teachers do not start implementing activity-based learning in the classroom. Then, schools will keep struggling in the shadows of our learners' poor academic achievement. However, a lot of teachers are still finding it difficult to adapt to this new approach. As a result, science instructors in schools need to be familiar with the techniques for activity-based teaching.

Now a day in classroom, a fresh approach is required to move away from the traditional or lecture-based teaching technique and toward active learning. The typical format is one in which the instructor reviews the lesson from the day prior first and then presents the materials for the next lesson without involving the students very much. The researchers discovered that this approach results in the following:

(a) The student act as a spectator in the processes of learning and instruction, whereas the instructor is extremely engaged.

(b) The students simply watch.

(c) Students' ability to remember and retain knowledge is unaffected. Consequently, a small number of concepts are forgotten by learners' days after the lesson.

2.2 Activity base Teaching approach

After analyzing various research data, came to the following conclusion and proposed six guidelines for an effective system of attitude coaching. Following are the succinct points of these rules:

1. Make the directions logically sound, relevant, useful, inspiring, and compelling.

2. Discuss never heard before facts.

3. Present important facts in the most believable manner.

4. Create a deep emotional connection with the students.

5. Involve the learners in knowledge creation, building till delivering.

6. Schedule post-lesson editing opportunities and consultations.

Learning takes place in an ocean of views and opinions, which a successful instructor consistently rules—often so expertly that learners are unaware of their own efforts. It is an intentional educational act that entails explicitly promoting specific values and views. While having a knowledge of activity-based teaching it is important for setting up the right social atmosphere. The physical environment also needs to be well-thought-out in order to facilitate the intended relationships.

2.2.1 How Activity-based Teaching Helpful for the Student

Activity-based teaching, was initially popularized by British-born educator David Horsburgh. If students are to be accepted, the activity based technique has produced a noticeable improvement in student's learning. Young students begin to learn to make autonomous decisions at an early age, from choosing their activity card on a daily basis to recording their roll call. With each developmental step, a letter or word is taught, a sentence is formed, science is practiced, or an idea is understood. The students obtain an Exam Card if they have achieved all of the learning objectives in a topic. Contrary to the previous traditional approaches, which required the students to discover by themselves if they were gone for one day, the students pick up where they left off (Gürbüz et al., 2014).

The curriculum includes exercises to promote awareness of the environment, cleanliness, and dietary requirements. Creative approaches are employed to deliver these information, including puppetry performances, music, and poems. "Activity-based teaching" places a strong emphasis on interactive, hands-on learning experiences to engage students and improve their conceptual comprehension. Active involvement among pupils is fostered by activity-based learning. Students actively participate in the learning process as opposed to simply listening to lectures. They take part in group discussions, work together with classmates, and do practical exercises, all of which improve knowledge and memory of the material. Through a variety of exercises, experiments, and projects, this way of teaching enables students to actively involved in their learning process as opposed to the typical lecture-style instruction (Akerson et al., 2000).

Activity-Based learning places more emphasis on the learner than the instructor. Students are engaged and given the resources to solve problems on their own. Enhancing creative and critical thinking skills begins with activity-based learning. But if students lack

the motivation to reach their full abilities, this approach will fall short. Engaging students in hands-on tasks is the most beneficial and efficient way to teach difficult concepts. This is also the foundation of activity-based learning. The use of various activities in the classroom helps students develop their intellectual and inventive skills. Student retention greatly depends on the classroom's emphasis on effective learning. To ensure that students like the course and set objectives, teachers must be flexible in response to the ever-changing needs of their students and the changing nature of the classroom. Activity-Based Learning, which is characterized as an educational method in which students are continuously engaged, is one such technique (Harfield et al., 2007).

Through practical exercises, students can get a more profound comprehension of intricate ideas. Students can get a personal understanding of how theoretical principles apply in practical contexts when they actively alter materials or conduct experiments. Across all academic fields and educational levels, activity-based learning is a revolutionary pedagogical technique that offers students various advantages. This approach enables students to take an active role in their own education by moving the emphasis from passive receipt to active involvement (Botts et al., 2012). By use of experiential learning, experiments, dialogues, and group assignments, students become not just consumers but also producers and discoverers of knowledge. Additionally, activity-based learning accommodates a variety of learning preferences, guaranteeing that any student can achieve. Students, whether they are kinesthetic, auditory, or visual learners, can interact with the content in ways that suit their unique learning styles and aptitudes. This inclusiveness fosters a feeling of community and motivates all kids to participate fully.

Activity-based learning also fosters cooperation, communication, and teamwork—skills that are necessary for success in the contemporary world. Students gain valuable

experience in listening to others, negotiating, and exchanging different points of view, and effectively communicating their ideas through collaborative projects. These social skills are extremely essential and important in the workplace, in the classroom, and in personal and professional interactions in the future. Essentially, activity-based learning fosters critical thinking, teamwork, and a love of learning that equips kids for future challenges as well as academic success. It goes beyond simply imparting knowledge. By adopting this pedagogical strategy, teachers can enable their students to become lifelong learners who are prepared to prosper in a world that is always changing.

Furthermore, by exposing children to a variety of obstacles and uncertainties, activity-based learning fosters resilience and adaptation in them. Students gain the ability to negotiate and communicate uncertainty, overcome challenges, and accept failure as a chance for personal development through practical experiences as well as activities and problem-solving exercises. In a world where people must constantly adapt and innovate due to rapid technology breakthroughs and global changes, resilience is very crucial. Activity-based learning gives children a growth mentality and perseverance, which prepares them for life in a world that is constantly changing (Jarzabkowski, 2005).

2.2.2 Patterns of Activity-based teaching

Real items perform well while trying to understand them than imaginary or fictitious ones. Giving science lessons will be much more engaging with practical method then just by lecture. The fact that both instructors and learners can contribute to making this happen is the finest part. Repeating the same method repeatedly could get tiresome.

By giving the theme of scientific lab to classroom can be exciting for students. Teacher can design her own unique classroom setting to take advantage of the enthusiasm and to create the right environment for the moment. Senior students, like in secondary classes, perform

their tasks independently. Teachers help younger students create their projects. In any case, students learn more about the task or topic they are currently working on. Daily project work not only increases topic understanding but also inspires an urge to study with greater clarity by breaking up the monotony (Cairns & Shaljan Areepattamannil, 2017).

In science subject perspective teacher can utilize a report, a movie, or a lecture. Any form of film would be appealing to them. Learners who are sick of constantly staring at their boards can be interested in even the briefest clips. Engage students in online tutorials by breaking their pigeonhole. Remaining at one place for extended amounts of time can be hard on students. By switching the environment, may have a significant influence. A distinct learning environment should be tried. Let students sit beneath a tree and attend a lesson. It is good for both the teacher and students as a refreshing shift (Mehmood et al., 2021).

The greatest method to recruit students. The greatest method to engage students in the classroom is to provide them the tools to do so. An instructors reassure that she will welcome any questions, no matter how dumb, can effectively persuade a learner to keep their focus in class. A stand-alone question and answer period is a wonderful technique to get each individual chatting if the learners aren't engaged in the lesson.

2.3 Correlation between activity based teaching strategies and innovative teachings

A recent study by Picciano (2017**)** highlights that innovative teaching strategies, such as Activity-Based Teaching (ABT), promote collaborative learning environments where students engage in problem-solving and hands-on activities, aligning with constructivist principles. This approach not only enhances cognitive development but also fosters the growth of non-cognitive skills such as communication and teamwork, emphasizing the link between innovation in teaching and the core principles of Activity-Based Teaching.

Picciano's (2017) study highlights that ABT fosters active participation through problem-solving and collaboration. This approach enhances cognitive understanding while developing non-cognitive skills like communication and teamwork, demonstrating how innovative teaching strategies align with constructivist principles.

A more recent study by Johnson and Johnson (2020) further corroborates this view, demonstrating that collaborative learning environments significantly improve both cognitive and non-cognitive outcomes. Their research highlights how ABT, when combined with structured collaboration, enables students to develop essential 21st-century skills. For instance, the process of discussing, debating, and working through problems in groups fosters essential communication skills while also cultivating interpersonal relationships, which are vital for success in the modern workplace.

Furthermore, recent research by Hmelo-Silver (2021) on the impact of inquiry-based and activity-based learning strategies reaffirms the connection between activity based teaching and constructivism. Hmelo-Silver argues that by engaging students in authentic, real-world problems, activity based teaching encourages students to take ownership of their learning

while also improving their metacognitive abilities, such as self-reflection and problem-solving. This approach not only builds knowledge but also nurtures the development of critical non-cognitive skills, including adaptability and resilience.

Moreover, the findings of a study by Smith et al. (2022) show that activity based teaching, when implemented effectively, supports inclusive learning by accommodating diverse learning styles and abilities. By providing opportunities for active engagement, peer collaboration, and hands-on problem-solving, Activity based teaching creates an inclusive learning environment that promotes equity and access for all students. The study suggests that, activity based teaching emphasis on collaboration and active participation not only enhances academic performance but also develops students' social and emotional competencies, which are crucial for overall well-being.

In conclusion, the recent literature confirms that innovative teaching strategies like activity based teaching, which prioritize collaboration, problem-solving, and hands-on learning, align with constructivist principles and foster both cognitive and non-cognitive skill development. These strategies provide a holistic approach to education, preparing students not only with academic knowledge but also with the essential skills needed to succeed in the complex, interconnected world of today.

2.4 Brainstorming

Brainstorming is considered as a problem-solving activity where students evolve higher order thinking skills. Through brainstorming, kids are encouraged to think creatively and beyond the box. They are also encouraged to express all of their ideas, regardless of how unconsent they may sound. The instructor can introduce a topic, pose a query or issue, or start a brainstorming session with one of these methods. The instructor can introduce a

topic, pose a query or issue, or start a brainstorming session with one of these methods. Students can share ideas and terms that might be used as solutions. Contributions are welcomed without bias or judgement, and the teacher or scribe will typically summarise them on a whiteboard as the ideas are called out. Then, these concepts are investigated, typically in an open conversation approach (Winda Ismi Hidayanti et al., 2018).

Students adapt their prior knowledge or understanding, make room for new information, and raise their awareness levels by sharing their thoughts and listening to others.

The primary goals of brainstorming are to:

- Draw students' concentration to a specific subject and produce a large number of thoughts.
- Teach students to accept and value individual differences; encourage them to take chances when expressing their thoughts and opinions; and show them that you value and accept their knowledge and linguistic skills.
- Introduce the concept gathering process before starting any work, like writing or issue solving.
- Give students the chance to build on one other's contributions to share ideas and increase their own knowledge.

2.4.1 Common issues using brainstorming

In a group context, some students might be afraid to speak up at first, but brainstorming is an open-sharing exercise that promotes participation from all students. Active listening should be emphasised by teachers during these sessions. Emphasised by teachers during these sessions. It is important to motivate students to: When they are unable to hear other properly, they should inform the speakers or the teacher and listen intently and politely to what their peers have to say. They should also consider other comments or responses to give. All brainstorming sessions should follow the golden rule that quantity

over quality will increase the likelihood that an idea will be worthy of execution. For this reason, especially in group brainstorming times, make sure that all students check their criticisms at the door and make it clear that the only bad ideas are none at all. Certainly, not every brainstorming process will go as planned. Some typical challenges include: Unbalanced conversations, sometimes because extroverts dominate the discussions (Snow, 2020).

During brainstorming, there will be a difference between the two student teams if they are a mix of introverts and extroverts. Teachers must make sure that all opinions are heard because, while extroverts will have no trouble sharing their wildest concepts in front of a group, shy introverts may not feel the same way. The teacher might want to share the assignment ahead of time so that some students have time to get ready. The teacher can also use the timer to ensure that everyone has equal speaking time during the session, or she can give every student few minutes to brainstorm before presenting their ideas to the group similarly Peer pressure is the influence of others to interact and think in a certain way.

2.4.2 Effective brainstorming: How to achieve it?

- Select a teacher and a scribe
- Specify the issue or concept that needs to be discussed. Ensure that everyone understands the subject being discussed.
- Establish ground rules for the meeting.
- Granting authority to the leader while enabling everyone to participate
- Postponing idea judgement till all ideas have been collected
- Unless it's a repeat, recording each response and presuming that all contributions are legitimate.

- establishing a time limit and ending when it's reached.

2.5 Hands on Activities

Learning by doing is known as hands-on learning. It entails students actively engaging in a project or activity and learning concepts via the use of their hands and bodies. This could include constructing a model, carrying out research, or coming up with an idea. If science ideas are taught to students through hands-on activity, they can learn the science subjects scientifically. Science is an activity- and practical-oriented subject that is best learned via an inquiry-based approach. Compared to traditional teaching methods, the effects of a hands-on approach on students' academic achievement are unquestionably greater. Students who receive guidance using a hands-on approach are guided to learn through experience. This allows the students to work with real objects while learning about them, such as stone, water, vegetation, magnetic forces, laboratory equipment, devices such as calculators and different patterns. It can also be a demonstration. Actually, it's a scientific method that involves having students actively participate in class. Additionally, a student's overall educational experience will improve their critical thinking (Ivory, 2023).

2.5.1 Ways to Incorporate Hands-On and Experiential Learning in Your Classroom

1.) Establish the lesson's learning objectives and goals first

2.) Seek out chances to relate what you learn to actual experiences. This could be accomplished

through virtual experiences, guest lecturers, or field visits. Your kids will find the event more significant the more real it is. For instance, you could arrange a field trip to a nearby nature reserve for your pupils to observe and learn about the plants and animals in their natural habitat if you're teaching a course on local ecosystems.

3.) Include exercises that let students directly interact with the subject matter. Role-playing, simulations, and other interactive exercises may be used to accomplish this. For instance, you may have students design their own fictitious archaeological excavation to learn about the procedure and find artefacts if you're teaching a course on ancient civilizations.

4.) Students should be encouraged to investigate their own interests and pose questions. This promotes interest and a sense of control over the learning process. If you're teaching a nutrition unit, for instance, you may assign students to conduct research and give a presentation on a topic of their choice, like the advantages of a certain food for health or the effects of factory farming on the environment.

2.6 Project Method

The project method places a strong emphasis on the idea of learning by doing. Pupils engage in the learning process by actively participating, which helps them develop their skill set, first-hand knowledge, and critical thinking ability. Long-term benefits can result from integrating active learning into students' daily routines.

2.6.1 Planning

The project method places a strong emphasis on the idea of learning by doing. Pupils engage in the learning process by actively participating, which helps them develop their skill set, first-hand knowledge, and critical thinking ability. Long-term benefits can result from integrating active learning into students' daily routines.

2.6.1.1 Types of Project Method of Teaching:

Kilpatric, the creator of the Project Method, divided it roughly into four categories, which are described below:

2.6.1.2 Constructive Approach

Using the constructive project method, students are asked to build socially relevant objects like parcels, maps, charts, and models.

2.6.1.3 Method of Art

In the fields of aesthetics and the arts, such as music, fine arts, culture, literature, and so forth,

this kind of instruction is typically used.

2.6.1.4 Method of Solving Problems

Any problem pertaining to real-life scenarios, such as how to utilise a specific

product, write an email, or manage bank accounts, can be solved using the

problem-solving method. Ideally, resolving these issues will improve the pupils'

social skills.

2.7 Experimental Method

It is a test used to find out whether something is true or effective and also to learn something. Both teacher and the student can benefit from trying out new teaching techniques. One can utilise creativity as a trigger to encourage passionate study. It is feasible to acquire new ideas while following to curricular standards. Friedman et al., (2022) stressed the value of implementing innovative teaching strategies and offering supplementary teaching resources to improve student learning. Allowing students to use their skills in whatever way they see and help them identify their interests, strengths, and talents. Any learner can't succeed until he builds favorable mindsets and beliefs regarding themselves, his peers, the instructors, and the criteria of the tasks that make up the subject

being taught. If knowledge is gained via mixed teaching approaches like experimenting activities that can be broken down into teacher-led and student-led activities, just like any other form of instruction. Experimentation fosters critical thinking, encourages favorable views regarding science. It helps students to place materials in a meaningful context, and involves students in the scientific nature of science. Instead of providing science instruction as the learning of concepts and information, the focus is on teaching science as inquiry.

The traditional teaching approach, in which the teacher imparts knowledge to the class, ought to give way to practical exercises where students carry out research, identify concepts, and practise using those concepts in a range of contexts. Experimental strategy has a significant motivational impact that arises from inbuilt motivation, which is connected to students' perceptions of the significance and importance of the material they have learned and understand. Conventional education is typically driven by extrinsic motivation, or the joy of receiving praise (Duschl, 2008). It is incorrect, though, to assume that students must complete experiments or practical's entirely on their own. no matter their age, the majority of students require a lot of instruction to improve their knowledge and capacity for activity completion. Regardless of age, the majority of students require a great deal of training to build their comprehension and inquiry skills to the point where they can carry out their own research from beginning to end. Activity-based teaching is the baseline for creative and critical thinking skills enhancement. However, this method will not function properly if students are not motivated enough to achieve their actual potential. The most useful and effective method to teach concepts that are complex in nature is by involving students in interactive activities, which is also the backbone of ABL. By utilizing different activities in the classroom, critical thinking skills and creative skills of the students are also enhanced.

This pedagogical method not only makes learning easy but is also beneficial in so many ways. A feature of a pedagogical method is that it motivates students to rely on facts by having them engage in an intended tasks and activities within an organized educational setting (Anwer, 2019), promote the application of cause-and-effect reasoning (Celik, 2018), provide students with a similar set of research so that they may actively participate in conversations at any level, regardless of their social standing (Thayniath, 2015), it challenges students to respond in accordance with the outcomes of the perceived occurrence rather than just recalling the standard replies (Amuthavalli & Sivakumar, 2014), it encourages investigation into events that have been noticed and newly available information. Individual experiments allow students to become more familiar with the events and complex elements, which improves learning and instruction (Kuyate, 2019).

According to Patil et al., (2016) research, activity-based learning and instruction was beneficial in filling the gap between philosophical ideas and practical scenarios as well as in raising student achievement levels.

2.8 Strategy for Active Teaching

Teaching is by far one of the most challenging profession and at times creates difficulties for the teachers to establish a strong relationship with the students which in turn makes it difficult to positively motivate them. The role of a teacher is to incorporate a variety of teaching methodologies and techniques to capture the attention and interest of difficult students as well. Many researches also agree with the importance of the element of motivation in teaching and learning outputs as it stimulates a person to move in a certain direction. The focus of current research on successful science education is on lessons that encourage student engagement and activity. Teachers should try to avoid

giving lecture and focus on activity-based teaching in accordance with the new teaching paradigm (Hilmi Hilmi & Summiyani Summiyani, 2023).

The majority of teachers in the educational system frequently use the "telling method" to teach science. All it takes is to make lesson plans then delivering the content or subject matter to the students, and subsequently assessing the learners is all that is required. As the students are very "passive," because the instructor becomes quite "active". When students are passive it means they are not learning anything useful and because of this they find hard to understand the topic. It becomes difficult for students to absorb and grasp and score poorly in exams. In the field in learning, instruction and learning are complementary.

The only instrument that seeks to provide its students with the necessary knowledge to empower and equip them is education. Teachers are the main source of information for the students, so it is their responsibility to set high expectations for their students. They must meet the necessary qualifications and have subject-matter expertise. In order to help students, gain a clear understanding and encourage critical thinking, this knowledge needs to be imparted to them in the most impartial and innovative way possible.

