Review Journal of Social Psychology & Social Works

http://socialworksreview.com

ISSN-E: 3006-4724 Volume: 3
ISSN-P: 3006-4716 Issue: 3 (July - September, 2025)

A Study of Teachers' Perception towards the Impact of Effective Use of Hands-on Activities on the Academic Performance of Lower Secondary Students in Science: Evidence from Karachi

Tariq Saeed[1], Dr. Fayyaz Ahmad Shaheen[2], Daulat Karim Dayaan[3], Dr. Muhammad Faseeh Ullah Khan[4]

1. Lecturer, Education, Govt. Degree Girls College 11-C, Karachi, Pakistan. tariqsaeed1988@gmail.com
2. Assistant Professor, Department of Education, Faculty of Social Sciences & Humanities, Hamdard University, Karachi, Pakistan. fayyaz.shaheen@hamdard.edu.pk
3. Research Scholar M.Phil., Department of Education, Faculty of Social Sciences & Humanities, Hamdard University, Karachi, Pakistan. tdkkarimi101@gmail.com
4. Assistant Professor, Nazeer Hussain University, Karachi, Pakistan. m.faseeh@nhu.edu.pk

DOI: **https://doi.org/10.71145/rjsp.v3i3.407**

Abstract

The aim of this study was to find out how lower secondary science teachers view the advantages of engaging their pupils in productive hands-on activities. Since elementary school is a critical time for scientific learners, the advancement of science and technology calls for significant changes in the way science is taught at this level. The survey approach was used to gather the data. To facilitate the survey, a questionnaire was created. 104 general science teachers working in Karachi's public and private sectors at the lower secondary level made up the study's sample. The frequencies and percentages of the responses were used to interpret the data. The nature of this research study was descriptive. Finding the most important elements and their function in the efficient use of hands-on activities was another aspect of the study. The most crucial elements in the successful implementation of hands-on activities in general science at the lower secondary level are the teacher's self-motivation and the preparation of the activities. The results of the study also indicated that the hands-on activities in the formative assessments should receive 20–25% of the possible points. Easy and straightforward tasks are meant to take precedence over ideas that are expensive or nonexistent. Based on the results, specific suggestions were made.

Introduction

The integration of hands-on activities in science education has long been recognized as a catalyst for enhancing students' conceptual understanding, critical thinking, and problem-solving abilities (Hofstein & Lunetta, 2004). In lower secondary education, particularly in contexts such as Karachi, Pakistan, where science instruction often remains dominated by rote learning and teacher-centered pedagogies (NEAS, 2014), the shift towards experiential, activity-based learning represents both a pedagogical necessity and a challenge. Hands-on activities ranging from laboratory experiments to interactive models offer students opportunities to engage directly with scientific phenomena, thereby bridging the gap between theoretical knowledge and real-world application (Abrahams & Millar, 2008). Teachers' perceptions play a pivotal role in determining the extent to which such pedagogical strategies are implemented effectively. Research indicates that educators' beliefs about the value, feasibility, and impact of hands-on learning significantly influence their instructional choices and classroom practices (Bennett et al., 2005). In the context of Karachi's lower secondary schools, these perceptions are shaped by multiple factors, including resource availability, institutional support, curriculum demands, and professional development opportunities (Aslam & Nisa, 2019). Moreover, the academic performance of students in science is not solely a function of cognitive ability but is also mediated by the quality of instructional strategies employed (Bybee, 2013). Empirical evidence suggests that when students actively participate in constructing their own understanding through guided inquiry and experimentation, their retention of scientific concepts improves, and their attitudes towards science become more positive (Freeman et al., 2014). However, in resource-constrained educational environments, the implementation of such methods often encounters systemic barriers, including inadequate laboratory facilities, large class sizes, and limited teacher training (Safwan et al., 2025). Inquiry-based science education is not a novel idea. The core of John Dewey's philosophy is the inquiry-based approach to learning, or learning by doing (Abd-El-Khalick et al., 2004). This "doing" of practical activities can be done in both controlled laboratories and the open setting of classrooms. The best way for students to comprehend scientific ideas and explanations is through real-world application. Students must have their own experiences acting in the real world in order to understand the approximate portrayal of it (Martin, 2006). As a result of this shift in approach, science classes now mostly focus on developing higher order cognitive skills through science-related activities (Hofstein & Lunetta, 2003). Hands-on activities are synonymous with terms such as materials-centered science and activity-centered science. Therefore, unlike laboratory work, hands-on activities don't always call for specialized equipment or supplies.

