Environment and Social Psychology (2025) Volume 10 Issue 12
doi: 10.59429/esp.v10i12.3232

ISSN: 2424-8975 (O)
2424-7979 (P)

RESEARCH ARTICLE

Harnessing Science Teaching Strategies for the Least-Exposed Learners in Science Real-Life Settings

Aldrex A. Barrientos*

University of Antique, Tario-Lim Memorial Campus, Tibiao, Antique, 5707, Philippines

*** Corresponding author:** Aldrex A. Barrientos; barrientosaldrex@gmail.com

ABSTRACT

Teaching advanced science concepts to learners with limited exposure to real-life scientific applications remained a persistent challenge in science education. Learners who lacked meaningful engagement with real-world contexts often experienced difficulty understanding abstract scientific concepts. This study examined the learning characteristics of least-exposed learners in science and identified instructional strategies used to support learning in real-life settings. A qualitative descriptive-exploratory design was employed, utilizing semi-structured interviews with twenty higher education science educators from the Philippines, selected through purposive sampling. The participants, consisting of both male and female faculty members from public and private universities, had direct experience teaching students with limited exposure to advanced science concepts. The data were analyzed using thematic analysis to identify recurring patterns related to learner characteristics and teaching strategies. The findings revealed that least-exposed learners struggled with abstract understanding, relied heavily on memorization, and demonstrated limited curiosity toward scientific topics. Educators reported that hands-on experiments, problem-based learning, technology integration, and collaborative learning enhanced student engagement, real-world problem-solving skills, and retention of scientific knowledge. The study concluded that grounding science instruction in real-life contexts and employing student-centered strategies improved the accessibility and relevance of advanced science concepts for least-exposed learners, thereby supporting more inclusive and meaningful science learning experiences in higher education.

Keywords: Harnessing; Science; Teaching Strategies; Least-Exposed Learners; Science Real-Life Settings

1. Introduction

Teaching advanced science to students with minimal exposure presents one of the major challenges in modern education. Scientific topics are often complex, and the gap in foundational knowledge that educators must bridge while making these topics engaging and accessible poses a significant challenge [1]. Traditional teaching methods are not sufficient for those students who lack prior exposure to science, creating barriers of understanding and interest for students [2]. To solve this problem, new teaching methods that focus on real-life applications of science are being utilized and have the potential to enhance learning experiences for unexposed learners [3-4]. This can be done by creating interactive context-dependent lessons, representing a real-life situation where otherwise inaccessible content will be connected by the teacher to the learner's

ARTICLE INFO
Received: 14 November 2025 | Accepted: 21 December 2025 | Available online: 31 December 2025

CITATION
Barrientos AA. Harnessing Science Teaching Strategies for the Least-Exposed Learners in Science Real-Life Settings. *Environment and Social Psychology* 2025; 10(12): 3232 doi:10.59429/esp.v10i12.3232

environment.

One of the most critical approaches for making science relevant to all learners is problem-based learning. One of the most critical approaches for making science relevant to all learners is problem-based learning (PBL). PBL is a student-centered instructional approach grounded in constructivist learning theory, where learners actively construct knowledge by solving real-world problems. In this approach, students engage in authentic problem-solving tasks that encourage deeper understanding, critical thinking, and meaningful learning experiences. In fact, research shows that PBL is very effective for learners who have limited background science knowledge. It gets the learners active and helps them build foundational understanding of scientific concepts [5]. The approach shows the importance of contextualizing science, rendering abstract ideas more tangible and accessible.

Another way to educate a novice is to use digital media, simulations, and graphics, which make scientific abstract terms more understandable. These provisions fill in a gap for students who lack backgrounds in more complicated material [6]. Experience can be developed through digital means and virtual labs wherein one can safely do experiments and witness results in a simulated environment [7]. Research has also shown that students involved in virtual labs retain the information much better and apply it in real-life situations. These technologies help not only gather and analyze data but also provide students with a door to much wider learning opportunities [8]. Using digital tools, educators can design vibrant and interactive learning spaces, more preferable to the technologically savvy generations of today.