According to Driver at al., (1983) "Effective learning in the classroom relies on the ability of the instructor to sustain the curiosity that brings students to the lesson in the first place," Maintaining student enrolment in the classroom requires a strong emphasis on effective learning. In order for the students to like the course and set goals, the teachers must be flexible in response to the changing needs of the students and the changing classroom. Activity Based teaching is one such approach. According to Harfeild et al. (2007), Activity based learning is defined as an educational process in which learners are continuously engaged. The definition of activity-based learning is when students actively engage in the process of learning as opposed to just listening to lectures.

The classroom lecture method is not entirely appropriate for teaching science, many teachers find that they spend between 40 and 50 percent of their class time lecturing. Since students don't actively engage in this style of instruction, the teacher serves as the main source of knowledge in the classroom, delivering lessons in teacher-controlled manner. When there are few instructional materials or a large number of students in a class, lecturing is the only option. Additionally, it can be useful when there aren't enough time slots on the schedule to finish the whole course (Majoka et al., 2010). The term "activity-based learning" refers to a broad range of activities with varying demands on the skills of students and educators as well as distinct goals (Htun, 2014). Constructivist goals support activity-based learning, which provides opportunities for sharing knowledge as well as access to resources rich in information. The term "active learning" refers to teaching methods where students are encouraged to physically experience, interact, explore, reason, and deduce concepts.

2.8.1 Learning via Discovery

The discovery approach, as its name indicates, is a teaching strategy in which teachers help students learn truths via planned activities and observations. In this method, the teacher gives learners the essential teaching resources and directs them through specific tasks that will help them learn new information. Such exploration exercises might be carried out alone or with a small group of students. With this strategy, students may take an active role in their education and might make their own discoveries. For example, teachers' handover magnets to students and they discover that same pole repel each other while opposite attract each other.

2.8.2 Suitable practical working

The majority of students find that the most efficient way to increase their knowledge in science is via hands-on activity. Learners unable to structure it, try to make

meaningful relationships among the inputs, or connect them to previous knowledge. As a result of that flawed ideas are formulated (Elliot et al., 2013). There is a well-known Chinese saying, which says "What I hear I forget; what I see I remember; what I do I understand," also lends supports this theory. This indicates that students cannot grasp a topic unless they do it practically or engage in the learning process.

Teaching aids helps in sparking and maintaining students' interest in learning, which enhances student performance. Festus, (2013) found out in Education Resource Information Centre that utilizing needed study material has a higher likelihood of resulting in greater success than those sessions in which there is no material available.

The two components that make up ABL are essential for creating a conducive atmosphere for learning in the learning space. According to Churchill (2003) activity-based learning encourages learners to develop cognitive models that support higher performance, like the use of information, capabilities, and problem-solving techniques. Activity based teaching methodologies are more effective at facilitating learning and understanding than large-group didactic teaching.

Informative instruction might have a negative effect on students' abilities to comprehend and retain the information they learn (Ofstad et al., 2017). Miller and Metz (2014) define active learning as a teaching strategy that involves students actively participating in the learning process and emphasizing knowledge application above memorization. These techniques strengthen students' critical thinking and teamwork abilities and improve educational achievements. As a result, in student-centered learning, the instructor becomes a mentor off to the side (Koehler, 2018).

Activity-based learning is the bedrock for enhancing creative and critical thinking abilities. This approach would not be succeeded, though, if students lack the drive to fulfil their inner capabilities. Of all the most effective and beneficial ways to deliver concepts which are difficult by design is to include learners in engaging activities, which is the considered the cornerstone of activity base learning.

Use of various activities in the learning environment helps students develop their critical thinking and creative skills. The significance of varied activities and their use in routine activity-based teaching approaches are emphasized (Abid et al., 2024). According to (Anwer, 2019) the best way to improve learning is through student-teacher engagement and communication. As they allow the students to participate informally rather than by memorization of the answers, these exchanges raise the bar for their performance. By participating in open conversations in class, students can pick up new concepts from other students with different backgrounds and experiences. Moreover, active planning is required to promote student interaction. The claim made by Chafe (1998) is that emphasizing cooperative learning over individual learning encourages communication and engagement, which is a more effective learning strategy than competition-based outcomes and goals. Students are able to collaborate in groups and in teams with peers from all backgrounds thanks to interactive learning. This enhances the amount of variation and the opportunity for learning and idea sharing for the pupils.

Also, by doing this, students' input and output are maximized, and a helpful and engaging learning environment is created. Internet technology was employed to carry out projects in several research on online project based learning (Heo et al., 2010), which also improved the efficiency of learning. Online forums e-mails, and chat rooms promote student collaboration and communication while hyperlinks, hypertexts, and indexes on the

Internet offer students rich and varied learning settings outside of the classroom. There are greater opportunities for peer interaction and potential benefits from project work for learners. As a result, scholars adopt project base learning using information and communication technologies (Heo et al., 2010).

Among best learning and teaching practices, as stated by Bhalli et al., (2016) Teaching through activities have been helpful all the time in almost every aspect. If students start learning by doing, then their comprehension can be improving. Activity base has plenty of benefits. It uplift student's self-esteem. Students can work alone as well as in groups as said (Arioder et al, 2020). As kids conquer challenges by using their creativity, knowledge, and intellect, it motivates them. The activity-based method puts learning front and center. The communication relationships of the students are enhanced via activity-based teaching by allowing them to cooperate and work together. It made a point of emphasizing how it fosters ingenuity in people (Metin, 2020).

Several studies Camargo et al., (2023) encouraged work-life balance and makes use of educational resources for children. Students learn more actively than passively. To start with, activity-based teaching simply implies that the child takes an active role in his education and gains knowledge via doing. To begin with, activity-based teaching simply implies that the student takes an active role in his education and gains knowledge via doing. To keep the child interested, a variety of AV aids are used, such as realistic models, demonstrations, riddles, index cards, and role-playing techniques. This learning is dependent on the child's engagement, and the degree and subjects change each grade. By traditional teaching Students will be inspired to study via boredom and an eagerness to comprehend in order to solve an issue is through inquiry-based learning.it is one of the

strategy to let students actively participate in the class. Students who are curious will encourage them to make observation.

When using the activity method, a teacher can highlight their teaching philosophies through fun activities or exercises that promote student engagement and learning. It is intended for children. It is a tactic that physically includes the child as well as cognitively. This approach places an emphasis on learning by doing. As is well known, a student understands and remember things more when their senses are stimulated (Martella et al., 2020).

Hence, to apply theoretical information in real-world situations and develop a deeper understanding of topics, students must involve in practical learning. It is imperative to guarantee authenticity and integrity in hands-on learning opportunities to make things easier and understandable for students. Assign children to practical tasks, assignments, and quizzes like investigations into science or art pieces that promote experimentation and creativity. The base of education is practical learning, which gives students the infinite chance to apply theoretical information in practical settings. Practical learning goes beyond the confines of conventional classroom teaching, including students in practical activities that promote an excellent development of ideas and abilities. In addition to gaining theoretical information, students who participate in practical learning also develop the critical thinking, problem-solving, and teamwork abilities necessary for success in different academic and professional undertakings.

The aim of practical learning to close the gap between theory and practice is one of its main benefits. Although theoretical knowledge gives students a basic comprehension of concepts, practical learning enables them to observe how these ideas appear in actual

settings. Students can witness scientific ideas in action by participating in a science experiment in a lab, for instance, which strengthens their comprehension and helps them retain the knowledge and information. Students gain an enhanced knowledge of the subject matter and it's important to their lives by directly experiencing the application of theoretical concepts in real-world circumstances. Additionally, practical learning fosters creativity and innovation in students. Students are encouraged to approach challenges with an open mind and explore multiple solutions when they are solving complex problems, designing a prototype, and conducting research. This encourages and motivate students to develop a spirit of innovation and entrepreneurship and empowers them to come up with new and innovative ideas and solutions to problems that they encounter in the real world. Exercises using simulation are also advantageous for hands-on learning. They offer a safe space where students can rehearse techniques and scenarios without fear of repercussions in the real world. In industries like emergency response, aviation, and healthcare, simulations are very helpful. Additionally, chances for experiential learning outside of the classroom are provided by field trips and site visits. Observing pertinent workplaces or sites can provide insight into the issues and practices of the business(Hartley, 2023).

Experiential learning techniques such as "project-based learning, fieldwork, simulations, and hands-on experience" provide people with priceless chances to master critical skills and broaden their comprehension. Learners bridge the gap between theory and application by actively participating in real-world settings, which promotes critical thinking, creativity, and teamwork. In addition to improving understanding, practical learning boosts self-esteem and gets people ready for success in their chosen industries. Adopting practical learning strategies guarantees that students have the information and abilities required to prosper in a world that is always changing.

2.9 Advantages of Activity Base Teaching

Activity-based learning, according to Festus, (2013) has numerous advantages for both teachers and students. For instance, it helps students apply course material in real-world situations, builds teamwork skills, boosts self-esteem, encourages participatory learning, provides opportunities for problem-solving, supports the idea of discovery learning, strengthens learner bonds, and improves communication with diverse learners. Most significantly, both educators and learners participate actively in learning and teaching processes in activity-based learning.in student-centered teaching, where teachers enable learners to find integrate and, synthesize information from various sources and evaluate performance in a number of methods (Rangachari, 2010).

In addition to raising student achievement, an active learning environment may also foster a more diverse learning environment (Goodman et al., 2018). The effectiveness of utilizing activity-based learning tactics in the classroom as opposed to more conventional ones and whether they are appropriate to boost students' motivation and achievement have been hot topics in recent years. Students participate in active learning when they actively engage with the learning experience rather than merely listening. Students' attention spans and levels of focus will decline in passive seating.

Activities that foster the development of critical thinking genuinely benefit students in their learning, as opposed to studying passively. Active learning can be used to enhance student learning outcomes in a range of school settings, both inside and outside the traditional four walls of the classroom. The technique does, however, have several shortcomings, such as how challenging it is to implement.

Through various activities, students are encouraged to describe, evaluate and apply real-life experiences. This approach helps develop abilities to think critically, make informed decisions, and solve problems creatively. Collaboration, group discussions, and activities encourage students to work together, brainstorm, and communicate effectively. This encourages cooperation, collaboration, and the ability to share ideas and thoughts safely. Students process information in many ways, and activity-based instruction provides visual, auditory, and tactile students with opportunities to interact with information that is relevant to them. When students participate in activities, they are more likely to retain and understand the content being taught. By applying what they have learned in real life, they can establish better relationships and retain information better. Critical thinking, problem solving and social skills, and long-term retention of knowledge. By making it interactive and fun, it encourages students to become strong learners and prepares them to succeed in everything in life. There are several benefits associated with activity-based teaching that greatly enhance students' educational experience. This method encourages deeper involvement and improves learning and retention of topics by combining interactive assignments and hands-on experiences. Furthermore, because activity-based leaming is dynamic, it fosters thinking critically, figuring out solutions, and ability to make decisions, which provide students important tools they need to succeed in both their professional and academic lives (Mahdi et al., 2020).

Moreover, activity-based teaching's capacity to accommodate a range of learning preferences and styles is one of its main benefits. Students actively participate in their learning process regardless of the mode of instruction visual, aural, or kinesthetic which promotes maximum understanding and subject matter mastery. Additionally, activity-

based learning empowers students and fosters a lifetime love of learning by promoting teamwork, creativity, and independent inquiry.

Learning through activities fosters creative thinking. Engaging pupils in solving issues tasks and contests is an excellent method of encouraging them to think creatively. It is crucial for students to develop these critical thinking and creative skills as they advance through higher education. Active learning places more emphasis on the learner than the instructor. Students are engaged and given the resources to solve problems on their own. Students are encouraged to communicate their knowledge and ideas creatively when studying through activities. Students get the chance to demonstrate what they have learned both orally through presentations and through the act of doing thanks to the activity-based learning approach. Students' sense of inclusion and teamwork are enhanced via activity-based learning. Dividing the class into smaller groups (Nold, 2017).

It benefits students to be inquisitive and independent. It stimulates their critical thinking. They become more alert and engaged as a result, becoming less passive. Students start to notice more details about their environment. It centers on the methodology of experiential learning. It encourages the development of social skills. It strengthens their sense of self, tests their ability to work well in groups, and improves their communication skills. Students are trained to make plans for themselves and think of creative solutions. It makes memory better. Compared to what we consume or listen to, we have a longer memory for what we do. There is little doubt that activity-based learning has superior retention and recall rates.

2.10 John Dewy learning by doing

John Dewey, an eminent American philosopher, psychologist, and educational reformer, exerted a profound influence on multiple fields throughout his lifetime. Dewey's intellectual contributions continue to resonate across various disciplines, particularly in pragmatism, psychology, and educational theory. John dewey developed his theory in 1930s.

In addition to his philosophical endeavors, Dewey made significant contributions to the field of psychology, particularly in the areas of functionalism and experimental psychology. Drawing on his pragmatic philosophy, Dewey argued for a psychology that focused on the functional aspects of consciousness and behavior, rather than abstract mental states or structures. He advocated for an experimental approach to psychology that emphasized the study of behavior in real-world contexts, viewing the mind as an adaptive organism constantly interacting with its environment. Dewey's work in psychology helped pave the way for the development of behaviorism and laid the groundwork for modern cognitive psychology (Baggio, 2016).

However, Dewey is perhaps best known for his influential work in educational theory and reform. As an educational reformer, Dewey believed that education should be a dynamic and interactive process that prepares individuals for active participation in democratic society. He argued against traditional educational methods that relied on rote memorization and passive learning, advocating instead for a hands-on, experiential approach to education. Dewey believed that education should be centered around the interests and experiences of the learner, with an emphasis on inquiry, problem-solving, and critical thinking skills (Williams, 2017).

The great scholar John Dewey is renowned for his "learning by doing" theory, which is characterized as experiential education (Griffin, 1995). This idea and ' pragmatic philosophy of William James have a lot in common (Shaheen et al., 2019). William James' ideas gained attention and are now referred to as "constructivism." Activity-based learning has been impacted by constructivist thinking. Constructivism's theories on learning hold that everyone may "build" their knowledge and learning process. This procedure is dependent on his or her prior knowledge. According to the notion, learning happens when a person's mental environment interacts with particular structures. Active classrooms must do a variety of activities for pupils (Activity-based teaching is based on John Dewy theory of learning by doing.

An overall investigation of the search for one's own identity might serve as a summary of the theoretical development of educational activities. The John Dewey philosophy of pragmatism spent a lot of effort attempting to define and operationalize the term "experiential education" in a way that resembled a "quest for certainty." The definition of experiential learning has several critics. The phrases like "challenge education" “adventure education, “outdoor education" and "environmental education" are just a few of the new terminologies that are mixed in (Adkins & Simmons, 2002). Each of them has a lesson that children must be encouraged to learn either through observation or by doing. This suggests that the teaching-learning process should be child-centered.

2.11 Kolb’s Experiential Learning Model

David Kolb learning styles were published in 1984 through which he developed his learning style inventory. Learning involves the creation of knowledge through the transformation of experiences (Kolb,1984, p .38)

There is an old famous Chinese quotation that “I hear and I forget, I see and I remember, I do and I comprehend”. David Kolb suggested his four-stage paradigm in this regard. He developed a learning technique afterwards. According to Robert's (2016) research, during Kolb's experiential learning cycle, the learner encounters the following foundations:

- Particular experience: This type of experience can be acquired by coming across new events or experiences, or it can be reinterpreted from previous experiences.
- Critical observation of new experience: This includes identifying any gaps between experience and knowledge.
- Abstract conceptualization: People learn from experience and use reflective observation of new events to create new abstract conceptions or modify old ones.
- Active experiment: Students test their hypotheses on the real world to observe what occurs.

The Experiential Learning Model of Kolb's is described briefly in these stages.

First Stage: when a person has specific information or skills he can move to the next phase or stage.

Second Stage: One can take note of the events and reflect on them after that he can move to the third phase or stage.

Third Stage: Formation happens during this period. Concepts are developed through analysis and conclusions, and it reaches the ultimate stage.

Fourth Stage: At this level, ideas are put to use to test a hypothesis in hypothetical circumstances, leading to the acquisition of new knowledge.

Kassa et al., (2022) carried out a study to look at how students' academic performance, attitudes, and conceptual understanding were affected by activity-based science instruction. The author came to the conclusion that teaching science through activities can improve students' conceptual knowledge, learning attitudes, and academic achievement. According to the study, science teachers can effectively involve their students in the active learning and enhance their overall academic outcomes by using activity-based teaching. The activity based teaching practice benefits learners' learning in many ways and strengthens their acquisition skills (Virtanen et al., 2017). Active learning requires cooperative learning. There are occasions when students serve as teachers and teachers serve as facilitators (Demirci, & Yavaslar, 2018).

This study highlights the potential for activity-based learning to enhance learners' motivation and perspectives towards science, supporting its implementation in scientific education as a whole.

To identify science students, how students' academic performance, attitudes, and conceptual understanding were affected by activity-based science instruction. The author came to the conclusion that teaching science through activities can improve students' conceptual knowledge, learning attitudes, and academic achievement. According to the study, science teachers can effectively involve their students in the process of learning and enhance student’s overall knowledge outcomes by using activity-based teaching.

In order to ascertain the effect of inquiry-base and activity-base teaching student instructions motivation, performance, and attitudes towards science, carried out through a meta-analysis (Salloum et al.,2020). The study highlights the potential for action-based learning to enhance students' motivation and perspectives towards science, supporting its implementation in scientific education as a whole. To identify science students, this

investigation will be carried out. By contributing to the learning process, Students participate in active learning rather than merely listening. Students' attention spans and levels of focus will decline in passive seating.

2.12 Bruner’s Constructivist Theory

Jerome Bruner's constructivist theory emphasizes the importance of discovery learning, where learners develop their understanding by building on prior knowledge and experiences. Instead of passively receiving information, students actively engage with the content, constructing new insights through exploration. In Activity-Based Teaching, discovery learning is central, with students participating in hands-on tasks, problem-solving, and exploration, using their previous knowledge to make sense of new concepts. For instance, a science experiment or historical simulation enables students to interact with the material and uncover outcomes on their own, rather than just listening to a lecture. Bruner’s theory also highlights the role of non-cognitive skills such as self-efficacy and self-esteem. As students engage in activities, they experience a sense of achievement, boosting their confidence and fostering resilience. The process of learning through trial and error, an essential element of Activity-Based Teaching, also contributes to the development of perseverance and problem-solving abilities.

2.13 Vygotsky’s Social Constructivist Theory

Vygotsky's social constructivist theory emphasizes that learning is fundamentally a social process, where students develop their cognitive abilities through interactions with others. According to Vygotsky, knowledge is constructed through social engagement and collaboration, particularly with more knowledgeable peers or teachers. He introduced the concept of the Zone of Proximal Development (ZPD), which refers to the gap between

what a learner can do independently and what they can accomplish with guidance. This suggests that students are most effective when they receive support and scaffolding from others to reach higher levels of understanding. Vygotsky believed that language and social communication are key tools in cognitive development, as they help students internalize concepts and strategies. Ultimately, his theory underscores the importance of a collaborative learning environment where students actively engage with one another to build knowledge and enhance their thinking.