This study seeks to explore teachers' perceptions regarding the impact of effective use of hands-on activities on the academic performance of lower secondary science students in Karachi. By examining these perceptions, the research aims to provide insights into the pedagogical, institutional, and contextual factors that either facilitate or hinder the adoption of experiential learning approaches. The findings are expected to contribute to the discourse on science education reform in Pakistan, offering evidence-based recommendations for enhancing both teaching practices and student outcomes.

Objectives of the Study

1. The teachers' perception regarding their self-motivation and effectiveness of hands-on activities.
2. The role of planning in the effective use of hands-on activities to improve learners' skills and interest towards profession.

Research Questions

1. What is the teachers' perception regarding their self-motivation and effectiveness of hands-on activities?
2. What is the role of planning in the effective use of hands-on activities to improve learners' skills and interest towards profession?

Scope and Delimitations

Due to a lack of funding, personnel, and time, the study was restricted to all Karachi's public and private lower secondary schools.

Literature Review

Hands-on learning in science education is grounded in constructivist theory, which posits that learners actively construct knowledge through direct engagement with materials, phenomena, and problem-solving tasks (Piaget, 1972; Vygotsky, 1978). John Dewey's principle of learning by doing emphasizes that authentic experiences foster deeper understanding and retention of concepts (Dewey, 1938). In science education, this translates into laboratory experiments, model-building, and inquiry-based investigations that allow students to connect abstract theories to observable realities (Hofstein & Lunetta, 2004). International research consistently demonstrates that hands-on activities enhance conceptual understanding**,** critical thinking, and academic performance in science (Freeman et al., 2014; Tindan & Anaba, 2024). A systematic review by Tindan and Anaba (2024) synthesizing over 100 empirical studies found that students engaged in hands-on science scored significantly higher on assessments measuring both factual recall and higher-order thinking skills. Similarly, Abrahams and Millar (2008) argue that practical work not only reinforces theoretical knowledge but also improves students' attitudes towards science, making them more likely to pursue STEM-related careers. Teachers' beliefs about the value and feasibility of hands-on learning are critical determinants of its classroom implementation (Bennett et al., 2005). Educators who perceive hands-on activities as time-consuming or resource-intensive may avoid them, even when aware of their pedagogical benefits (Tanghian Laid & Adlaon, 2025). In many contexts, including Pakistan, teachers' perceptions are shaped by their own training, institutional culture, and the extent of administrative support (Aslam & Nisa, 2019). In Karachi, science education at the lower secondary level often remains dominated by lecture-based, rote-learning approaches (NEAS, 2014). A study by Aminullah et al. (2021) found that while teachers acknowledged the potential benefits of activity-based learning (ABL) for student engagement and performance, many lacked the training and resources to implement it effectively. Barriers included inadequate laboratory facilities, large class sizes, rigid curricula, and limited professional development opportunities. These constraints often lead to a reliance on textbook-driven instruction, which may hinder the development of inquiry skills and conceptual understanding.

Empirical evidence suggests a strong correlation between the effective use of hands-on activities and improved academic performance in science (Bybee, 2013; Freeman et al., 2014). In the Pakistani context, Safwan et al. (2025) highlight that when teachers integrate structured, inquiry-based activities into lessons, students demonstrate higher achievement scores and greater retention of scientific concepts. This is attributed to the active engagement of multiple cognitive processes observation, hypothesis formulation, experimentation, and reflection which collectively enhance learning outcomes. While global literature affirms the pedagogical value of hands-on science activities, there is limited empirical research focusing specifically on teachers' perceptions in Karachi's lower secondary schools. Existing studies tend to examine either student outcomes or general instructional practices, without deeply exploring how teachers' beliefs, experiences, and contextual realities influence the adoption of experiential learning strategies. This study addresses that gap by investigating the nuanced relationship between teachers' perceptions, the effective use of hands-on activities, and students' academic performance in science. The investigation came to the conclusion that there wasn't enough data to draw the conclusion that the people who designed these science teaching activities considered the connection between concepts and observables. Students can take an active role in their education by carrying out experiments on their own with science experiment kits. Their comprehension of scientific ideas is strengthened by this practical experience, which also improves their ability to solve problems. The human mind is always looking for new information. Through this quest, he aims to understand the ever-changing environment around him. In order to comprehend the different events occurring around him, he has been using all five senses. He makes an effort to systematically collect information about his surroundings by effectively using his senses and communication abilities. For this reason, he learns by making connections between different pieces of information and formulating general ideas from a systematic collection of unrelated facts. Man's meticulous approach is referred to as science (Joshi, 2005).