Mentorship and collaborative learning are crucial components in teaching complex scientific concepts to naïve learners. When students work in groups or under the guidance of mentors, they are exposed to diverse perspectives and gain valuable insights through collaborative peer interactions [9]. Anchored in the Zone of Proximal Development theory emphasizes that learners particularly those who are inexperienced in handling complex scientific material learn more effectively when supported through scaffolding provided by more knowledgeable peers or teachers. Such support fosters a sense of belonging and confidence, encouraging learners to become more actively engaged in the learning process. Moreover, instructional strategies such as project-based learning and group discussions allow educators to create differentiated learning experiences that help students build on their strengths, ultimately supporting deeper scientific understanding and interpersonal development [10].

The overarching goal of these teaching strategies Is to enable students with limited exposure to science to engage meaningfully with advanced scientific content. Fostering inclusive learning environments that emphasize the real-world applications of science, teachers can help learners recognize the relevance of scientific concepts in their everyday lives [11]. Students who perceive science as understandable and applicable are more likely to pursue further studies in scientific fields and contribute to the development of a scientifically literate society [12]. Through approaches such as problem-based learning (PBL), digital simulations, mentorship, and collaborative learning, educators can significantly improve access to advanced science education and support equitable learning opportunities for all students.

Another effective instructional approach is inquiry-based learning, which promotes active exploration and discovery of scientific concepts. This method encourages teachers to pose thought-provoking questions and guide students through investigative activities and experiments, thereby stimulating curiosity, independent thinking, and deeper conceptual understanding [13]. Inquiry-based learning not only increases student engagement but also clarifies the relevance of science to real-world contexts and everyday decision-making [14]. When combined with hands-on activities, collaborative learning, and technology-integrated strategies, inquiry-based instruction provides richer educational experiences for unexposed learners. These integrated approaches foster both a sustained interest in science and adequate preparation for future academic and professional pursuits in an increasingly complex and science-driven world [15].

2. Literature

In recent years, the world of education has recognized the significance of using effective science teaching methodologies targeted to unexposed learners, particularly in advanced science real-world situations. It represents a larger realization that conventional teaching approaches frequently fail to engage students who have not had a solid education in science. For unexposed students to interact with advanced science in real-life situations, effective science teaching techniques are essential. According to Gholam & Petro[16], children who have never been exposed to complex scientific topics before can fill in knowledge gaps in science through active, inquiry-based learning. Students gain the most from teaching strategies that actively engage them and promote inquiry and discovery. Particularly, inquiry-based learning promotes students' own investigation of scientific concepts, which builds their resilience and sense of independence in comprehending difficult subjects. Teachers can also make the content more relevant by utilizing real-world contexts to teach, which makes scientific concepts less abstract and more approachable [17]. As a result, teachers are using more and more creative teaching techniques that accommodate a variety of learning settings and encourage a deeper understanding of scientific ideas.

The idea of student-centered learning, which emphasizes active participation over passive information intake, has given rise to one important framework. Encouraging students to take part in practical investigations, this method develops critical thinking skills and a sincere interest in science. Students' understanding is deepened when they are able to connect abstract theories to real-world experiences through laboratory exercises or fieldwork. According to research by Garil [18], students who get experiential science instruction are more likely to apply scientific ideas practically in addition to having greater memory retention. For unexposed learners, who might ordinarily find it difficult to relate theory to practical application, this is very helpful [19]. Teachers have discovered that giving students the freedom to work with materials and carry out experiments improves their comprehension of scientific concepts and promotes inquiry outside of the classroom. Students who have had little exposure to scientific material benefit from this kind of active engagement, which also gives them a sense of agency over their education.

In order to help unexposed learners, understand science, peer teaching and collaborative learning are also essential. According to studies, social connection fostered by collaborative learning can result in a shared understanding and deeper cognitive engagement with the subject matter [20]. Students can clarify difficult ideas to one another through peer teaching, which helps their classmates and strengthens their own comprehension. The advantages of cooperative learning settings, where peer interactions promote deeper conversations and widen viewpoints on scientific subjects, are highlighted by research. Group projects allow students to benefit from one another's expertise and experiences, weaving a complex web of cooperative learning that strengthens their comprehension of challenging scientific ideas. Since it builds a network of support that encourages a sense of inclusion and belonging in the classroom, this approach is well suited to the needs of unexposed learners. In addition to enhancing subject comprehension, this mutual process fosters a sense of belonging and support among students [21].