2.14 Factors of Conceptual Framework

This study was based on constructivist approach. Constructivism is a theory that depends on observation and scientific research into how students learn. It states that students create their own understanding and awareness by doing practically and reflecting on their observations. When students come across any un familiar information, they integrate it with the old information. This may involve changing their beliefs or dismissing it as irrelevant. Regardless, we actively create our own knowledge according to Kirschner et al., (2006), it's important to ask questions, discover and assess our knowledge. Eddy (2004) defines constructivism as a knowledge, or theory, that explains how students know what they know. The fundamental notion is that problem solving lies as the basic of learning, thinking, and development. As students solve the problems they built their own understanding and learn the effects of their actions, reflecting on past and present experiences. Learning is therefore an active process that necessitates a change in the learner. Tobias and Duffy (2009) suggest that learners achieve this through engaging in activities, considering their consequences, and reflecting on their experiences.

The conceptual framework of this study combines Activity-Based Teaching (ABT) strategies with the strong plus model, both of which prioritize student-centered, hands-on,

and inquiry-driven learning approaches. Although the terminology used in each model may differ, the core educational principles are closely aligned, highlighting the effectiveness of activity-based methods in fostering student engagement and deep learning. The ABT strategies, including brainstorming, hands-on activities, project method, and experimental method, closely align with the components of the strong plus model. For example, brainstorming in ABT corresponds with the open inquiry component of the strong plus model, as both encourage students to generate ideas, explore new concepts, and engage critically with the subject matter. Hands-on activities in ABT directly relate to the hands-on activities in the strong plus model, both of which promote experiential learning by allowing students to engage physically with materials and apply concepts in real-world contexts. The project method in ABT mirrors the project (open inquiry) strategy in the strong plus model, as both involve long-term, collaborative problem-solving tasks that require in-depth research, critical thinking, and solution-oriented learning. Finally, the experimental method in ABT, where students conduct experiments and draw conclusions, aligns with the strong (inquiry scenarios) component of the strong plus model, emphasizing inquiry-based learning through structured, hands-on investigations.

This alignment demonstrates that the ABT framework is grounded in well-established pedagogical models such as the strong plus model, strengthening its credibility and significance. Both frameworks aim to engage students in impactful, active learning experiences that promote critical thinking, problem-solving, and the development of lifelong learning skills. By incorporating these strategies, this study seeks to establish a comprehensive and effective learning environment that enables students to build their own knowledge through interactive, inquiry-based experiences.

This present study model was given by Balasubbramanian, Cios and Wilson (2005) which explains the innovative teaching strategies which are divided into four main parts.

- Projects
- Brainstorming
- Hands on Activities
- Experimental

The conceptual framework of this study which is the basis of objectives of this study is given below.

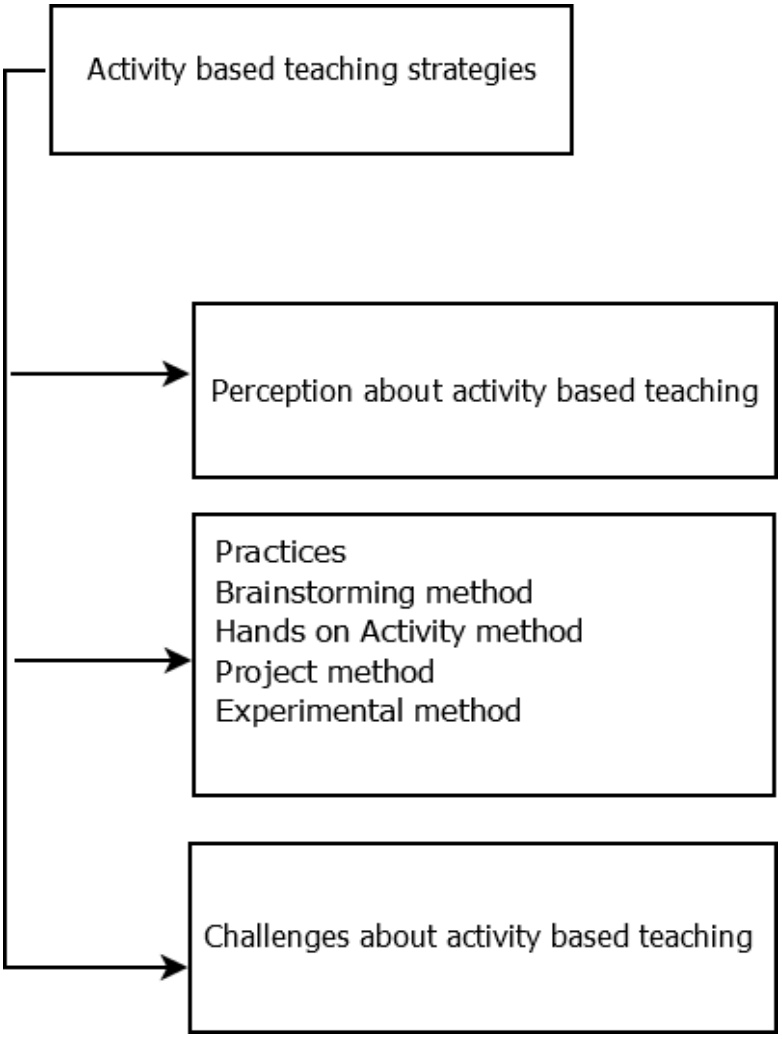


Fig 2.1 Conceptual framework of the study

2.15 Techniques adopted by science teachers

Pedagogy, or teaching science, involves instructional strategies, resources, and educational exercises. At the same time as national policies and efforts have been routinely examined to improve educational services for children, pedagogical practices have recently undergone a significant transformation. At all stages of education, lecturing has historically been employed, with professors acting as whistle blowers (information provider) and students acting as passive consumers. The primary educational materials were textbooks written for particular age groups and topic areas (Celestine, 2021). Significant learning activities included reading and writing from the textbook or the whiteboard. Cooperative learning is an alternative to the lecture method. Beisbier & Laverdure (2020) emphasized that Effective educational strategies can result from an understanding of the growing child's needs and the way the developing brain learns many educators like Lan, Gett and Flamand from 2008 to 2021 have expressed worries about the standard of our educational system.

Assessing how well activity base teaching is used to improve educational outcomes for students is a key component to measure learning at secondary school level. Learn by playing, based on skills assessments, the rubrics, observations, and pre- and post-knowledge are some of the typical methods of activity base teaching used to measure learning of students. Solé-Beteta at al., (2022) suggested a number of methods to encourage students' interest and participation for the encouragement of task significance there are many alternative activities like games to help with teaching, is one of these tactics. Teachers can fully understand if the students are taking interest or not by student's behavioral factors, and emotional & cognitive thought processes.

There is strong notion that placed emphasis on hands-on learning. Goal behind this statement of experience knowledge from the 20th century was to keep the natural world

research in mind. A set of educational tactics are used to teach learners how to gain information through conducting experiments and observing, but if learners are not engaged in this process, it means they are not interested and not getting the knowledge.

Several studies have demonstrated that the teacher-centered mode of instruction is ineffective. We actually live in a time where no human organization can thrive or advance without the use of technology. The first thing that pops into my head is, "Why can't teachers use activity-based learning or any other student-centered approach of teaching?" Research was done to provide a solution, and it was shown that teacher education programmer was to blame for school instructors' incapacity to adopt student-centered tactics, particularly activity-based strategies (Salami, 2009).

Students learn best when they are given freedom to experience things on their own whether it is inside the class or outside. Every school need to have a garden nearby so that learners can enjoy looking at the nature while also hoping to learn something new. For example, observing nature to carry out gardening-related activities. Activities related to garden includes testing the acidity of soil samples, examining the structure and layering of the soil, studying the shoot and root systems of regular and yearly plants, managing solid waste, making fertilizer from manure, growing vegetables, and planting techniques. This strategy will make student get knowledge for a longer time since senses are incredibly reliable slaves of memory. In simple terms, it entails instructing learners utilizing a way of learning by exploration, supported in a natural environment, where they pick up true everlasting skills. The pupils get an understanding of their surroundings and learn better with activities. Jolly (2020) gave a statement that, school garden gives learners the chance to "learn by doing and learning by living," Although activity base teaching make students learn the skills necessary for this century in order to successfully adapt and live better.

According to Gök, & Sürmeli (2022) suggested that Schools have a significant role to play in the development of the skills, and it is desired that instructors collaborate with innovators and help students improve their talents. For this reason, it's critical that the surroundings in which science is taught are created in a way that helps maximize students' scientific growth. In the 21st century, creativity is to have the capacity to look at something from various angles, to find new approaches as opposed to traditional ones, to push beyond the limits of what is possible with the knowledge and to methodically connect things that appear unrelated to one another.

In researches Leng et al., (2021) stressed that when learners experience the difficulty themselves and learn by practically involving in the classroom, learning as well as teaching becomes meaningful. Additionally, when a genuine, multimodal educational design is used, learners gain vital skills (Hawari & Noor, 2020).

After doing research, Bell & Kahrhoff (2006) came to the conclusion that "every instructor believe that an atmosphere of active learning is more favorable than a passive one. There are several methods students may use to develop conceptual knowledge and fundamental abilities that will help them in the future.

Furthermore, Shah et al., (2014) supported using activity base teaching. After the analysis of data, they said now it is evident that type of instruction being used affects how well students learn, with the lecture technique yielding less impressive outcomes than learning through active participation of students. A research was conducted by Fallon et al, (2013) they chose undergraduate students. They came to the conclusion that students won't benefit fully from information if instructors neglect to involve them, and activity base teaching improves student engagement, making learning easier and enjoyable for the

students. They give an explanation of the idea that in order to get the best results, several obstacles to activity base teaching have to be recognized and effectively controlled.

School gardening also plays a significant role in the education of science by helping students comprehend the true meaning of fundamental scientific ideas, which in turn helps to increase their level of meaningful involvement (Ambusaidi & Alburaidi, 2019). Avgitidou (2020) makes the case that activity-based education helps learners develop higher-order cognitive abilities like evaluating and coming up with original ideas. In this context different researchers suggested that learners who participate in practical learning in natural settings have much higher scientific scores than those who relies solely on lecture memorization (Acharya, 2019).

Effective teaching methods are necessary to raise the caliber of science instruction, and these strategies heavily rely on the growth of teachers' pedagogical abilities. This study investigates the effects of using an activity-based teaching strategy at the secondary school level.

Students also benefit when technology is used in activity-based teaching. But there are also ongoing discussions in the educational world about the specific role of technology in students' learning and education. This section seeks to clarify the benefits and difficulties of using technology in the classroom. The curriculum can offer helpful ideas for effective application in classrooms. Additionally, Costley (2014) asserts that if technology is used in the classroom it may have a favorable impact on students' learning. The positive effects by inclusion of technology in activity-based education on student learning outcomes have been consistently shown in numerous research. Positive results in terms of student motivation and involvement have been found by studies using technology in science studies.

According to Wilson (2015) highlighted issues related to giving learners the chance to understand diverse scientific concepts. Implementing significant changes to promote activity base teaching and growth in education is a challenge for teachers. it was stressed that every student must have fair exposure to science education and science tools. While teaching science implementing activity base teaching has the potential to significantly improve student learning outcomes. But it's also essential to approach this process thoughtfully and by keeping in mind about any difficulties that might arise. In order to guarantee successful acceptance, teachers must follow best practices and provide ongoing support.

Solé-Beteta (2012) investigates the methods teachers use to measure students' involvement in the classroom by asking them directly about their learning experiences. Educational, emotional, behavioral, and cognitive aspects of student participation were some of the numerous characteristics she stressed. According to Jituafua (2020), engaging in authentic outdoor activities that emphasize the natural world, hands-on learning, collaborative work, and the application of solving problems through various engaging activities can foster positive learning experiences.

Effective learning is the end result of an efficient educational process. The set of learning goals should be achieved by students as a result of an efficient teaching procedure. By completing these learning objectives, the learner exhibits wanted behaviors and provides proof that they have mastered the concepts and abilities they were taught. Students develop their problem-solving, logical, and critical thinking abilities when studying science. According to Muslim Scholars Ahmad, et al., (2019) suggested that these abilities help students learn how to handle circumstances and issues that arise in the actual world. Feuerborn et al., (2016) defined student engagement as a social, mental, and intellectual

willingness to learn that is characterized by students' sense of fascination, involvement or engagement, and willingness to acquire knowledge. This study thus investigates the perceptions and practices of teachers' involvement teaching methods like activity base teaching on students' cognitive abilities and, consequently, cognitive learning outcomes. According to Bruner's (1960) constructivist theory of learning, students represent knowledge in three different ways as they learn: passively or action-based, ironically or image-based, and symbolically or language-based. He contends that this progression from passive to active to figurative representation while acquiring new content makes learning more successful.

This suggests that learning is active rather than passive because of the involvement of the learner, who can create new knowledge based on his or her representations of the given information. The Activity base teaching is a method of instruction that actively incorporates learners into the learning process. This method promotes student participation and a greater comprehension of the content being provided. The activity-based teaching and learning strategy is additionally defined as strategies a teacher employs to stress their instructional methodology via activities in which students fully participate to produce effective educational experiences

Both cognitively and practically; they acquire knowledge by doing. As per the cognitive and constructivist learning theories, people strive to make sense of everything that is around them as they acquire knowledge, and they eventually create new meaning from the knowledge at hand. Students ought to be given exercises or activities that allow them to use their cognitive processes to assess information in this regard. They grow in their ability to think critically and solve problems as a result. As Kazmi et al., (2017) suggested that following results are attained via activity-based teaching.

1. For the improvement of student performance on the concept-assigned task;

2. Develop students' critical thinking, deductive reasoning, and practical skills;

3. Enhance students understanding of learned material;

4. Transform them from dependent to independent learners.

Today's education must include an essential component called student involvement. It is essential for fostering the required non-cognitive and intellectual abilities in students. Non-cognitive, cognitive, and emotional student involvement were all recognized by Abla & Fraumeni (2019) International.

The non-cognitive involvement entails students participating in activities and monitoring behavior and standards. In terms of emotional involvement, students' sentiments of interest, joy, despair, worry, and boredom are taken into consideration. Therefore, the level and kind of involvement that students experience can lead to variances in learning results. There are so many different definitions of participation which all acknowledge that school is not just a place where knowledge is passed from one generation of students to the next, but it is an effect where emotions connect that can be positive or negative occur. According to Abla & Fraumeni (2019) in the activity-based teaching to fostering accomplishment of the many learning goals, the teacher turns into a scheduler, organizer, a guide, decision-maker, and assessor.

STEM education also follows the idea of activity-based teaching. In science as well as in other subjects, activity-based methods of instruction have been studied by researchers. In 2013 an investigation was held to check the effectiveness of activity-based teaching strategies, Mishra and Yadav (2013) discovered that implementing different strategies in

science improved student accomplishment across all three cognitive areas, including levels of understanding, knowledge, and application. Thus, it may be observed that involving students in lesson-related activities might improve their cognitive abilities.

Singal et al., (2017) investigated how activity base teaching affected both gender students' intellectual learning outcomes. The study found that learning has improved significantly. It also evaluated how well students who were and weren't exposed to ABL learned. The study found that learners exposed to activity base teaching showed reduced reliance on their instructors. Compared to students who weren't taught using the activity base teaching, these learners relied more on their classmates and showed more confidence in handling their homework and exams. Study discovered that by activity base teaching students had stronger educational and career ambitions but poorer self-esteem and enthusiasm.

According to Anwer (2019) who examined the impact of interactive, activity-based techniques on learner outcomes, discovered that learners who were taught using the activity-based techniques, achieved greater educational objectives as compare to the students of control group. Additionally, students who were participating in the experiment, out of them all up to 80 percent uncovered the activity-based teaching to be more interesting, enjoyable.

Basalama (2020) looked into how activity-based teaching affected the educational success of social studies learners. The results showed that learners who get activity-based teaching performance was improved academically as compare to the students of lecture method. Additionally, male, female students did not significantly vary within activity base teaching. Anwer (2019) investigated the impact of activity-based teaching on learners' achievement and inspiration and came to a point that those who received education

applying the activity-based instruction appeared more driven and had more academic success.

Despite the importance of curricular materials, instructors also influence learners to use scientific demonstrating models when examining events in nature. For instance, by guiding the students, instructor can

(1) Plan suitable demonstrating activities that will resolve student's queries.

(2) Listen to ideas of learners and encourage learners to communicate and discuss each other ideas.

(3) Relate learner's thoughts with the science concepts.

(5) help learner identify and create the most crucial components of their framework,

(6) Carefully assess learner's model until they make something accurate.

According to Azuka (2013) asserts that the instructor must act more like a guide and mediator than like a speaker or professor. In order to accomplish the goals of learning outlined by the course of study, Carl (2009) noted that the position of the instructor was that of an enthusiastic guide. The most effective method to improve performance among learners, according to prior researchers, is activity-based teaching. The activity-based teaching approach was shown to be the most effective for teaching English, according to (Kuyate, 2019). The activity-based approach should be preferred while teaching English because it emphasizes every learner's active engagement in the exercises for improved learning. The role of learners is interactive rather than receptive (Suparno et al., 2019).

According to Haq (2016) research, activity-based education produces greater results than conventional instruction. Whereas in 2019 Anwar stated that compared to

lectures, activity-based instruction is a more engaging type of instruction. ABT is a novel method for its core component is educating and getting learners involved in the classroom (Hansraj, 2021). When teaching is modelled around a project. Pupils are. They are continuously occupied with observing and monitoring their environment (Harfield et al., 2005). Prince (2004) claimed in a task that Students participate in the learning processes in class. Getting involved in projects helps children learn the material. (Noreen et al., 2020) of mathematics. According to Mishra & Yadav (2013) the activity-based technique improves students' learning across the board, but especially in science topics.

A variety of research have been conducted on the topic of activity-based education, evaluating its impacts in the fields of mathematics, science. These investigations, yet, are only concerned with student learning. Uncovered in previous research is the evaluation of the instructor's contribution in the execution of activity-based teaching. Whether our teachers are capable of appropriately organizing, developing, and executing activities?

Science activities must be designed using inexpensive materials that are locally accessible in the area so that learners can become enthusiastic while learning through simple exercises. Various methods of instruction for to educate are referred as activity based teaching. The main purposes involve ensuring that students education or teachers instruction revolve around performing practical tests and tasks within controlled circumstances in order to collect data for analysis. Since students are viewed to be active individuals rather than in active users of knowledge, the idea of activity based learning has begun to take root in the minds of society. Giving a youngster the best opportunity to discover on their own results in learning that is both enjoyable and long-term. Activity base teaching is like a package with interactive, engaging instruction for the students. This is

used to let students have the deep knowledge about the topic without boredom (Sadi & Cakiroglu, 2011).

Some scientific lessons in secondary classes merely cover more than the terminologies and technical terms of the subject. Numerous studies have demonstrated the value of experiential learning. Learners who are given motivation gain more, as well as become better readers. Activity-based education helps learners integrate what they have learned to real-world situations and prepares them for a career in science (Patil et al., 2016). In an effective pedagogical method known as activity-based teaching, students carefully study obstacles and difficulties from everyday life while collaborating with partially small teams.

The growth of the economies of all nations as well as successful science instruction are inseparable. In order to stay up to date with advancements in science and technology as well as to preserve such advancements, there exists an enormous gap of specialists who would apply information and generate technological changes.

Noreen & Rana (2019) mentioned that teaching based on activities is somehow recognized as a model and standard in science education and is utilized in courses which are developed nationally however it is hardly been applied to real or truly classroom activities.