Methodology

Research Strategy

Because it offers a thorough and accurate image of the traits and behaviors, as well as a better knowledge and insightful information for further research, a descriptive research approach was selected as the methodology. The investigator looks into the reasons behind incidents, their effects, and their importance to the people being studied (Ogdan, R., & Biklen, S.K., 2006). For example, the purpose of this study was to understand how teachers perceived the effects of using hands-on activities effectively. Surveys were used for data collection because they are not only economical but also time-efficient.

Population and Sampling

All of Karachi's public and private general science instructors at the lower secondary level make up the population from which the samples were drawn. The easy sampling approach was used by the researcher to choose the participants for this investigation. 104 general science instructors from lower secondary public and private schools in Karachi made up the study's sample.

Instruments

The survey method was used in this study. The researcher has created a questionnaire as a study tool for this objective. Teachers who are directly involved in teaching and learning general science at the lower secondary level were asked to complete the survey. In order to facilitate the online survey, the link was also created on Google Form. The English-language questionnaire was created in an easy-to-understand manner.

Data Collection

Two data collection procedures were used by the researcher. This was carried out in order to gather sufficient and pertinent data to meet the study's research goals. With the aid of a questionnaire, the survey approach was used to gather the primary data. Tables with frequencies and percentages were used to record the data. On the other hand, the information was classified as secondary data and was obtained through library and online research. Both the literature review and chapter two of this study make use of secondary data.

Findings and Results

Table 1: *Motivational Factors*

S.#.	Items	Frequency	Percentage (%)
01.	I include hands-on activities because	62	59.6
02.	I include hands-on activities	52	50.0
03.	It is one of the major issues for me in the designing and performing hands-on activities	50	48.1
04.	The use of Hands-on activities also helped to improve grades of my students as well	50	49.0
05.	Designing Hands-on activities also helped to improve my skills and interest towards profession	61	58.56

The survey makes it abundantly evident that the majority of teachers believe that hands-on activities are a great way to teach science concepts at the lower secondary level that students will remember for a lifetime. The second-highest percentage of teachers agree that hands-on activities increase students' and teachers' interest. The poll makes it abundantly evident that the majority of teachers incorporate practical exercises into each chapter. On the other hand, the second-highest proportion of teachers fall into the group that incorporates hands-on activities once a term. Time is the biggest problem when it comes to creating and carrying out hands-on activities, followed by environmental concerns. The majority of teachers firmly concur that using hands-on activities helps students' grades as well. The second-highest percentage of teachers concur. The majority of educators firmly believe that practical exercises enhance their own abilities and enthusiasm. The second-highest percentage of teachers concur.

Table 2: *Planning Factors*

S.#.	Items	Frequency	Percentage (%)
01.	I believe that hands-on activities must be very well planned	64	61.5
02.	The hands-on activities incorporated have to be simple and easy	47	45.19
03.	The cost of hands-on activities must be as low as possible	42	40.38
04.	Assigning marks for a task related to hands-on activities is always effective	40	38.46
05.	Normally the design of my hands-on activities is equipped to strengthen	56	53.84

Every hands-on activity needs to be prepared before it is carried out, according to the majority of teachers. The second-highest percentage of teachers concur. The majority of teachers strongly feel that nearly all students are more likely to understand simple and uncomplicated tasks. The second-highest percentage of teachers concur. The majority of teachers firmly believe that while creating any hands-on activity within the constrained budget, ideas that are free or inexpensive are always beneficial. The second-highest percentage of teachers concur. The majority of educators concur that using marks for practical exercises is a useful strategy. The second-highest proportion of teachers strongly concur. The majority of teachers create their practical exercises to foster creative thinking. The second-highest proportion of teachers create their practical exercises to foster psychomotor abilities.

Discussion

Although the survey makes it abundantly evident that hands-on activities are very beneficial in teaching lower secondary students lifelong science principles, it is also thought that the best usage of hands-on activities fosters both teacher and student enthusiasm. Along with many other advantages, it also raises teachers' interest and ability levels. A teacher becomes involved, which fosters curiosity and interest in the subject matter as well as in the profession. The teacher's self-motivation, hands-on activity planning, and technical skills were found to be indicators of the best utilization of hands-on activities in scientific literacy. Teachers primarily employ creative thinking in hands-on activities because they are a useful tool for developing higher order thinking skills.

The data also makes it clear that every hands-on activity needs to be meticulously prepared before being created or carried out. Before implementing their activities in the classroom, not all teachers conduct pilot testing. A lot of teachers do it periodically. Others, however, never test their actions. In order to maximize the intended goals from practical exercises, prior testing always increases confidence and precision. Science coordinators must conduct and thoroughly inspect all hands-on activities beforehand. Easy and straightforward tasks are meant to take precedence over ideas that are expensive or nonexistent. Students are encouraged to participate in hands-on activities when they receive marks for the activity-based learning evaluation. Any low-cost or no-cost notion is always beneficial when creating any hands-on activity inside the constrained financial framework. When creating the hands-on activity, consideration must be given to material reuse and recycling. In addition to saving money, it will teach them to value things and refrain from being extravagant for the rest of their lives.