Another effective teaching method is scaffolding, particularly for difficult scientific subjects [22]. As students become proficient, teachers can progressively lessen their support by breaking down complex scientific concepts into digestible steps. These methods enable unexposed students to grasp basic ideas before taking on more complex subjects on their own. According to Verstegen et al [23], scaffolding gives pupils competence and confidence, enabling them to tackle difficult scientific content without feeling overburdened. Scaffolding serves as a bridge in this way, assisting students as they progress from rudimentary to sophisticated scientific knowledge. Incorporating technology into science instruction is essential for improving student comprehension and engagement. According to studies, students can investigate intricate scientific processes in an engaging and approachable way by using digital tools and virtual simulations [24]. In addition to offering chances for experimentation, this technology-rich approach gets pupils ready for a future in which technological literacy will be crucial. Teachers can bridge the gap between theoretical knowledge and real-world application by utilizing these resources to create engaging learning experiences.

Relating science classes to students' cultural backgrounds can greatly increase unexposed learners' involvement. Verdeflor [25] asserts that culturally responsive scientific instruction enables teachers to simplify difficult subjects in ways that are applicable to students' daily lives. For instance, utilizing environmental problems that impact students' communities as case studies might encourage curiosity about science [26]. Students are more inclined to comprehend and interact with complex scientific subject when they can directly observe how science affects their life. This method not only improves understanding but also gives students the confidence to see science as a useful instrument for solving problems in the real world. the need to modify science teaching methods in order to successfully involve students who have not been exposed to sophisticated science. Wang and Zhang [27] revealed that teachers may establish more inclusive and productive learning environments by utilizing student-centered approaches, inquiry-based methodology, technological integration, and collaborative learning opportunities. These techniques foster a lifelong love of learning and scientific inquiry in addition to improving students' comprehension of scientific concepts.

3. Methodology

3.1. Research design

This study employed a descriptive-exploratory approach to both describe and analyze the phenomena under investigation. The exploratory design is helpful in this study as it enables great understanding of participants' experiences. Using this approach, the study was able to gain deeper insights into the subject matter, enabling the researchers to explore various dimensions and nuances of the experiences being examined [28].

3.2. Population and sampling

The participants of the study consisted of twenty science educators from the Philippines, selected through purposive sampling. The respondents were higher education faculty members teaching science-related courses and had direct experience handling learners with limited exposure to advanced science concepts in real-life settings. The participants included both male and female teachers and were employed in both public and private universities. This diversity of institutional affiliation and teaching background provided a broader perspective on instructional strategies used for least-exposed learners. This selection was suitable because it engaged targeted intentional sampling toward subjects who have particular characteristics or experience relevant to the topic of the research. In this case, the aim was to gather insights from teachers who have experience in teaching science and technology to learners with limited exposure to advanced scientific content, particularly in real-life settings.

According to Chavez and Del Prado [29], purposive sampling is the most common procedure in qualitative research processes that gather subjects who can supply more pertinent and detailed information about the research being undertaken. Focusing on teachers who meet these criteria, the study ensured that the data collected would be especially rich and useful for exploring the strategies that can best support unexposed learners in science education.

3.3. Instrument

To gather data, the study employed an interview guide containing a series of carefully crafted questions. Table 1 outlines the specific interview questions used during the study. An interview, as described by Knott et al. [30], is a qualitative research method in which participants are asked a series of open-ended questions to explore their personal experiences, perspectives, concerns, and aspirations.

For this study, semi-structured interview questions were developed to encourage meaningful dialogue with the respondents. Semi-structured interviews allow researchers to delve deeper into particular topics of interest, while also offering participants the freedom to share their personal stories and experiences in a way that is relevant to the study [31]. This interview format provides the flexibility to explore both specific research questions and broader, unanticipated themes, ensuring that the conversation remains focused on the study's objectives while allowing for organic discussion [32].