Activity base teaching is considered costly widespread and time-consuming contrasted to regular instructional methods, which in turns become an advantage for text-oriented teaching and after that students are not prepared for real time examinations. The responsibility for the cost of tasks couldn't be released. Most institutions are unable to maintain modern, efficient scientific labs. Despite this, creating inexpensive exercises that

are easily achievable in the vicinity is undoubtedly beneficial. Therefore, it shouldn't be accepted as an excuse for neglecting fundamental scientific principles.

The goal of the developed, regulated activity based teaching is to get learners to develop concepts that are without errors. Teaching that is given to students must be according to their age and mental level. Social standards, and available material in the area. The classroom environment must be free of tension while fostering enthusiasm and joy in the everyday activities of education. The majority of educationalists, including, Dewey and Rousseau have emphasized the activity-based teaching. It is possible for students to actively engage themselves by participating in a variety of indoor as well as outdoor tasks that are covered by diverse instructions that may influence scientific achievement. Activities which are related with accessories improves relationships with others, better goals, and outstanding attention level, these are the key components of the affective domain of learning. It has a favorable impact on a student development in the emotional, mental, and psycho-motor domains (Anwer, 2019).

It was found that when per-service educators were introduced to several teaching strategies and methods, their instructors were primarily interested in explaining the concept and the characteristics and situations when each strategy or method could be applied most effectively. Most of the time, lecturers do not teach using an activity-based technique, and they also do not permit future teachers to prepare and implement this approach while they are in training. This is based on the notion that we instruct in the manner in which we were educated (Aremu, 2013).

Constructivist theory, which is the foundation for the activity-based teaching technique, holds that students can build their own understanding provided they are given the opportunity to engage, explore, or actively participate in the learning process (Marley

et al., 2010). By combining what they already know and believe with the phenomenon or idea they encounter, it enables students to develop their own original new understandings. Several students at various levels have used and found the effectiveness of activity-based learning (Marley et al., 2010).

According to Maneewan et al. (2017) activity-based learning is the process of inquiry and discovery, of getting knowledge; of understanding how to acquire it. No one is capable of recalling all the information. A student will benefit from it forever, and active based learning approach is much more likely to inspire a lifetime interest in learning than rote learning does (Jensen, 2008). Activity-based instruction is a type of learner-centered method that has been found to be more effective than teacher-centered instruction.

In a teacher-centered approach, the instructor is the main source of knowledge while in a learner-centered approach, student and teacher work together to create understanding. Students integrate using problem-solving, critical thinking, and enquiry skills with the teachers' direction. Traditionally, lab experiments are explained by teachers using the demonstration technique. There is additional evidence that project based learning fosters teacher and student collaboration and that it is more appealing to both instructors and students than traditional teaching techniques (Thomas et al., 2015). This body of studies is quite persuasive in favor of encouraging the adoption of project-based learning in the United States. Additionally, a sizable body of evidence indicates that this research's conclusions as well as its method of language learning are applicable to different nations and cultures. Additionally, a large amount of evidence indicates that this research's conclusions as well as its method of language learning are applicable to different nations and cultures.

Only when teachers are conducting science experiments students just watch the demonstration. Students are engaged in learning and can increase their interest in science by adopting inquiry-based learning in science experiments.

2.16 Knowledge source

In the teacher-centered paradigm, lecturing or storytelling teaching tactics are frequently used. This approach gives a lot of emphasis to the large quantity and quicker rate of knowledge transfer from teacher to student. Yet, in learner-centered classroom instruction, a stronger focus is placed on the relevance of getting knowledge.

2.17 Knowledge acquisition

In a teacher-centered classroom, students passively take in knowledge, whereas in a learner-centered classroom, students actively seek it out. As we know in teacher center approach, teachers are our primary source of knowledge so there are only two types of answers the correct and the wrong because the instructor serves as the main source of information. So, the tools that distinguish the correct answer from the other responses are those that are utilized for assessment. Yet, in activity based teaching classroom, the value of better questions is prioritized over the value of correct responses. Several methods are used to reflect many elements of learning. There will also be portfolios, performances, A.V aids, multimedia etc. students gain information to deal with challenges and concerns from the actual world. A teacher needs to have sufficient understanding of the subject matter in order to be able to teach through a variety of ways.

According to Eggen & Kauchak (2006) a necessary condition for effective instruction Education professionals in Pakistan must fully appreciate the value of activity based teaching since it allows for a deeper grasp of concepts. Pakistan, like many

developing nations, needs a lot of assistance in the area of education because there aren't enough fundamental teaching methods there. The input for students' learning will increase as a result of teachers' training. Teachers will be better able to combine community and individual improvement if training is provided. As a result, both teachers and students will benefit from increased creativity and critical thinking abilities, as well as better motivational qualities.is subject-matter expertise, commonly referred to as logical thinking. It includes more autonomous learning, group activities, and open projects and assignments that encourage student collaboration (Niemi, 2016).

The primary factor of any society which can power to significantly alter the norms and morals of its citizens is education. There are two fundamental components to the educational process that we encounter while defining the term education. These two sides include teaching and learning. These two aspects are connected with each other. They are like a coin both sides. Which means learning is not possible until there is better teaching and teaching can’t be productive or useful if there is no eager to learn. Traditional methods were not based on modern psychology which stresses on the student understanding thinking feelings and emotions during teaching process (Little & Little, 2014).

According to the modern psychology the key role is of students first then teachers. Research on a number of psychologists has demonstrated that activity-based learning is much more intimate with students' conscious, stimulating their enthusiasm for efficient learning. A particular kind of academic teaching methodology is the activity-based approach. Its fundamental theories include the need that students should learn through practical work and from activities. The core concept of activity base teaching is the idea that students should be active learners rather than passive recipients of information. If a learner is given the chance, they will be joyful to practically do it and have lasting

memories. With the help of this method, the students actively engage in activity-based learning, both consciously and subconsciously. In activity base teaching student is a guide of himself. It gives students the adaptable and flexible learning methods they need to be prepared for (Zheng, 2022).

Instead of expanding, now classrooms are becoming more and more supportive of the abilities that students must acquire. With an open mind and an awareness of how humans learn, creativity in the classroom is promoted and developed. The design of an active learning environment is of the utmost importance since researches shows that the physical environment of the classroom affects students' behavior. Teachers try to work hard to instill a love of learning and a drive to learn in their students, strive to find ways to improve students' critical thinking abilities so they can solve problems on your own. Students must learn the skills necessary for this era so as to successfully adjust and live better.

One should also be aware of how active learning in the classroom can help students succeed and encourage them to participate more fully in the learning process development. As several decades ago, numerous educationalists have presented different kinds of teaching techniques. One of the renowned researchers, Aristotle was the first one to introduce the dialogue system in students learning to convey his message in his school of philosophy. Popular philosophers such as the Muslim, Greeks and Romans bestow their expert opinions on a range of methods for imparting knowledge to students. Modern psychology has demonstrated that learning by doing increases willingness and motivation, which in fact increases learners' interest in embracing new ideas (Hassan, 2024).

According to (Ahlfeldt et al., 2005) said that it would be an old technique if the teacher just delivers all the knowledge to some passive learners. The purpose of the new

teaching approaches is to give the students an environment where they are able to interact with the learning materials and one another.

Likewise, Benson & Blackman (2003) said that if students does not take interest in class and don't participate actively then all the knowledge is in vain and there's no learning.

They continued by saying that it is challenging for a teacher to inspire and motivate learners to study by doing practical's because mostly students like to participate in activities due to some psychological factor.

Regarding the benefits of experiential learning, Petress (2008) found that learners who are actively taking part in various activities are considered to be having following traits.

Students as an active learner are constantly on the lookout for questions to ask so that there is no ambiguity. Such students will be able to question the subject matter, the instructional strategies, and the core concepts.

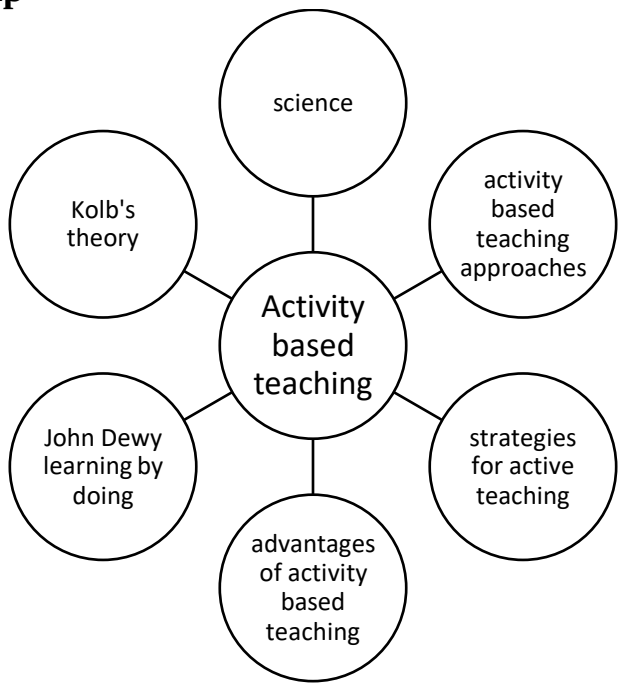
- They will be able to relate new information to previous experience.
- These students are able to evaluate their learning as they develop different talents.
- They will always be eager to learn and share what they have learned with others.

It is clear from a comparison of conventional and contemporary activity-based learning methods that learning by doing is an easier and advantageous approach than the more outdated traditional methods. Now Pakistani educational institutions came to understand the value of activity-based teaching, and as a result, different organisations are now creating learning resources based on different activities (Batool & Ahmad, 2022). Students are motivated to think logically about the subject matter by an imaginative teacher. A

teachers' role is like an instructor who show the right path in learning for students to lead (Shaheen & kayani 2017)

Gleason et al. (2011) suggested some activity based strategies related to learning like students giving presentations, Socratic questioning. Another strategy named "think pair share" where students are given a specific problem. They have to think alone to find the solution of the problem and then share with the whole class.

2.18 Concept map



2.19 Conclusion

Based on the extensive body of research on experiential and activity-based learning, several key conclusions and areas for improvement emerge. The foundation laid by John Dewey's pragmatism and "learning by doing" theory emphasizes the critical role of hands-on, inquiry-based education that enhances learner engagement and autonomy. Dewey's model encourages active participation, moving away from rote memorization toward

interactive, problem-solving-focused education. Similarly, David Kolb's experiential learning model provides a structured approach for transforming experiences into knowledge through stages such as concrete experience, reflective observation, abstract conceptualization, and active experimentation. This approach highlights that learning becomes more meaningful when learners are actively involved and able to relate new experiences to prior knowledge. Research has consistently shown that activity-based learning not only improves academic outcomes but also enhances motivation and attitudes toward subjects, particularly in fields like science. Studies by researchers such as Kassa et al. (2022) and Salloum et al. (2020) underline that activity-based learning strengthens conceptual understanding, learning attitudes, and academic performance. Additionally, cooperative learning environments, where teachers act as facilitators rather than mere information providers, have proven effective for student engagement and knowledge retention.

Despite the strong support for activity-based learning, certain challenges remain. Many educational institutions, particularly in Pakistan, have been slow to fully integrate activity-based models into curricula, often due to resource constraints, lack of training, or adherence to traditional methods. Furthermore, while the theoretical benefits of experiential learning are well-established, there remains a gap in understanding its long-term impact on critical thinking and problem-solving skills in real-world contexts. More practical implementations and resource support are needed to maximize the effectiveness of these approaches in diverse educational settings. In summary, experiential and activity-based learning are widely supported as effective pedagogical methods. Yet, for comprehensive adoption, efforts should focus on overcoming practical barriers, developing adaptable teaching models, and encouraging more extensive training for educators. This

would create a balanced, learner-centered approach capable of inspiring lifelong learning and active participation across all disciplines.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Approach

The current research was based on quantitative approach. The main strategy used in the research was a quantitative approach using statistical analysis on the gathered data. Numerical data is primarily used in quantitative research to interpret findings and conclusions.

The main focus of this study was to asses' science teachers' perceptions and practices regarding activity-based teaching at secondary school level. For accomplishing the main objectives of the study quantitative data is required.

Statistical analysis was used to gather data as part of the research quantitative method. Numerical data is mostly used in quantitative research to evaluate the findings and draw conclusions. It uses numerical data to draw conclusions, exposing various study trends. The study's main goals were to assess science teachers' perceptions related activity based teaching at the Secondary School level and assess what practices are carried out at the secondary school level and to explore challenges faced by science teachers' that affect activity base teaching strategies.

3.2 Research design

Objectives of a study decides design of the study. Keeping in view of the objectives the study aims to asses' science teachers' perceptions, practices and explore challenges to activity based teaching. The researcher adopted descriptive research design in this present study as descriptive research design helps to describe a phenomenon in detail.

3.3 Population

All science secondary school teachers (male and female) of Public Sector of Islamabad City made up the study's population. The Federal Directorate of Education (FDE) has records for the year 2023 http://fde.gov.pk/ showing that there were 37 Secondary schools operating in Islamabad City. There were 37 secondary schools total, including 14 institutions for boys and 23 for girls. From the 380 science instructors working in these 37 Public secondary schools, 178 of them were male whereas 202 were female science teachers. All selected schools provided informed consent to participate in the study, ensuring ethical standards were met throughout the research process

Table 3.1

Population of the study

Sr.no	Secondary Schools	No. of male teachers	No. of female teachers	Total number
1.	37	178	202	380

3.4 Sampling Technique

The significant aim of sampling is to select the respondents from which the researcher is interested to obtain data. In most of the researches where population is large in size and it is hard for the researcher to obtain data from the overall population. Therefore, keeping in view the nature and large population size, the researcher adopted random sampling technique for the purpose of data collection for this study. Keeping in view the aim of this study. The population of this study was consisted of two major groups of (male & female).

3.5 Sample

The population of the present study was divided into two categories using Islamabad Model Schools for Girls (IMSG) and Islamabad Model Schools for Boys (IMSB). The Federal Directorate of Education (FDE) recognized 23 IMSG and 14 IMSB public schools in Islamabad City as offering secondary education. According to Morgan table if the population is beyond 380 than 191 considered as the perfect sample size. Keeping in view this point researcher selected 191 science teacher as a sample of this study. Each stratum was consisting of proportionate number of teachers. Science schools within a researcher feasible range were selected to ensure the ease of access for data collection. This approach helped in managing time and resources effectively while ensuring the quality of data collection.

Table 3.2

Sample size of the study

Sr. No	Group	N	N
1	Male	178	90
2	Female	202	101
3	Total number	380	191

3.6 Tool Construction

Data were gathered by the researcher using a questionnaire. By keeping conceptual framework into consideration given in this study, the questionnaire was developed. The conceptual framework used for the study is based on the " activity based teaching

strategies" in addition to four main teaching strategies. As a result, the questionnaire had four main sections and sub sections.

Furthermore to check the practices followed by teachers' questionnaire part B was used using statement "To what extent these four activity based teaching practices are performed?" the statement was based on five point Likert scale : Never, rare, sometimes, often, always.

3.6.1 Demographic Information

Demographic information science teachers at Secondary School's level at Islamabad were obtain to collect personal information of the respondent. Item related to demographic information was based on gender, age, subject.

3.6.2 Activity Based teaching

This section was based on activity based teaching questionnaire. There were total 26 items and each dimension had 6, 6 ,7 ,7 items. Detail of the item were given in table 3.3 below

Table 3.3

Description of Activity Based Teaching tool

Sr. No	Dimension	Item	Number of Item
1	Brainstorming	B1, B2, B3, B4, B5, B6	6
2	Hands on activities	HA1, HA2, HA3, HA4, HA5, HA6.	6
3	Project method	P1, P2, P3, P4, P5, P6, P7	7
4	Experimental method	E1, E2, E3, E4, E5,E6,E7	7

The table 3.3 shows total no of items that were comprised in the tool. There were total 26 items.

A five-point Likert scale was used to rate the scale. The options ranged from 5 to 1, with 1 denoting the respondent's preferred response (5 being strongly agree, 4 being agree, 3 being neutral, 2 being disagree, and 1 being strongly disagree).

3.6.3 Validation of the tool

To check the validity of the tool, researcher considered three experts from the educational field of different public universities. At first researcher compiled letter of request of validity, cover letter of questionnaire, objectives of the study, conceptual framework and questionnaire and certificate of validity to form a document. After this stage

researcher personally went to the experts and validated the tool. Few changes were made in the tool as expertise instructed. After multiple valuable suggestions the tool was improved.

3.6.4 Pilot testing

The researcher distributed questionnaire of 70 teachers' from the population consisted of male and female for pilot testing and the total responses were 50. The rate of return was 70%. Researcher personally visited each school to collect data. The researcher personally distributed questionnaire among teachers' to select from 5point Likert scale. The respondent was assuring that data they were given only be used for research.

3.6.5 Reliability of the tool

After pilot testing, the data that were collected through pilot testing was analyzed through SPSS version 27 for the purpose to obtain the desired results and interpreted in tables form in order to access the strength of the questionnaire and as well to improve the items for the final version of the questionnaire. All items were coded for this study. For this purpose, Cronbach Alpha, Item-total correlation, and intersection correlation were calculated by the researcher.

Table 3.4

Cronbach Alpha Reliability of activity teaching strategies Scale Pilot testing (No of teachers'=50)

Scale	Sub variables	Items	Cronbach Alpha reliability
Activity teaching strategies		26	.76
	Brainstorming	6	.60
	Hands On Activities	6	.45
	Project Method	7	.50
	Experimental method	7	.66

The above table 3.4 shows the reliability of the "activity based teaching strategies". Overall Cronbach Alpha was .765. While the major dimension's reliability of "brainstorming" "hands on activities" "project method" and "experimental method" were .60, .45,.50, .66 respectively.

3.6.5.2 Item Total Correlation

By using SPSS version 27th item total correlation was calculated on the sample of 191 science teachers'. The following table indicates item total correlations of sample which show that items are highly correlated with each other and reliable for activity based teaching strategies.

Table 3.5

Item-total correlation of scale pilot testing (No of teachers'=50)

Codes of Items	R	Codes of Items	r	Codes of Items	r
B1	.605**	HA4	.311*	PM7	.227
B2	.452**	HA5	.200	E1	.508**
B3	.404**	HA6	.541**	E2	.546**
B4	.448**	PM1	.412**	E3	.415**
B5	.438**	PM2	.361*	E4	.188
B6	.341*	PM3	.200	E5	.114
HA1	.555**	PM4	.367**	E6	.352*
HA2	.393**	PM5	.319*	E7	.498**
HA3	.227	PM6	.489**		

The above table 3.5 showed the Item-total correlation of activity based teaching strategies scale. The highest Item-total correlation was of item No. B1 (.605**) and the lowest Item-total correlation was of item No. E5 (.114)

Table 3.6

Intersection correlation of activity teaching strategies Scale pilot testing (No of teachers'=50)

	Brainstorming	Hands on activities	Project method	Experimental method	Activity based Teaching Strategies
Brainstorming	1				
Hands on activities	.486**	1			
Project method	.488**	.433**	1		
Experimental method	.252	.258	.131	1	
Activity based teaching strategies Scale	.771**	741.**	.697**	.630**	1

*Correlation is significant at the 0.01 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

The above table 3.6 shows the intersection correlation of activity based teaching strategies Scale. The highest intersection correlation was found between Brainstorming and activity based teaching Strategies Scale (.771**) while the lowest intersection correlation was found between experimental and project method (.131)

Final version of the tool

After reliability of the pilot testing E4 and E5 were removed because of them inter correlation was weak whereas HA3 HA5 PM3,PM7 statements were modified.