The aforementioned explanation makes it abundantly evident that experiential science learning activities are beneficial to children of all learning styles, even those in primary school. These activities can significantly boost students' motivation to learn science when compared to typical science instruction.

Recommendations

To completely understand this study, further empirical data is needed. Research utilizing quantitative methods and thorough examination of the several components that were determined to be most relevant in this study can yield this type of confirmation. Interest-related variables, such as instructor and student motivation, may be investigated. On the other hand, planning elements such as the frequency and length of hands-on activities can be researched to learn more about them. Using practical exercises for various evaluation methods could lead to new discoveries.

Conclusion

The study's conclusions made it abundantly evident that formative assessments must be linked to practical exercises. The assessments' hands-on activities may receive 20–25% of the possible points. Every science chapter at the lower secondary level needs to be connected to a practical exercise. Science programs in elementary schools should include more hands-on activities. The current study's scope was limited. Further research in this area is necessary to provide a more comprehensive understanding of the problem. Allowing students to design some of their own experiments (student-centered activities) is crucial to ensuring that they do more than simply follow their teachers' instructions.

References

Abd-El-Khalick, et al., (2004). Inquiry in science education: International perspectives. *Science Education*, 88, 397–419.

Abrahams, I., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education*, *30*(14), 1945–1969. https://doi.org/10.1080/09500690701749305

Aminullah, H., Kang, M. A., & Saeed, A. (2021). Impacts of activity-based teaching in science subjects in secondary private schools of Karachi in the context of John Dewey's theoretical perspectives. *Pakistan Journal of Social Research, 3*(4), 526–534.

Aslam, R., & Nisa, N. (2019). Perceptions and practices of science teachers about professional development at secondary school level: A phenomenological study. *International Journal of Academic Pedagogical Research, 3*(9), 9–15.

Bennett, J., Lubben, F., & Hogarth, S. (2005). A systematic review of the effects of context-based and science-technology-society (STS) approaches in the teaching of secondary science. *Research in Science & Technological Education, 23*(3), 347–369. https://doi.org/10.1080/02635140500266457

Bybee, R. W. (2013). *The case for STEM education: Challenges and opportunities*. STA Press.

Dewey, J. (1938). *Experience and education*. Macmillan.

Freeman et al., (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences, 111*(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

Hofstein, A. & Lunetta, V. N. (2003). The laboratory in science education: Foundations for the twenty-first century. *Wiley Interscience*, 88, 28-54.

Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science Education, 88*(1), 28–54. https://doi.org/10.1002/sce.10106

Joshi, S. R. (2005). *Teaching of science*. New Delhi: APH.

Martin, D.J. (2006). *Elementary Science Methods: A Constructivist Approach.* Belmont, CA: Thomson Wadsworth.

National Education Assessment System (NEAS). (2014). *National assessment report 2014*. Government of Pakistan.

Ogdan, R., & Biklen, S.K., (2006). *Qualitative Research for Education: An Introduction to Theories and Methods. 5th ed.* London, UK: Pearson.

Piaget, J. (1972). *The psychology of the child*. Basic Books.

Safwan, S., Shaheen, F. A., Zaidi, S. J. A., & Siddiqui, S. (2025). Exploring determinants of teacher performance in Karachi's private secondary schools: The roles of subject mastery, organizational leadership, experience, and communication skills. *Discover Education, 4*, 244. https://doi.org/10.1007/s44217-025-00682-5

Safwan, S., Shaheen, F. A., Zaidi, S. J. A., & Siddiqui, S. (2025). Exploring determinants of teacher performance in Karachi's private secondary schools: The roles of subject mastery, organizational leadership, experience, and communication skills. *Discover Education, 4*, 244. https://doi.org/10.1007/s44217-025-00682-5

Tanghian Laid, S. M., & Adlaon, M. S. (2025). A systematic review of innovative teaching strategies in science: Exploring hands-on learning, technology integration, and student-centered approaches. *Applied Sciences and Education, 4*(2), 101–114. https://doi.org/10.53623/apga.v4i2.645

Tindan, T. N., & Anaba, C. A. (2024). Scientific hands-on activities and their impact on academic success of students: A systematic literature review. *IOSR Journal of Research & Method in Education, 14*(6), 39–47.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.