3.7 Data collection

The data was collected through questionnaire. The researcher visited each school personally for data collection. The researched sought the permissions of the school principles to obtain the desired data. The researcher distributed questionnaire among teachers' by herself and request them to fill the questionnaire.

3.8 Data analysis

The data was collected with the help of questionnaire and open ended questions, then analyzed by using statistical package for social sciences SPSS 27th version. To analyze the data accurately mean test was applied for objective 1. Whereas for objective 2 frequency and percentage was calculated and objective 3 were analyzed through thematic analysis. Although they are not the main focus of the study, the open-ended thematic questions are probably used to offer more background information or insight. Since the goals of the study are probably centred on the characteristics of quantitative research, the entire research design was considered quantitative, with the open-ended thematic questions acting as an add-on to offer more information.

Table 3.7

Data analysis table

Objectives	Questions	Statistical test
To asses science teachers' perception about activity based teaching strategies at secondary school level.	What are the science teachers' perception about activity based teaching at secondary school level?	Mean
To assess science teachers' activity based teaching practices at secondary school level.	What are the science teachers' practices about activity based teaching at secondary school level?	Frequency and percentage
To explore challenges faced by science teachers in implementing activity based teaching at secondary school level.	What are the challenges faced by science teachers in implementing activity based teaching at secondary school level.	Thematic analysis

3.9 Delimitations of the study

- Only public sector secondary school teachers in Islamabad.
- Only science subject teachers were considered.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

This chapter represent the data in tabular form. Various variables were statistically analyzed. Data were divided into three major sections developed for the analysis on the basis of research objectives. First section deals with the demographic information collected throughout the process of data collection. Whereas the second section deals the descriptive statistics. In second section mean score, frequency, and percentage were evaluated. Third section deals with the thematic analysis.

Section 1

Demographic information of the study

Table 4.1

Gender wise distribution of sample size

Gender	Frequency	Percentage
Male	120	63%
Female	71	37%
Total	191	100%

Male and female participants were split up into two groups. The above table 4.1 shown that the sample of this study was consisted of 120 (63%) male teachers' and 71 (37%) female teachers' serving in Public Secondary Schools of Islamabad.

Table 4.2

Age wise Distribution of Sample Size

Age	Frequency	Percentage
25-30	39	20%
31-35	71	37%
35-above	81	43%
Total	191	100%

The above table 4.2 shown the ages of sample. The sample were divided into three groups. the sample of this study was consisted of age from 25 to 30 was 39 (20%), age from 31 to 35 was 71(37%) and age from 35 above was 81 (43%) teachers' serving in Public Secondary Schools of Islamabad.

Table 4.3

Subject Wise Distribution of Sample Size

Subjects	Frequency	Percentage
Physics	65	34%
Biology	66	35%
Chemistry	60	31%
Total	191	100%

The above table 4.3 shown that three subjects were selected. Sample of this study was consisted of physics, biology and chemistry subjects. Total number of Physics teachers'

were 65 (34%), Biology teachers' were 66 (35%), chemistry teachers' were 60 (31%) serving in Public Secondary Schools of Islamabad.

Section 2

Descriptive statistics

Objective No. 1: To assess science teachers' perception about activity based teaching strategies at secondary school level

Question No.1: What are the science teachers' perceptions about activity based teaching strategies at secondary school level?

Table 4.4

Science teachers' perception about activity based teaching strategies

Variables	n	Mean	Remarks
Brainstorming	191	3.7	Agree
Hands on activities	191	3.6	Agree
Project method	191	3.8	Agree
Experimental method	191	3.9	Agree
Activity Based Teaching Strategies	191	4.0	Agree

Table 4.4 show the mean score of science teachers' perception regarding activity based teaching. The mean score of brainstorming was 3.7 which shows that teachers' agreed with brainstorming similarly the mean value of hands on activities was 3.6 which shows that teachers' also agreed on hands on activities. The mean score of project method was 3.7 showing teachers' also agreed with project method. The mean value of experimental method was 3.7 which indicates that teachers' agreed with experimental method. The overall mean value of teachers' perception regarding activity based teaching was 4.0 which indicates that all teachers' fall in the category of agreed.

Objective 2: To assess science teachers' activity based teaching practices at secondary school level.

Question 2: What are the science teachers' practices about activity based teaching at secondary school level?

Table 4.5

Frequency and percentage of activity-based teaching practices

Variables	Never	Rare	Sometimes	Often	Always
Brainstorming	24(12%)	57(30%)	52(28%)	44(22%)	14(8%)
Hands on activities	19(9%)	28(15%)	61(32%)	57(30%)	26(14%)
Project method	31(16%)	23(12%)	42(22%)	47(25%)	48(25%)
Experimental	17(9%)	20(10%)	53(28%)	52(27%)	49(26%)

The above table 4.5 show that 101 teachers' often used experimental strategy. The highest frequency was of experimental strategy. The lowest followed strategy used by teachers' was brainstorming having frequency 14(8%). It showed that most teachers' were using experimental. The least strategy which is adopted by teachers' is brainstorming. Hands on activities and project method were used respectively 26(14%) and 48(25%).

Section 3

Objective 3: To explore challenges faced by science teachers in implementing activity based teaching at secondary school level.

Question 3: What are the challenges faced by science teachers in implementing activity based teaching at secondary school level?

Q1. How activity based teaching influence science student's engagement during instructional process?

Some of the teachers' said that Activity-based Teaching has a positive impact on students because it helps them to engage positively in studies also it promotes critical thinking moreover few participants were agreed to encourage student motivation for better learning outcomes, increase academic achievement, and engage students.

Majority of the teachers' emphasize on the utilization of the activity-based, a student-centered instructional method which emphasize their teaching approaches through a lesson plan because this method places a strong focus on experimental learning.

Furthermore, respondents also said that one must acknowledge the importance of activity based teaching since it allows for better conceptual understanding. The ability to think critically and deliver information more effectively allows students to convey thoughts and ideas in an engaging and clear manner. besides this teacher also recognized the

importance of Activity Based Teaching as it creates room for improved conceptual understanding.

However, some teachers' said that learning to think critically helps students to go in further detail and express their ideas clearly and persuasively when they talk or present their concept to others. Some of the respondent said Activity Based teaching support "learning by doing". As learning by doing emphasize student involvement significantly and for a practical, focused on project approach. As activity based learning stands out from other teaching methods because it provides many advantages for active learners who prefer methods that focus on absorbing knowledge through active participation. Other learning approaches including experiential learning, action learning, cooperative learning, service-learning, peer learning and situational learning are also linked to learning-by-doing.

Some of the respondents also mentioned group work as an activity based teaching as it helps students to exchange knowledge. In their opinion it is the most effective way to improve learning for students and for them to communicate and engage during instructional process. Students must come up with more as a result of these exchanges because they are provided the chance to communicate actively instead of rote learning.

Moreover, some of the respondents also encouraged personalize learning. This makes learning more effective and individualized by enabling students to interact with the information in a manner which best meets their needs and interest. In the framework of activity-based teaching, personalized learning refers to adjusting educational opportunities to each student's unique requirements, interests, and preferences. Some of the respondents said that personalize learning aims to deliver more individual learning opportunities by acknowledging that students have varying methods of learning, skills, and areas for improvement.

Fig 4.1 word cloud of the activity based teaching influence science student's engagement

Table 4.6

Themes of the activity based teaching influence science student's engagement

Sr. no	Statement	Theme	Sub-theme
1.	Activity based teaching influence science student's engagement.	Practical education	Promote critical thinking Encourage student's motivation Improve conceptual understanding. Exchange of knowledge Collaborating problem solving.

		Encourage personalize learning Peer learning.

Q2: How activity based teaching practices are mostly performed?

Some of the respondents said that activity-based teaching is a student-centered method that emphasizes involving students in interactive, hands-on activities while some of the respondents mentioned brainstorming activities as it empowers learners to come up with concepts, answers, or inquiries about a certain phenomenon. Some of the respondents also mentioned that when they lead group conversations students express their ideas, views, and help out each other. Group discussion, field trips, quizzes and exercises were the activity based teaching practices mentioned by some of the teachers'. Most of the teachers' said to select learning objectives-aligned activities that foster critical thinking, active participation, and knowledge application. For implementation to be successful, it must be flexible and adaptable to the unique requirements and dynamics of the class.

Fig 4:2 word cloud of activity based teaching practices

Table 4.7

Themes of the questionnaire question 2

Sr.no	Statement	Themes	Sub themes
1	activity based teaching practices are mostly performed	Activity based teaching practices	Hands on activity Field trips Quizzes Group discussion

Q3: What are the challenges that affect teachers' activity based teaching strategies?

The instructors outlined many obstacles to using cutting-edge teaching techniques, including a less encouraging atmosphere from upper management, heavy workloads for instructors, outdated testing procedures that don't align with cutting-edge instructional strategies, and students' inability to make the connection between topics

and test requirements reduced acceptance of the research culture Lack of both teachers' and other staff for scientific instruction, Absence of sources, materials, and tools (classrooms and laboratories are out of date for teaching science), When teachers' and students lack scientific understanding, it might be challenging to control the learning pace of slow learners in the presence of typical pupils. Absence of possibilities for teacher training to provide educators with the most recent and creative methods of instruction.

Scheduling becomes a problem to finish the courses on time, and load shifting is a barrier to managing the scientific laboratories. absence of modern science labs. Most scientific labs lack the essential instrumentation and devices, and the capacity of learners is not taken into account when choosing science as their area of study. Social norms and parents might occasionally pressure children to choose scientific courses even when they are interested in other disciplines. There is no ideal internet access accessible in the laboratories or classes. It becomes challenging to display images or video snippets straight from the internet because of this.

Based on the mentioned themes it was found that challenges to implement activity-based teaching at secondary level were lack of time, no collaboration or teamwork, teachers' heavy workload, old laboratory infrastructure, lack of resources.

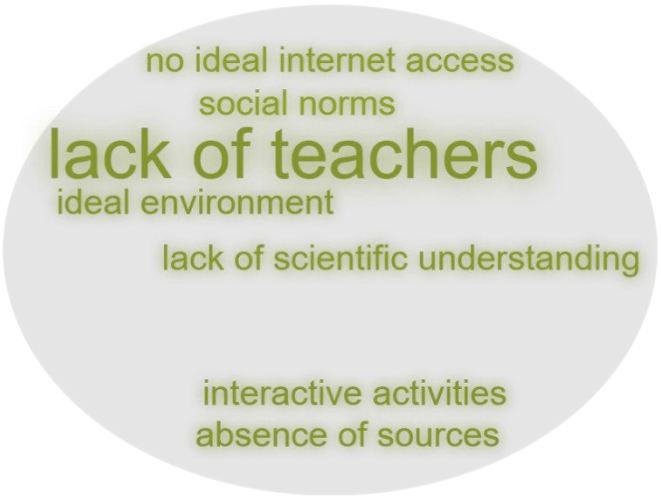


Fig 4.3: Word cloud of challenges affecting teachers' activity based teaching strategies

Table No 4.8

Themes of challenges affecting teachers' activity based teaching

Sr.no	Statement	Themes	Sub themes
1.	challenges affecting teachers' activity based teaching strategies.	Teaching obstacles	lack of teacher recruitment Lack of teacher training lack of teacher professionalism Outdated and inaccurate resources language and literacy barrier Lack of science teachers'

	unreliable internet connections lack of well-equipped laboratories.

Q4: Give suggestions to improve activity based teaching strategies.

Some of the teachers' said that proper time to each activity must be given to perform any activity so that students have enough time to understand each concept. Few teachers' said that due to lack of resources activity based teaching strategies are difficult to implement however to improve activity based teaching proper environment should be given to the students to avoid any uncertainty. Few teachers' also suggested that within week extra classes should be given for the practical's. Teachers' also suggested that technology enhanced learning should be promoted where students can use different gadgets for concept clarity. Some of the teachers' said that students must have a continuous process of improvement and reflection. Overall teachers' stressed on the creative learning environment.

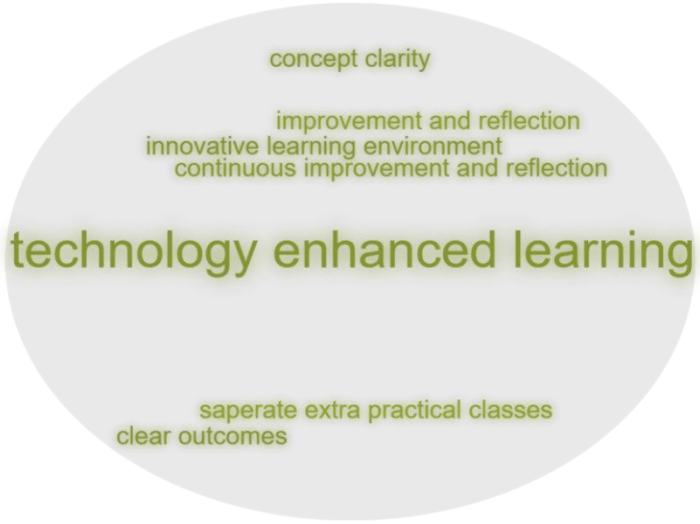


Fig 4.4: Word cloud of activity based teaching strategies improvements

Table No 4.9

Themes of activity based teaching strategies improvements

Sr.no	Statement	themes	Sub themes
1.	Suggestions to improve activity based teaching strategies.	Improvements	Teacher concept clarity Innovative learning environment. Continuous improvement and reflection. Separate extra practical's classes Defined learning objectives .

Chapter 5

Summary, Findings, conclusion, recommendation

5.1 Summary

The interpretation of the data is covered in this chapter. The main goal of the study was to assess how secondary school teachers' in the system perceived about activity-based teaching. The study's main objectives were: To assess science teachers' perception about activity based teaching strategies at secondary school level, to assess science teachers' activity based teaching practices at secondary school level, to explore challenges faced by science teachers' in implementing activity based teaching at secondary school level.

In addition, the researcher created three main questions and four sub questions based on these objectives. The study's sample consisted of 380 science teachers' employed in Islamabad Public Sector Secondary Schools. The sample was chosen using a random sampling procedure. The two main societal strata were thought to be composed of male and female science teachers'. The instrument was based on four main strategies relevant to activity based teaching. Initially the researcher developed twenty-six items. The instrument was validated by three experts from educational field. Suggested changes were incorporated and tool was improved accordingly.

Twenty-four items were finalized after pilot testing and the tool was improved for final data collection. Demographic variables were added to collect background information of the respondents. Data were collected personally visiting each school by researcher. The data were analyzed by using SPSS version 27^{th} through applying Cronbach Alpha, Item-total correlation, intersection correlation, mean, frequencies and percentage. The results were interpreted and suggestion were given. The purpose of the study was to investigate science teachers' perception about activity-based teaching. Three main goals guided the

conduct of this study, which focused on science instructors at the secondary level. The study's primary goal was to investigate secondary school teachers' opinions on activity-based learning techniques. A questionnaire that the researcher created was used to assist gather the data.

5.2 Findings

Findings of this study were interpreted step by step with respect to the perceptions and practices about activity based teaching at secondary school level.

Objective No. 1: To assess science teachers' perception about activity based teaching strategies at secondary school level

The result of first objective showed that according to Table 4.4, the overall mean score for activity-based teaching was 4.0 at secondary school level which revealed that teachers' at school level were agreed with activity-based teaching.

Furthermore, experimental strategy showed highest Mean score (3.9) comparatively brainstorming having Mean (3.7), hands on activity having Mean (3.6) and project method having Mean (3.8)

Objective No. 2: To assess science teachers' activity based teaching practices at secondary school level

According to the second objective Table 4.5 showed that majority of teachers' were not practicing brainstorming strategy having frequency score 14(8%). They were neutral. Similarly, it showed that most teachers' were using experimental strategy with highest frequency score 49(26%). It was found that most of the teachers' were not practicing hands

on activity strategy and project method having 26(14%) and 48(25%) frequencies respectively.

Objective No.3: To explore challenges faced by science teachers' in implementing activity based teaching at secondary school level.

According to the third objective to explore challenges following open ended questions were added and it was found out that:

Q1. How activity based teaching influence science student's engagement during instructional process?

Teachers' can highlight their approaches to teaching in a lesson plan by using the activity-based method, a student-centered instructional style. Students benefit from activity-based learning because it encourages critical thinking and helps them to participate in their academics in a positive way. The importance of activity-based learning should be acknowledged by teachers' since it allows for better conceptual comprehension.

Q2: How activity based teaching practices are mostly performed?

Activity Based Teaching Practices are performed by engaging students in hands on activities which promotes deeper understanding of concepts. Activity-based teaching is a student-centered approach that focuses on engaging students in interactive, hands-on activities.

Brainstorming Sessions, case study, experiments, project based learning are some typical methods and approaches for putting activity-based learning into practice

Q3: What are the challenges that affect teachers' activity based teaching strategies?

According to secondary science school teachers' they integrate many science activities like lecture method, multimedia, project method, hands on activities, library

visits, experimentation, Demonstration etc. while integrating science activities teachers' faced many challenges like heavy workload of work, lack of resources, lack of scientific knowledge in teachers' as well as lack of equipment's. There is also lack of scientific knowledge in students which makes their learning speed slow. In our country load shedding is also a very big problem which leads further to many problems. Time management is a serious problem when executing experiments because of load shedding. Traditional examination techniques from the past do not align with modern teaching approaches. Additionally, there aren't enough modern science laboratories from which students can get benefit. There are very less laboratories which have required instruments or equipment's for science teaching.

Q4: Give suggestions to improve activity based teaching strategies?

• Teachers' should manage time well to ensure students fully understand each idea.

• Limited resources make it difficult to implement activity-based teaching methodologies.

• Provide a conducive environment for activity-based learning to reduce uncertainty among students.

The study found that while secondary school teachers' generally support activity-based teaching here are inconsistencies in its implementation. Experimental and project-based methods are favored, but brainstorming and hands-on activities are less frequently practiced. Key barriers include high workloads, limited resources, and inadequate teacher knowledge, which restrict effective implementation. Teachers recognize that activity-based methods enhance student engagement and understanding. To improve these practices, the study suggests better resource allocation, time management, and teacher training.

5.3 Discussion

This study was design to investigate the perception and practices of science teachers' regarding activity-based teaching. This study was carried out at secondary school level with having three major objectives. The first objective was to assess the perception of science teachers' regarding activity-based teaching strategies at secondary level. The data were collected through self-made questionnaire. The results showed that science teachers' had a positive perception regarding activity-based teaching. Therefore, the finding revealed that science teachers' were positive regarding of activity-based teaching. Similar study also pointed out that relevant studies had been carried out on the related area in other countries (Daniel, Cano, & Cervera, 2015). Researchers also claimed that activity-based teaching strategies are utilized for the improvement of learner's acquisition by their active participation in instructional activities in accordance to 21st century changes (Lodhi et al., 2023). According to Ercan & sahin (2015), the implementation of innovative teaching strategies such as activity-based teaching is the most significant channel to upgrade student's achievements. Teachers' training programs must lay emphasize on the utilization of latest instructional methods, therefore that future teachers may be provided with the novel knowledge about innovative teaching strategies. An online survey was conducted to assess the teachers' knowledge regarding activity-bases teaching methods and found that teachers' were well aware but awareness alone cannot make changes in the field (Parr, 2015).

The significant of adopting activity-based teaching within educational setting provide students with multiple-practices and opportunities, teaching the desired skill within daily framework without further need for extra instructional activity, emphasizing on

student's interest and increasing level of accomplishment in educational settings (Ozen & Ergenekon, 2011).

A recent study by Picciano (2017**)** highlights that innovative teaching strategies, such as Activity-Based Teaching (ABT), promote collaborative learning environments where students engage in problem-solving and hands-on activities, aligning with constructivist principles. This approach not only enhances cognitive development but also fosters the growth of non-cognitive skills such as communication and teamwork, emphasizing the link between innovation in teaching and the core principles of Activity-Based Teaching.

Picciano's (2017) study highlights that ABT fosters active participation through problem-solving and collaboration. This approach enhances cognitive understanding while developing non-cognitive skills like communication and teamwork, demonstrating how innovative teaching strategies align with constructivist principles.

A more recent study by Johnson and Johnson (2020) further corroborates this view, demonstrating that collaborative learning environments significantly improve both cognitive and non-cognitive outcomes. Their research highlights how ABT, when combined with structured collaboration, enables students to develop essential 21st-century skills. For instance, the process of discussing, debating, and working through problems in groups fosters essential communication skills while also cultivating interpersonal relationships, which are vital for success in the modern workplace.

Furthermore, recent research by Hmelo-Silver (2021) on the impact of inquiry-based and activity-based learning strategies reaffirms the connection between activity based teaching and constructivism. Hmelo-Silver argues that by engaging students in authentic, real-world

problems, activity based teaching encourages students to take ownership of their learning while also improving their metacognitive abilities, such as self-reflection and problem-solving. This approach not only builds knowledge but also nurtures the development of critical non-cognitive skills, including adaptability and resilience.

Moreover, the findings of a study by Smith et al. (2022) show that activity based teaching, when implemented effectively, supports inclusive learning by accommodating diverse learning styles and abilities. By providing opportunities for active engagement, peer collaboration, and hands-on problem-solving, Activity based teaching creates an inclusive learning environment that promotes equity and access for all students. The study suggests that, activity based teaching emphasis on collaboration and active participation not only enhances academic performance but also develops students' social and emotional competencies, which are crucial for overall well-being.

In conclusion, the recent literature confirms that innovative teaching strategies like activity based teaching, which prioritize collaboration, problem-solving, and hands-on learning, align with constructivist principles and foster both cognitive and non-cognitive skill development. These strategies provide a holistic approach to education, preparing students not only with academic knowledge but also with the essential skills needed to succeed in the complex, interconnected world of today.

The second major Objective of the study was to assess science teachers' activity based teaching practices at secondary school level. Data were collected through questionnaire part B. The data found that most of the science teachers' preferred project method and experimental more comparatively brainstorming and hands on activity.

According to Kokotsaki and wiggins in 2016 it was found that the effectiveness of learning can be measured by a teachers' ability to put activity-based teaching into practice. Teachers' execution of activity-based teaching highlighted to significantly affect understanding of content and skills development (Kokotsaki, Menzies, & Wiggins, 2016). The next generation teachers need to be educated to utilize activity-based teaching if we are willing to develop a stable nation for the coming life (Denning, 2016). Teachers' are utilizing different instructional methods in classroom now a day, activity-based teaching in classroom strategy adopted by teachers' lay emphasize on his or her method of instruction by activity where students participate thoroughly and bring significant learning experiences (Khan, 2015).

The third Objectives of the study was to explore challenges faced by science teachers' in implementing activity based teaching at secondary school level. Data were collected through open-ended questions. The data that was collected faced a little challenge. The collection of data found some challenges as teachers highlighted many obstacles or difficulties while using advance teaching techniques.

As the first open ended questionnaire was about how activity based teaching influence science student's engagement during instructional process? In recent decades, there has been a focused effort to introduce science education through an inquiry-based approach, aimed at igniting students' curiosity and motivating them to actively engage in learning scientific concepts. This method encourages students to inquire about challenging topics, experiment with potential solutions, and consider alternative perspectives, thereby bridging their evolving understanding with prior knowledge and experiences. Inquiry covers various cognitive processes that facilitate the creation of new scientific knowledge. Teachers' adopting this approach not only impart content but also guide students to grasp

the methodologies and procedures. An essential aspect of comprehending scientific inquiry lies in understanding the underlying processes of science itself. Science constitutes a series of interconnected processes, prompting students to question their surroundings similar to scientists as they explore diverse phenomena. Essentially, students grasp scientific concepts through active participation in scientific practices, which require questioning, data collection and analysis, hypothesis formulation and testing, and problem-solving intended for outcomes. Problem-solving often entails engaging students in real-world, current issues, such as climate change, motivation, and learning. Nevertheless, many teachers' encounter challenges in integrating inquiry-based science into their curricula. This difficulty arises due to the requirement of situating learning within authentic problems, requiring teachers' to guide and support students' inquiries within the complexities of classroom management. Some students struggle with understanding difficult material, which can make them rely on shortcuts like memorization or superficial connections to get by. When it comes to science education, many students find it hard to break down complex problems using their thinking skills effectively (Onah and Anamezie,2022).

When students engage in activities that enhance their learning, like active participation, seeking guidance from teachers', and collaborating with peers, they typically become more invested in their academic pursuits (Rahmawati et al.,2022). When their engagement in activity will take place such as lab works, experiments, practical's automatically results will come because they are engaged properly in their learning and students will seems to be more attentive and thoughtful. To engage the student's teachers' must focus on giving them such tasks in which critical thinking take place so the students could figure out the real world problems. One of the best example in this is laboratory

experiments and in this they can learn by doing practically and enhance their leaning.as its problems based learning represents not merely a teaching tactic, but an overarching framework for structuring and implementing educational programs. Case studies are also the best ways to engage the students because they analyze and deal with the situation and tackle the complex situations many skills such as decision taking power thinking power take place in it.

The second open ended question discusses about practices that are mostly followed as in the world of science education, activity-based teaching methods encompass a variety of hands-on strategies personalised to facilitate experiential learning. These approaches aim to engage students in practical, interactive experiences that deepen their understanding of scientific principles. One of the best strategy used is experimental. Experimental method is a key aspect of activity-based teaching, allowing students to engage directly with scientific concepts through hands-on exploration. By conducting experiments and making observations, students gain first-hand experience and develop a deeper appreciation for the subject matter. From building models to conducting experiments, such activities help reinforce theoretical concepts and engage students in active learning. Another strategy is inquiry-based learning which encourages students to ask questions, formulate hypotheses, and design experiments to investigate scientific phenomena. Teachers' play a supportive role, guiding students through the inquiry process and fostering critical thinking skills.

Demonstrations are also used to visually illustrate scientific principles and phenomena. Through demonstrations, videos, or interactive models, teachers' engage students' interest and increase their curiosity about the natural world. Another activity based practice is collaborative projects. Collaborative projects promote teamwork and communication skills as students work together to solve scientific challenges. By

collaborating with their peers, students gain valuable understanding and deepen their understanding. Field trips and outdoor activities are such a interesting activities for students which provide opportunities to explore scientific concepts in real-world settings. Whether visiting museums, nature reserves, or laboratories, students apply their knowledge in authentic contexts and gain a deeper understanding of scientific inquiry.

Technology integration enhances the learning experience by providing students with access to interactive tools and resources. From educational software to virtual labs, technology helps students explore scientific concepts in self-motivated and engaging ways.

Overall, activity-based teaching practices in science aim to foster active engagement, critical thinking, and inquiry skills among students. By providing hands-on experiences and real-world applications, teachers' empower students to develop a deeper understanding of scientific principles and processes.

Teacher play an important role in the application of curriculum. If the teacher is professionally skilled then she can enforce all her potential on students. Activity based strategies can become tough when teacher does not have highly knowledgeable personality. To prevent unseen challenges a professional teacher having an update knowledge with good experience is very important. As it is said the "a teacher is known by the knowledge he keeps".it is important to deliver knowledge to students as it is meant to be. It can also be a big challenge if teacher is unable to deliver knowledge through activity based teaching. This can occur if the teacher is not skilled enough to teach or deliver knowledge. Many times the teacher is skilful but because of their strong personality students find it hard to ask any query or problem during the process of teaching. Teacher should have a large spectrum so that any student can come up to her and ask any question regarding learning besides that in Pakistan there are multiple reasons which affect teachers' activity based

teachings like lack of resources. If there are no instruments, no equipment's practical's cannot be done. Science subjects are meant be done practically.

Another challenge is lack of science teachers'. Lack of recruitment leads to lack of science teachers'. Load shedding has been a major and crucial challenge in implementing activity based teaching. As electricity is one of the major important thing to run any school or college. Without electricity nor students can survive nor perform any task related electricity. cultural barrier also acts as a challenge in our country. Diverse cultures students with diverse norms and ethics makes it even more hard to learn all together through activity based teaching. In our country one of the reasons why teachers' are not able to deliver the content is because of very less to no teachers' training. Every year multiple teachers' trainings should be organised. Teachers' learn new strategies and activities. They learn how to deliver knowledge to students through science activities which not only make students learn fast but also for long time. Teachers' are bound to cover outdated syllabus. Heavy workloads for teachers, outdated testing procedures that align with science activity based teaching strategies, and students inability create link between topics and practical's ,Lack of both teachers and other staff for scientific instruction, Absence of sources, materials, and tools (classrooms and laboratories are out of date for teaching science), When teachers and students lack scientific understanding, it might be challenging to control the learning pace of slow learners in the presence of typical students. In 21st century the advancement in technology has shift traditional classroom concept. Now science teachers' must encounter various challenges and obstacles and they ought to be equipped with latest techniques and instructional strategies (Das, 2015). According to Nudzor et al., (2015) the major challenges to activity-based teaching is insufficient teaching and learning materials or insufficient supply of textbook, insufficient teacher training of teachers' on activity-

based teaching strategies, crowded classrooms and lack of resources. The more challenging aspects of activity-based teaching in practice were project organization, technical issues, resources, students, relevant challenges and student's collaboration (Aksela & Maija, 2019). According to Hussain (2019) science teachers' pointed out various challenges in using innovative teaching strategies such as unsupported atmosphere, teachers' heavy workload, old assessment techniques, less research culture, unavailability of teaching staffs for science subjects, unavailability of resources, lack of scientific knowledge, lack of teaches training, unavailability of electricity, limited time, and lack of well-equipped laboratory.

To enhance activity based teaching strategies in science real world connection is very necessary. Teachers' need to relate scientific concepts with the real life implications so that students can have clear image. Interactive demonstrations, collaborative projects should be regularizing. Not only students will gain interest but will develop more self-esteem. Similarly, virtual labs and different study gadgets should be introducing. Activity based teaching can be enhancing when students get to learn and enjoy as well.

5. 4 Conclusion

The current study investigates the perception, practices and challenges about activity based teaching from the findings of the research, researcher have drawn the following conclusions.

It was concluded that most of the teachers' showed positive perception regarding activity based teaching at secondary school level. It was also concluded that teachers' were more positive regarding experimental as compare to other variables such as brainstorming, hands on activity, and project method moreover majority of the teachers' were practicing

activity-based teaching on different averages. Most of Science teachers' practice project method as compared to other methods such as brainstorming, hands on activity and experimental while some prefer experimental method more whereas it was also concluded that time management and lack of resources is one of the biggest challenges of activity based teaching. To develop interest group activities and proper guidance should be provided. One of the major cause of not being able to perform activity based teaching is limited time. Student need to be given space to practically experience it on their own. Additionally, there aren't enough modern science laboratories from which students can get benefit. There are very less laboratories which have required instruments or equipment's for science teaching. The research provides valuable insights for educators and policy makers to improve teaching practices. Implementing the recommended strategies can lead to a more interactive and effective learning environment, ultimately benefitting both teachers and students.

5.5 Recommendations

1. It was recommended that school heads may arrange professional development programs for science teachers' to enhance their ability to engage students effectively. These programs may include training on facilitating classroom discussions, encourage mind-mapping techniques, applying scientific knowledge in real life, understand complex concept and to make students able to learn by doing.

2. School administrators may arrange workshops and seminar to address teacher issues, training sessions to improve teaching strategies such as experimental, brainstorming and hands on activity. Each workshop should focus on one strategy, detailing its goals, methods, and classroom applications. Incorporate sessions for practical skill-building, where teachers' participate in mock lessons using these strategies. This will enable them

to learn by doing and receive feedback from peers and instructors. Conduct sessions on using low-cost or readily available materials for experiments and activities. For example, science concepts could be illustrated with everyday materials, fostering creative use of existing resources.

3. It was recommended that teachers' need to utilize existing resources creatively for different science activities and plan science activities which require less time. Those activities need to be focused more which are close to the learning objectives. Plan science activities which require less time. Those activities need to be focused more which are close to the science objectives. Teachers' need to empower students by encouraging them to participate in science activities.

5.6 Future Recommendations:

1. It is recommended in future researcher may use detailed interviews along.

2. In future researcher may conduct research on gender-based comparison.

3. it recommended that in future researcher may conduct study at primary level.

Table 5.1

Alignment table of objective, findings, conclusion and recommendations.

Objective	Findings	Conclusion	Recommendation
To assess science teachers' perceptions about activity based teaching strategies at secondary school level.	The mean score of experimental method, project method, and brainstorming is higher than hands on activities.	It was concluded that all variables were practicing on different averages. The mean score of experimental method was higher as compare to other variables of activity based teaching. Such as brainstorming ,hands on activities , project method.	It was recommended that school heads may arrange professional development programs for science teachers to enhance their ability to engage students effectively. These programs may include training on facilitating classroom discussions, encourage mind-mapping techniques, applying scientific knowledge in real life, understand

			complex concept and to make students able to learn by doing.
To assess science teachers' activity based teaching practices at secondary school level.	It was found that the highest frequency score was of experimental method and then project method as compare to other variables of activity-based teaching like brainstorming and hands on activity.	It was concluded that experimental strategy was practiced more and then project method as compare to brainstorming and hands on activity teaching strategies.	It was recommended that schools administration may initiate workshop, seminar to address teacher issues, how to keep students engaged during instructional process and ways to boost up student's confidence.
To explore challenges faced by science teachers' in implementing activity based teaching at	It was found that challenges to activity-based teaching were lack of time, lack of resources,	It was concluded that one of the main issues with activity-based learning is time management and resource	It was recommended that teachers' need to utilize existing resources creatively for different science activities and plan

secondary school level.	interactive demonstration, old infra structure, learning by doing.	scarcity. Activities for interest groups should be developed, and appropriate direction should be given. Lack of time is a major factor in the inability to implement activity-based learning. Students must be allowed the room to engage with material in a hands-on manner.	science activities which require less time. Those activities need to be focused more which are close to the learning objectives. Plan science activities which require less time. Those activities need to be focused more which are close to the science objectives. Teachers' need to empower students by encouraging them to participate in science activities.

5.7 Limitation

Due to limited time the study was limited to

1. Only public sector secondary schools located at Islamabad.

2. Only science teachers' were selected (Bio, phy, chem).

3. Only urban secondary schools in Islamabad were selected for this study.

References

Abid, S., & Masood, J. (2024). Activity Based Teaching Techniques: A Survey on the Improvement of Students Performances at Primary Level. *International Journal of Emerging Trends in Education*, *2*(1), 33-45.

Adkins, C., & Simmons, B. (2002). Outdoor, Experiential, and Environmental Education: Converging or Diverging Approaches? ERIC Digest.

Akben. N. (2018). Effects of the Problem-Posing Approach on Students' Problem Solving Skills and Metacognitive Awareness in Science Education. *Research in Science Education*, *50*(3), 1143–1165. https://doi.org/10.1007/s11165-018-9726-7

Akerson, V. L., Fouad Abd-El-Khalick, & Lederman, N. G. (2000). Influence of a Reflective Explicit Activity-Based Approach on Elementary Teachers' Conceptions of Nature of Science. *Journal of Research in Science Teaching*, *37*(4), 295–317. https://doi.org/10.1002/(sici)1098-2736(200004)37:4%3C295::aid-tea2%3E3.0.co;2-2

Amuthavalli, & Sivakumar. (2014). Impact of Activity Based Learning on Learning Science at Primary Level. Shanlax International Journal of Education, 02(02), 60-69. Retrieved from http://www.shanlaxjournals.in/pdf/EDN/V2N2/EDN_V2_N2_009.pdf

Anwer, F. (2019). Activity-based teaching, student motivation and academic achievement. *Journal of Education and Educational Development*, *6*(1), 154-170.

Anwer, F. (2019). Activity-based teaching, student motivation and academic achievement. *Journal of Education and Educational Development*, *6*(1), 154-170.

Anwer, F. (2019). Article Journal of Education and Educational Development Activity-Based Teaching, Student Motivation and Academic Achievement. *Journal of Education and Educational Developement*, *6*(1). https://files.eric.ed.gov/fulltext/EJ1216784.pdf

Arioder, L. J. Q., Arioder, V. Q., Quintana, V. V., & Dagamac, N. H. (2020). A application of constructivist teaching approach in introducing new environmental concepts to young elementary students in the philippines a small class sized experience from

slime moulds modeling. Interdisciplinary Journal of Environmental and Science Education, 16(2), 1-10. https://doi.org/10.29333/ijese/7818

Baggio, G. (2016). The Influence of Dewey's and Mead's Functional Psychology Upon Veblen's Evolutionary Economics. *European Journal of Pragmatism and American Philosophy*, *VIII*(VIII-1). https://doi.org/10.4000/ejpap.467

Balasubramanian, N., Wilson, B., & Cios, K. J. (2005). Innovative Methods of Teaching and Learning Science and Engineering in Middle Schools. Available at https://pdfs.semanticscholar.org/0733/4d7edc01a42044e86257c29c9ab9e34e8464.pdf on 05-04-2018.

Bell, D., & Kahrhoff, J. (2006). Active learning handbook. *Institute for Excellence*.

Benson, A., & Blackman, D. (2003). Can research methods ever be interesting?. *Active learning in higher education*, *4*(1), 39-55.

Bhalli, M., Sattar, A. & Asif, M. (2016). Teaching strategies; perception of medical students used in basic science year. The Professional Medical Journal, 23 (05), 614-619.

Botts, D. C., Losardo, A. S., Tillery, C. Y., & Werts, M. G. (2012). A Comparison of Activity-Based Intervention and Embedded Direct Instruction When Teaching Emergent Literacy Skills. *The Journal of Special Education*, *48*(2), 120–134. https://doi.org/10.1177/0022466912449652

Bryman, A. (2016). *Social research methods*. Oxford university press.

Cairns, D., & Shaljan Areepattamannil. (2017). Exploring the Relations of Inquiry-Based Teaching to Science Achievement and Dispositions in 54 Countries. *Research in Science Education*, *49*(1), 1–23. https://doi.org/10.1007/s11165-017-9639-x

Camargo L, J. R., Flórez C, O. D., & Jutinico, A. L. (2023). Project-Based Learning as a Tool to Meet Learning Results: A Case Study of Teaching Microcontrollers. *International Journal of Online & Biomedical Engineering*, *19*(11).

Çelik, H. C. (2018). The effects of activity based learning on sixth grade students' achievement and attitudes towards mathematics activities. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(5), 1963-1977.

Çelik, H. C. (2018). The effects of activity based learning on sixth grade students' achievement and attitudes towards mathematics activities. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(5), 1963-1977.

Chafe, A. (1998). Cooperative Learning and the Second Language Classroom. Retrieved from http://www.stemnet.nf.ca/~achafe/cooplang.html

Chauca, M., Phun, Y., Curro, O., Chauca, C., Yallico, R., & Quispe, V. (2021). Disruptive innovation in active activity-based learning methodologies through digital transformation. *International Journal of Information and Education Technology*, *11*(4), 200-204.

Churchill, D. (2003). Effective design principles for activity-based learning: The crucial role of 'learning objects' in science and engineering education. *Ngee Ann Polytechnic, 2*.

Churchill, D. (2003). Effective design principles for activity-based learning: The crucial role of 'learning objects' in science and engineering education. *Ngee Ann Polytechnic, 2*.

Driver, R., & Erickson, G. (1983). Theories-in-action: Some theoretical and empirical issues in the study of students' conceptual frameworks in science.

Driver, R., & Erickson, G. (1983). Theories-in-action: Some theoretical and empirical issues in the study of students' conceptual frameworks in science.

Duschl, R. (2008). Science education in three-part harmony: Balancing conceptual, epistemic, and social learning goals. *Review of research in education*, *32*(1), 268-291.

Duschl, R. A., Shouse, A. W., & Schweingruber, H. A. (2007). What research says about K-8 science learning and teaching. *PRINCIPAL-ARLINGTON-*, *87*(2), 16.

Elliot, A. J., Faler, J., McGregor, H. A., Campbell, W. K., Sedikides, C., & Harackiewicz, J. M. (2000). Competence valuation as a strategic intrinsic motivation process. *Personality and Social Psychology Bulletin*, *26*(7), 780-794

Elliot, D. L., Atencio, M., Campbell, T., & Jess, M. (2013). From PE experiences to PE teaching practices? Insights from Scottish primary teachers' experiences of PE, teacher education, school entry and professional development. *Sport, Education and Society*, *18*(6), 749-766.

English, M. C., & Kitsantas, A. (2013). Supporting student self-regulated learning in problem-and project-based learning. *Interdisciplinary journal of problem-based learning*, *7*(2), 6.

Federal Directorate of Education. (n.d.). *Federal Directorate of Education Islamabad*. Federal Directorate of Education. http://www.fde.gov.pk

Festus, A. B. (2013). Activity-based learning strategies in the mathematics classrooms. *Journal of Education and Practice*, *4*(13), 8-14

Friedman, R., George, A., Li, M., & Vijayan, D. (2022). Making teaching communal: Peer mentoring through teaching squares. *Papers on Postsecondary Learning and Teaching*, *5*, 67-74.

Gleason, B. W. (2011). *Secondary mathematics teachers' perceptions of their university preparation to become teachers* (Doctoral dissertation, University of Georgia).

Goodman, B. E., Barker, M. K., & Cooke, J. E. (2018). Best practices in active and student-centered learning in physiology classes. *Advances in Physiology Education*, *42*(3), 417-423.

Griffin, G. A. (1995). Influences of shared decision making on school and classroom activity: Conversations with five teachers. *The Elementary School Journal*, *96*(1), 29-45.

Gürbüz, R. Erdem, E., & Selçuk Fırat. (2014). The Effect of Activity-Based Teaching on Remedying the Probability-Related Misconceptions: A Cross-Age Comparison. *Creative Education*, *05*(01), 18–30. https://doi.org/10.4236/ce.2014.51006

Harfield, T., Davies, K., Hede, J., Panko, M., & Kenley, R. (2007). Activity-based teaching for Unitec New Zealand construction students.

Hartley, J. (2023, July 24). *Benefits of Practical Learning: Why Experience Outweighs Academic Knowledge*. Achology. https://achology.com/wisdom-for-life/benefits-of-practical-learning-why-experience-outweighs-academic-knowledge/

Hassan, I. Y. (2024). Linguistic Opinions According to Al-Rawasi in The Interpretations of Ibn Atiyya Al-Andalusi, Al-Qurtubi, And Abu Hayyan Al-Andalusi. *Zanco Journal of Humanity Sciences*, *28*(2). https://doi.org/10.21271/zjhs.28.2.11

Heo, H., Lim, K. Y., & Kim, Y. (2010). Exploratory study on the patterns of online interaction and knowledge co-construction in project-based learning. *Computers & Education*, *55*(3), 1383-1392.

Hilmi Hilmi, & Summiyani Summiyani. (2023). Implementation of Active Learning Strategies. *Journal of Curriculum and Pedagogic Studies (JCPS)*, *2*(1), 23–31. https://doi.org/10.30631/jcps.v2i1.1778

Hmelo-Silver, C. E. (2021). The impact of inquiry-based and activity-based learning strategies. *Educational Psychology Review, 33*(2), 307-329. https://doi.org/10.1007/s10648-021-09502-6

Hmelo-Silver, C. E. (2021). The impact of inquiry-based and activity-based learning strategies. *Educational Psychology Review, 33*(2), 307-329. https://doi.org/10.1007/s10648-021-09502-6

hlfeldt*, S., Mehta, S., & Sellnow, T. (2005). Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use. *Higher Education Research & Development*, *24*(1), 5-20.

Höttecke, D., & Allchin, D. (2020). Reconceptualizing nature-of-science education in the age of social media. *Science Education*, *104*(4), 641-666.

Htun, S. T. *A Study of the Effects of Activity-Based Learning Grade Ten Students in Teaching Chemistry* (Doctoral dissertation, MERAL Portal).

Htun, S. T. *A Study of the Effects of Activity-Based Learning Grade Ten Students in Teaching Chemistry* (Doctoral dissertation, MERAL Portal).

Ivory, A. (2023, August 29). *Importance of Hands-On Science Activities*. Hmhco.com. https://www.hmhco.com/blog/importance-of-hands-on-science-activities?srsltid=AfmBOoqqOm0uWqC-YYF8VkVi3dzGOt6kfYmJu36Eu2Vd0i1idiFpRKqT

Jarrett, O. S., Bulunuz, M., Jarrett, R., & Bulunuz, N. (2020). Teaching with Toys: Scientific Inquiry through Play. *Online Submission*

Jarrett, O. S., Bulunuz, M., Jarrett, R., & Bulunuz, N. (2020). Teaching with Toys: Scientific Inquiry through Play. *Online Submission*.

Jarzabkowski, P. (2005). *Strategy as Practice*. SAGE. https://www.torrossa.com/en/resources/an/4913191

Kassa, K., Arficho, Z., & Mulatu, M. (2022). Relationship between students' attitude towards vocabulary learning and their english vocabulary knowledge. *Theory and Practice in Language Studies, 12*(10), 1953-1960.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, **41**, 75–86. **https://doi.org/10.1207/s15326985ep4102_1**

Kuyate, P. (2019). A Study of effectiveness of activity-based teaching method in the English subject of Standard IV. *Educational Resurgence, 1*(1).

Kuyate, P. (2019). A Study of effectiveness of activity-based teaching method in the English subject of Standard IV. *Educational Resurgence*, *1*(1).

Little, W., & Little, W. (2014, November 6). *Chapter 16. Education*. Opentextbc.ca; BCcampus. https://opentextbc.ca/introductiontosociology/chapter/chapter16-education/

Mahdi, O. R., Nassar, I. A., & Almuslamani, H. A. (2020). The Role of Using Case Studies Method in Improving Students' Critical Thinking Skills in Higher Education. *International Journal of Higher Education*, *9*(2), 297. https://doi.org/10.5430/ijhe.v9n2p297

Majoka, M. I., Dad, M. H., & Mahmood, T. (2010). Student team achievement division (STAD) as an active learning strategy: Empirical evidence from mathematics classroom. *Journal of Education and Sociology*, *4*, 16-20.

Majoka, M. I., Dad, M. H., & Mahmood, T. (2010). Student team achievement division (STAD) as an active learning strategy: Empirical evidence from mathematics classroom. *Journal of Education and Sociology*, *4*, 16-20.

Martella, A. M., Klahr, D., & Li, W. (2020). The relative effectiveness of different active learning implementations in teaching elementary school students how to design simple experiments. *Journal of Educational Psychology*, *112*(8), 1582

McGrath, R., & MacEwan, G. (2011). Linking pedagogical practices of activity-based teaching. The International Journal of Interdisciplinary Social Sciences, 6(3), 261-274

Mehmood, K., Kanwal, W., & Muhammad. (2021). IMPLEMENTATION OF ACTIVITY BASED TEACHING AT PRIMARY LEVEL: A THEORETICAL PERSPECTIVE. *Pakistan Journal of Educational Research*, *4*(1). https://doi.org/10.52337/pjer.v4i1.53

Metin, S. (2020). Activity-based unplugged coding during the preschool period. International Journal of Technology and Design Education. https://doi.org/10.1007/s10798-020-09616-8

Miller, C. J., & Metz, M. J. (2014). A comparison of professional-level faculty and student perceptions of active learning: its current use, effectiveness, and barriers. *Advances in physiology education*, *38*(3), 246-252.

Mohamed, N. (2006). *An exploratory study of the interplay between teachers' beliefs, instructional practices & professional development* (Doctoral dissertation, ResearchSpace@ Auckland).

Nold, H. (2017). Using Critical Thinking Teaching Methods to Increase Student Success: An Action Research Project. *International Journal of Teaching*, *29*(1), 17–32. https://files.eric.ed.gov/fulltext/EJ1136016.pdf

Noreen, R., & Rana, A. M. K. (2019). Activity-Based Teaching versus Traditional Method of Teaching in Mathematics at Elementary Level. *Bulletin of Education and Research*, *41*(2), 145-159.

Ofstad, S. P., Tobolova, M., Nayum, A., & Klöckner, C. A. (2017). Understanding the mechanisms behind changing people's recycling behavior at work by applying a comprehensive action determination model. *Sustainability*, *9*(2), 204.

Oudbier, J., Spaai, G., Timmermans, K., & Boerboom, T. (2022). Enhancing the effectiveness of flipped classrooms in health science education: a state-of-the-art review. *BMC Medical Education*, *22*(1), 34.

Patil, S. A., & Prasad, S. R. (2016). Innovative methods of teaching and learning electronics engineering. *Journal of Engineering Education Transformations*, *29*(Special Issue)

Petress, K. (2008). What is meant by" active learning?". *Education*, *128*(4).

Picciano, A. G. (2017). Theories and frameworks for online education: Seeking an integrated model. *Online Learning*, *21*(3), 166-186.

Rangachari, P. K. (2010). Teaching undergraduates the process of peer review: learning by doing. *Advances in physiology education*, *34*(3), 137-144.

Roberts, J. (2016). *Language teacher education*. Routledge.

Sadi, O., & Jale Cakiroglu. (2011). Effects of hands-on activity enriched instruction on students' achievement and attitudes towards science. *Journal of Baltic Science Education*, *10*(2). https://www.researchgate.net/publication/40540853_Effects_of_hands-on_activity_enriched_instruction_on_students'_achievement_and_attitudes_towards_science

Salloum, S., & BouJaoude, S. (2020). Language in teaching and learning science in diverse Lebanese multilingual classrooms: Interactions and perspectives. *International Journal of Science Education*, *42*(14), 2331-2363.

Shaheen, M. N. K., Ullah, S. & Shah, N. H. (2019). Perceptions of Science Teachers Regarding Capacity BuildingTeacher Training Programme in Khyber

Pakhtunkhwa. International Journal of Innovation in Teaching and Learning (IJITL), 5(2), 79-90.

Simonson, M., & Schlosser, L. A. (2009). *Distance education 3rd edition: Definition and glossary of terms*. Iap

Singh, R., Kushwaha, A. K. S., & Srivastava, R. (2019). Multi-view recognition system for human activity based on multiple features for video surveillance system. *Multimedia Tools and Applications*, *78*, 17165-17196.

Snow, S. (2020, February 6). *Contently*. Contently. https://contently.com/2020/02/06/overcome-brainstorming-problems

Sola AO, Ojo OE (2007). Effects of project, inquiry and lecture-demonstration teaching methods on senior secondary students' achievement in separation of mixtures practical test. J. Educ. Res. Rev. 2(6):124-132.

Sola, A. O., & Ojo, O. E. (2007). Effects of project, inquiry and lecture-demonstration teaching methods on senior secondary students' achievement in separation of mixtures practical test. *Educational Research and Reviews*, *2*(6), 124.

Thananuwong, R. (2015). Learning science from toys: A pathway to successful integrated STEM teaching and learning in Thai middle school. *K-12 STEM Education*, *1*(2), 75-84.

Thayniath, S. (2015). Activity Based Language learning in the classroom? An Effective Learning Method. *SMART MOVES JOURNAL IJELLH*, *3*(5)

Triana, D., Yustinus Ulung Anggraito, & Saiful Ridlo. (2020). Effectiveness of Environmental Change Learning Tools Based on STEM-PjBL Towards 4C Skills of Students. *Journal of Innovative Science Education*, *9*(2), 181–187. https://doi.org/10.15294/jise.v8i3.34048

Virtanen, P., Niemi, H., & Nevgi, A. (2017). Active learning and self-regulation enhance student teachers' professional competences. *Australian Journal of Teacher Education (Online)*, *42*(12), 1-20.

Williams, M. (2017). John Dewey in the 21st century. *Journal of Inquiry & Action in Education*, *9*(1). https://files.eric.ed.gov/fulltext/EJ1158258.pdf

Winda Ismi Hidayanti, Rochintaniawati, D., & Agustin, R. R. (2018). The Effect of Brainstorming on Students' Creative Thinking Skill in Learning Nutrition. *Journal of Science Learning*, *1*(2), 44–44. https://doi.org/10.17509/jsl.v1i2.8738

Wu, J., Guo, R., Wang, Z., & Zeng, R. (2019). Integrating spherical video-based virtual reality into elementary school students' scientific inquiry instruction: effects on their problem-solving performance. *Interactive Learning Environments*, 1–14. https://doi.org/10.1080/10494820.2019.1587469

Yavaşlar, E., & Demirci, C. (2018). Vocabulary role play: an active learning strategy for vocabulary teaching. *European Journal of Education Studies*.

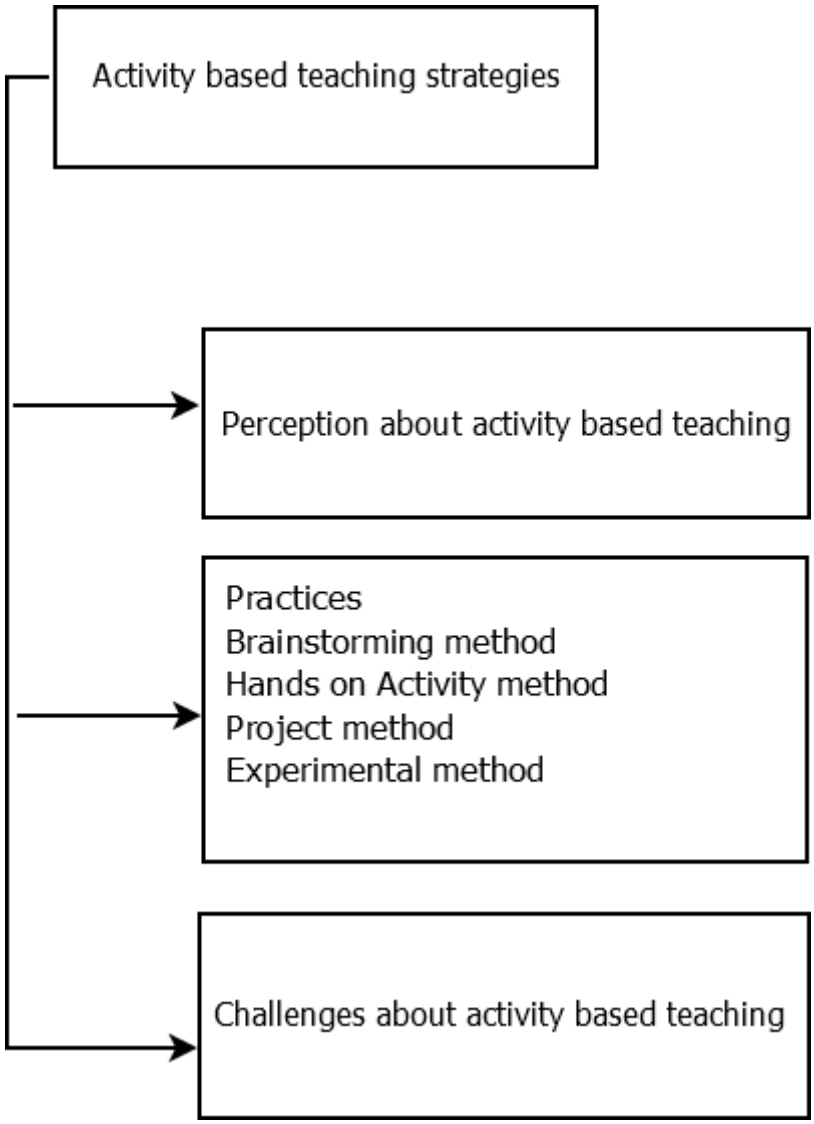
Younis, T. (2018). *A Study of the Effectiveness of Inquiry-Based Learning and Project-Based Learning of Science and Language Subjects at High School Level in the UAE* (Master's thesis, The British University in Dubai).Duan, X. (2021). The Application of Activity-based Method in English Reading Teaching in Senior High School. *Region - Educational Research and Reviews*, *3*(2), 60. https://doi.org/10.32629/rerr.v3i2.354

Zhou, R. L., & Luh, D. B. (2021, June). Activity Design of Nature Experience Teaching. In *International Conference on Applied Human Factors and Ergonomics* (pp. 269-275). Cham: Springer International Publishing.

Appendices

Appendix A

Conceptual framework



Appendix B

Topic Approval

NATIONAL UNIVERSITY OF MODERN LANGUAGES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF EDUCATIONAL SCIENCES

M.L.1-3/ES/2023/433 Dated: 26-06-2023

Name: **Maham Gohar** **Reg No. 27-M.Phil/Edu/F21**

Subject: **APPROVAL OF M.Phil THESIS TOPIC AND SUPERVISOR**

1. Reference to Letter No, M.L.1-4/Edu/2021/433, dated 26-06-2021, the Competent Authority has approved the title/theme/Practical/Theoretical Implication and Supervisor in 16th BASR Meeting dated 21st June 2023 and the recommendations of Faculty Board of Studies vide its meeting held on 27th April 2023.

a. **Supervisor's Name & Designation**
Dr. Aisha Bibi,
Assistant Professor,
Department of Educational Sciences NUML, Islamabad.

b. **Topic of Thesis**

Activity Based Teaching at Secondary School Level: Investigating the Perceptions and Practices of Sciences Teachers.

c Theme: Innovative Pedagogies

d. Practical Application: Policy Input

2. You may carry out research on the given topic under the guidance of your Supervisor and submit the thesis for further evaluation within the stipulated time by **30th Jan 2024** for further processing as per NUML MPhil Timeline. (**Timeline Attached**).

3. As per policy of NUML, all MPhil/PhD thesis are to be run on turnitin by QEC of NUML before being sent for evaluation. The university shall not take any responsibility for high similarity resulting due to thesis run from own sources.

4. Thesis is to be prepared strictly on NUML's format which can be taken from MPhil/PhD Coordinator.

Dr. Wajeeha Shahid
Head
Department of Educational Sciences

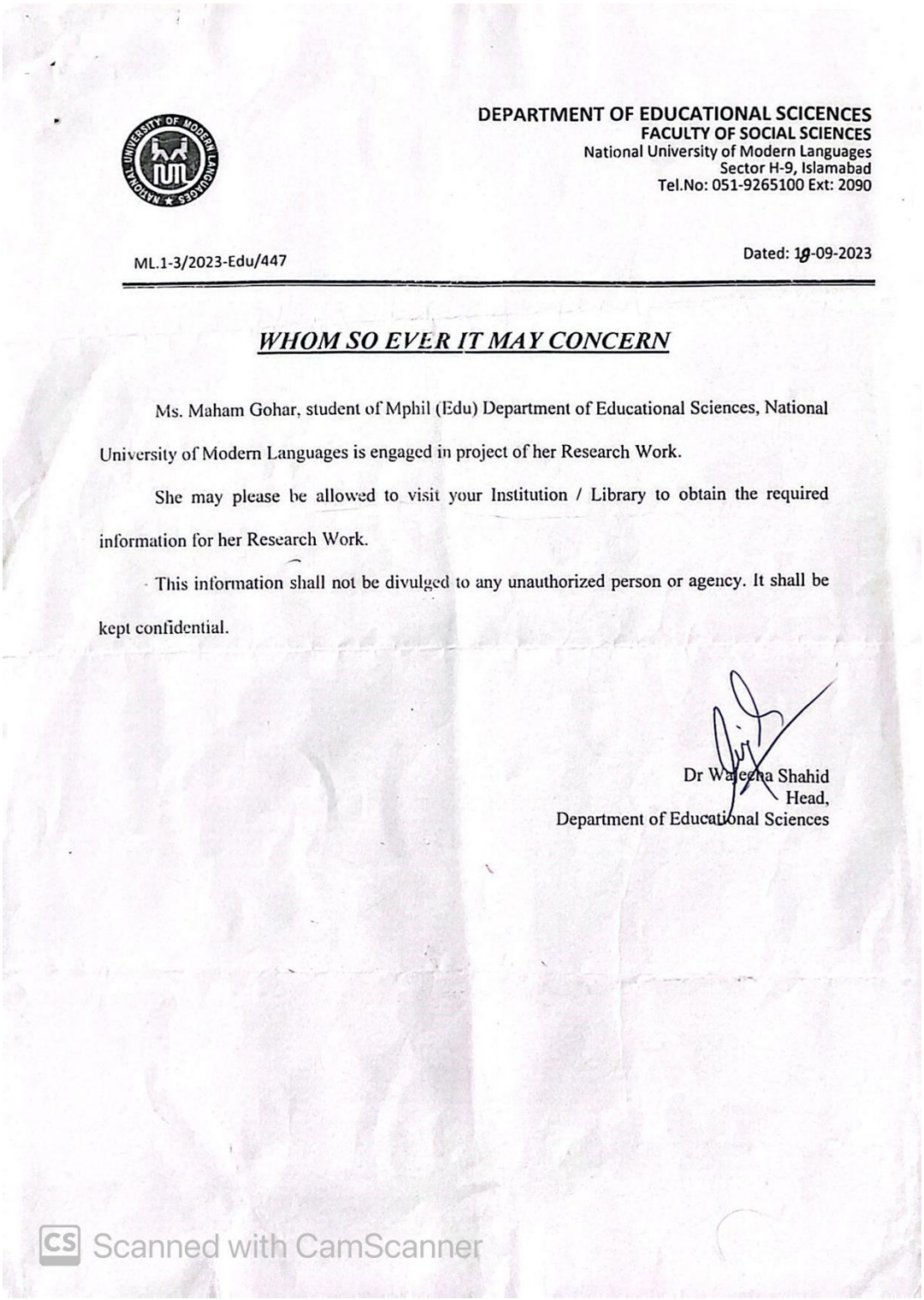
Distribution:

Ms. Maham Gohar (M.Phil Scholar)

Dr. Aisha Bibi (Thesis Supervisor)

Appendix C

Data Collection Reference Letter



DEPARTMENT OF EDUCATIONAL SCICENCES
FACULTY OF SOCIAL SCIENCES
National University of Modern Languages
Sector H-9, Islamabad
Tel.No: 051-9265100 Ext: 2090

ML.1-3/2023-Edu/447

Dated: 19-09-2023

WHOM SO EVER IT MAY CONCERN

Ms. Maham Gohar, student of Mphil (Edu) Department of Educational Sciences, National University of Modern Languages is engaged in project of her Research Work.

She may please be allowed to visit your Institution / Library to obtain the required information for her Research Work.

This information shall not be divulged to any unauthorized person or agency. It shall be kept confidential.

Dr Wareeha Shahid
Head,
Department of Educational Sciences

Appendix D

COVER LETTER FOR Validity

Letter for request for tool validation

SCIENCE TEACHER'S PERCEPTIONS AND PRACTICES ABOUT ACTIVITY BASED TEACHING AT SECONDARY SCHOOL LEVEL

Subject: Request for validity

Respected Madam/Sir,

I MahamGohar MPhil scholar at from department of Educational sciences is currently working on my research entitled: science teacher's perceptions and practices about activity based teaching at secondary school levelQuestionnaire as instrument as tool will be used in the said research. In view with this, the researcher requests you to place use of your expertise to validate the attached adopted questionnaire qualify for condition. Knowing your experience in the field of research and education, I request you to please help me in validating the said instrument before administering it to the participant of the study.

I have attached validation sheet along with the questionnaire. I will be thankful to hear your suggestions and comments for the improvement of the instrument.

I am looking forward that my request would merit your positive responses. Your positive response is highly appreciated.

Thank you.

Very truly yours,

MahamGohar

MPhil scholar, Department of Educational sciences

National University of Modern Languages,

Islamabad.

Appendix E

Sample of validity certificate

CERTIFICATE OF VALIDITY

SCIENCE TEACHERS' PERCEPTIONS AND PRACTICES ABOUT ACTIVITY BASED TEACHING AT

SECONDARY SCHOOL LEVEL

By: Maham Gohar

MPhil Scholar, Department of educational sciences, Faculty of Social sciences

National University of Modern Languages, H-9, Islamabad, Pakistan.

It is hereby certified that the tool adopted by the scholar towards his thesis has been assessed by me and I find it to have been designed adequately for data collection for students at higher education level.

It is considered that the research instrument, adopted for the above mentioned title, is according to the objectives of the research, assured adequate face and content validity according to the purpose of the research, and it may be used for data collection by the researcher with fair amount of confidence.

Name:_____

Designation:_____

Institution:_____

Signature:_____

Date:_____

Appendix F

List of expert's committee for tool validation

Sr.No.	Name of the Experts	Designation	Institution	Date
1.	Dr Farkhanda Tabassum	Assistant Professor	NUML	26-10-23
2.	Dr Jameela Ashraf	Assistanrt Professor	NUML	18-10-23
3.	Dr. Iqbal Ameen Khan	Lecturer	University of Malakand	12-10-23

Appendix G

Research Instrument Validity Certificate

Certificate of validity

SCIENCE TEACHER'S PERCEPTIONS AND PRACTICES ABOUT ACTIVITY BASED TEACHING AT SECONDARY SCHOOL LEVEL

By: MahamGohar

MPhil Scholar, Department of educational sciences, Faculty of Social sciences

National University of Modern Languages, H-9, Islamabad, Pakistan.

It is hereby certified that the tool adopted by the scholar towards his thesis has been assessed by me and I find it to have been designed adequately for data collection for students at higher education level.

It is considered that the research instrument, adopted for the above mentioned title, is according to the objectives of the research, assured adequate face and content validity according to the purpose of the research, and it may be used for data collection by the researcher with fair amount of confidence.

Name: Dr. Jameela Ashraf

Designation: Assistant Professor

Institution: NUML

Signature: _____

Date: 18/10/23

Certificate of validity

SCIENCE TEACHER'S PERCEPTIONS AND PRACTICES ABOUT ACTIVITY BASED TEACHING AT SECONDARY SCHOOL LEVEL

By: MahamGohar

MPhil Scholar, Department of educational sciences, Faculty of Social sciences

National University of Modern Languages, H-9, Islamabad, Pakistan.

It is hereby certified that the tool adopted by the scholar towards his thesis has been assessed by me and I find it to have been designed adequately for data collection for students at higher education level.

It is considered that the research instrument, adopted for the above mentioned title, is according to the objectives of the research, assured adequate face and content validity according to the purpose of the research, and it may be used for data collection by the researcher with fair amount of confidence.

Name: Dr. Farkhanda Abbasi

Designation: A/P

Institution: NUML Islamabad

Signature:

Date: 26-10-23.

Certificate of validity

SCIENCE TEACHER'S PERCEPTIONS AND PRACTICES ABOUT ACTIVITY BASED TEACHING AT SECONDARY SCHOOL LEVEL

By: Maham Gohar

MPhil Scholar, Department of educational sciences, Faculty of Social sciences

National University of Modern Languages, H-9, Islamabad, Pakistan.

It is hereby certified that the tool Self Developed by the scholar towards his thesis has been assessed by me and I find it to have been designed adequately for data collection for students at higher education level.

It is considered that the research instrument, Self Developed for the above mentioned title, is according to the objectives of the research, assured adequate face and content validity according to the purpose of the research, and it may be used for data collection by the researcher with fair amount of confidence.

Name: Dr. Iqbal Amin Khan

Designation: Lecturer

Institution: University of Malakand

Signature: _____

Date: 12/10/2023

APPENDIX H

List of Schools Included in Data

GOVERNMENT OF PAKISTAN
FEDERAL DIRECTORATE OF EDUCATION
ISLAMABAD

PROVISIONAL LIST OF EDUCATIONAL INSTITUTIONS UNDER ADMINISTRATIVE CONTROL OF FEDERAL DIRECTORATE OF EDUCATION, ISLAMABAD AS IT STOOD ON 01.04.2012

Sr.#		NAME OF THE INSTITUION	Phone	
			INSTITUION	PRINCIPAL
BOYS MODEL/SECONDARY SCHOOLS ISLAMABAD.				
1	1	Islamabad Model School for Boys (VI-X),F-6/2	9208260	
2	1	**Islamabad Model School for Boys (VI-X),F-8/3,**	9261678	
3	2	**Islamabad Model School for Boys (VI-X),PMSC, G-5**		
4	3	**Islamabad Model School for Boys (VI-X),G-6/4**	9207405	
5	4	**Islamabad Model School for Boys (VI-X),G-7/3-1**	2872466	
6	5	**Islamabad Model School for Boys (VI-X),G-8/1**	9107200	
7	6	**Islamabad Model School for Boys (VI-X),G-8/4**	9235115	
8	7	**Islamabad Model School for Boys (VI-X),G-9/1**	9262217	
9	8	**Islamabad Model School for Boys (VI-X),G-10/3**	9267052	
10	9	**Islamabad Model School for Boys (VI-X),G-11/2**	9267092	
11	10	**Islamabad Model School for Boys (VI-X),I-10/2**	4430690	
12	11	**Islamabad Model School for Boys (VI-X),I-8/4**	9235420	
13	12	**Islamabad Model School for Boys (VI-X) No.1 ,I-9/4**	4432828	
14	13	**Islamabad Model School for Boys (VI-X) No. 2, I-9/4**	4436109	
GIRLS MODEL/SECONDARY SCHOOLS, ISLAMABAD				
15	1	**Islamabad Model School for Girls (VI-X), E-8/3**	2855510	
16	2	**Islamabad Model School for Girls (I-X), E-9**		
17	3	**Islamabad Model School for Girls (VI-X), F-6/1**	9243235	
18	4	**Islamabad Model School for Girls (VI-X), F-7/2**	9102527	
19	5	**Islamabad Model School for Girls (VI-X), F-11/1**	9266260	
20	6	**Islamabad Model School for Girls (I-X), PEC G-5**	9246564	

21	7	**Islamabad Model School for Girls (I-X), PMSC G-5**	
22	8	**Islamabad Model School for Girls (I-X), UC G-5**	2601092
23	9	**Islamabad Model School for Girls (VI-X), G-6/1-3**	9208343
24	10	**Islamabad Model School for Girls (VI-X), G-6/2**	9208319
25	11	**Islamabad Model School for Girls (VI-X), G-7/1**	2202290
26	12	**Islamabad Model School for Girls (VI-X), G-7/2**	2204642
27	13	**Islamabad Model School for Girls (VI-X), G-8/2**	9235754
28	14	**Islamabad Model School for Girls (I-X), G-9/1**	2855518
29	15	**Islamabad Model School for Girls (VI-X), G-9/3**	9842605
30	16	**Islamabad Model School for Girls (VI-X), G-9/4**	2857035
31	17	**Islamabad Model School for Girls (VI-X), G-10/1**	9266249
32	18	**Islamabad Model School for Girls (I-X), G-10/3**	9266276
33	19	**Islamabad Model School for Girls (VI-X), G-11/1**	2290528
34	20	**Islamabad Model School for Girls (I-X), G-11/2**	9266194
35	21	**Islamabad Model School for Girls (VI-X), I-8/1**	9257852
36	22	**Islamabad Model School for Girls (VI-X), I-9/4**	9257536
37	23	**Islamabad Model School for Girls (VI-X), I-10/4**	4432347

APPENDIX I

Research Instrument

Serial No: ____

ACTIVITY BASED TEACHING AT SECONDARY SCHOOL LEVEL: INVESTIGATING THE PERCEPTIONS AND PRACTICES OF SCIENCE TECAHERS

Dear Respondent,

I am M.Phil scholar (Education) working on my research work on the above mentioned topic.

You are requested to fill in the questionnaire attached. The first part of the questionnaire consists

of demographic information. The remaining part of this questionnaire deals with investigating the perceptions and practices of science teachers' regarding activity based teaching at Secondary school level.

It is assured that your response will be kept confidential and will not be disclosed to any person

or authority. The questionnaire is developed to collect data for my research work only.

Maham Gohar
M.Phil Scholar (Education)
Department of Education,
National University of Modern Languages,
Islamabad, Pakistan

Part A

Activity Based Teaching Strategies

Demographic Variables

1. **Gender:** 1. Male ☐ 2. Female ☐

2. Age (Years)

1. 25-30	2. 31-35	3. 35-above

3. Subject

1.Physics	**2.Chemistry**	**3.Biology**

Please provide all the demographic information and answer all the questions as best you can on the scale from 1 to 5, with 1 being Strongly Disagree**,** 2 Disagree, 3 Undecided, 4 Agree and 5 Strongly Agree.

Sr. No.	code	Statement	SD 1	D 2	UD 3	A 4	SA 5
Brainstorming It refers to the method where teacher can ask various questions to start the instructional process.							
1	B1	Science students learn with more interest when The teacher asks them to put pictures of their unique experiences.	1	2	3	4	5
2	B2	The best way to think critically is to ask questions that are linked to science discipline.	1	2	3	4	5
3	B3	Asking questions help in fully realizing science concepts.	1	2	3	4	5
4	B4	Science students are encouraged to learn through mind-mapping.	1	2	3	4	5
5	B5	The time management of science students is disrupted through questions and answers session.	1	2	3	4	5
6	B6	Question answer sessions increase science student's confidence.	1	2	3	4	5
Hands On Activities An educational strategy that enables students to acquire knowledge by doing something practically is a hands-on activity. Students actively participate in their learning through hands-							

on activity.							
7	HA1	Studying any concept requires written practice.	1	2	3	4	5
8	HA2	Science-related hands-on experiences help students get ready for applying their knowledge in the real world.	1	2	3	4	5
9	HA3	The understanding of science students is simplified through written work.	1	2	3	4	5
10	HA4	Performing science practical's independently increase students confidence level.	1	2	3	4	5
11	HA5	Complicated science concepts are understood through hands on activities.	1	2	3	4	5
12	HA6	The making of worksheets puts extra pressure on the science teachers'.	1	2	3	4	5
Project Method With the help of a teacher, students work together in a project-based learning environment to define and address real-world problems through an extended inquiry process.							
13	PM1	Learning by doing is more effective than learning from a textbook.	1	2	3	4	5
14	PM2	Science projects connect abstract knowledge with practical world.	1	2	3	4	5
15	PM3	The best way to learn social skills are through science projects.	1	2	3	4	5
16	PM4	Science-related projects help students develop their critical thinking skills.	1	2	3	4	5
17	PM5	Performing science project teachers' presence doesn't matter.	1	2	3	4	5
18	PM6	Students need freedom while they share their knowledge about science subject.	1	2	3	4	5
19	PM7	Inventive science projects can be placed on display board to inspire them.	1	2	3	4	5
Experimentation the behavior of conducting investigations as a method, practice, or instance							
20	E1	Teacher play major role in experiment.	1	2	3	4	5
21	E2	Students are allowed to design their own science Experiments	1	2	3	4	5
22	E3	Students become more engaged and excited learners as the outcome of experiments related to studies.	1	2	3	4	5
23	E4	Students feel confident doing experiments without the teachers' presence.	1	2	3	4	5
24	E5	Students require enough time to do science experiments.	1	2	3	4	5

Research questions

How activity-based teaching influence science student's engagement during instructional process?

_____
_____
_____

How activity-based teaching practices are performed?

_____
_____
_____

What are the challenges that affect teachers' activity base teaching strategies?

_____
_____
_____

Give suggestions to improve activity base teaching practices.

_____
_____
_____

Part B

To what extent these four activity based teaching practices are performed?

Sr	Variables	Never 1	Rare 2	Sometimes 3	Often 4	Always 5
1	Brainstorming	1	2	3	4	5
2	Hands on activities	1	2	3	4	5
3	Project method	1	2	3	4	5
4	Experimentation	1	2	3	4	5

APPENDIX J

Turnitin report

National University of Modern Languages
Sector H-9, P.O. Shaigan, Islamabad
Tel : 092-051-9265100-09 Fax: 092-051-9265076
Email: info@numl.edu.pk
Web: www.numl.edu.pk

Ref. No. ML. 1-04/QEC/Tur/24

Date: June 07, 2024

Faculty of Social Sciences

Subject: **Turnitin Similarity Test Report of MPhil Thesis of Ms Maham Gohar (Educational Sciences) 1st Attempt**

This is to state that **MPhil** thesis of **Ms Maham Gohar** has been run through Turnitin software on **June 07, 2024**. Paper ID is 2397537383 and similarity index is **11%**. This is within the prescribed limit of Higher Education Commission.

The subject Turnitin similarity test report is attached for further processing, please.

Dr. Khushbakht Hina
Director
Quality Enhancement Cell

Dean/FSS

10/6/24

HOD Edu. Sciences

Dr Sumaira to disseminate.

11/6/24

APPENDIX K

Certificate of proofreading

Science Teachers' Perceptions and Practices about Activity-based Teaching at Secondary School Level

By

Maham Gohar

National University of Modern Languages, Islamabad

It is certified that research work titled "Science Teachers' Perceptions and Practices about Activity-based Teaching at Secondary School Level" conducted by Maham Gohar has been checked and proofread for language and grammatical mistakes.

Name Firdous Ahmed Shehri

Designation: Senior Assistant Professor

Institution: Bahria University, Islamabad

Signature:

Date: Jan,14 2025