Table 1. Interview Questions.

Objectives	Interview Questions
1. Identify learning characteristics of learners with the least exposure to science in real-life settings.	1. What do you observe about the learning characteristics of your learners who are less exposed to science in real-life settings? Discuss their learning characteristics. 2. What are the differences between students who are more exposed to real-life applications of science and technology versus those who are less exposed to them? Explain further.
2. Determine teaching strategies for learners who are least exposed to science in real-life settings.	1. What is the importance of teaching and learning in exposing your learners to advanced science in real-life settings? Elaborate further. 2. What are your experiences in terms of teaching the students who are exposed to real-life applications of science and technology versus those who are not exposed to them? Explain further. 3. What teaching strategies do you use for students who are not exposed to advanced science in real-life settings? Explain each teaching strategy you used.

3.4. Data gathering procedure

Prior to participating in the study, all respondents were provided with a consent letter outlining the purpose and scope of the research. The interviews were conducted face-to-face, following a semi-structured interview guide. Before beginning the interview, participants were given clear instructions regarding the process. They were encouraged to ask any questions to ensure they fully understood the procedure, and clarification was provided as needed.

The method of data collection allowed for different approaches to documenting responses. According to Taherdoost [33], there are various ways to record interview data, each with its advantages and challenges. These include using recording devices (which require explicit consent from the participants), taking notes during the interview (which might distract the interviewer or miss key points), or recording responses after the interview (which could lead to overlooked details). In this study, the interviewer used a combination of note-taking and audio recording to capture responses.

3.5. Data analysis

The primary data for this study were derived from narratives gathered through one-on-one interviews. Narrative data is a form of qualitative data that captures individuals' personal stories, experiences, or descriptive accounts [34]. These narratives were analyzed for recurring themes, allowing the researchers to explore the context of participants' experiences and interpret the data in relation to the research questions.

To analyze the narrative data, this study applied thematic analysis. Thematic analysis is a widely used qualitative research method aimed at identifying and examining patterns or themes within data sets, helping to uncover deeper meanings and interpretations [35]. This method provides a systematic framework for extracting codes and themes from qualitative data, making it a flexible and comprehensive approach for analysis [36].

4. Results

Research Objectives 1. Identify learning characteristics of learners not exposed to advanced science real-life settings.

Question No. 1. What do you observe about the learning characteristics of your learners who are least exposed to science in real-life settings? Discuss their learning characteristics.

1.1 *Abstract understanding*

Ten respondents indicated that learners with limited exposure to real-life science experiences often encounter difficulty in forming meaningful conceptual understanding. Rather than recognizing science as a practical and applicable discipline, students tend to perceive it as theoretical and distant, which limits their ability to internalize scientific ideas. This abstract perception of science hinders students' capacity to make conceptual connections between classroom content and their lived experiences, resulting in reduced engagement and comprehension. The respondents further suggested that without concrete reference points, learners struggle to visualize scientific processes, making it challenging for them to construct mental models necessary for deeper understanding. As a result, science learning becomes a task of information reception rather than an active process of sense-making.

> "I think many of my students struggle to grasp scientific concepts without practical examples, often viewing science as disconnected from daily life. This lack of connection can make it difficult for them to engage meaningfully with the material and to appreciate the relevance of science in their everyday experiences."

> "I believed that students often view science as abstract and detached from their everyday lives. They emphasize that when students can't relate concepts to familiar experiences, their engagement and understanding suffer."

1.2 Reliance on Memorization

Four respondents emphasized that students with minimal exposure to applied science frequently resort to rote memorization as a primary learning strategy. This tendency reflects a surface-level approach to learning, where students prioritize recalling information rather than understanding underlying scientific principles. Such reliance on memorization limits learners' ability to transfer knowledge to unfamiliar or real-world situations, particularly when faced with application-based or problem-solving tasks. The respondents noted that this approach often results in fragmented knowledge, as students struggle to integrate concepts across topics. Over time, excessive dependence on memorization may reduce learners' confidence in tackling complex questions and contribute to passive classroom participation, as students become hesitant to engage in analytical or inquiry-based activities.

> "Many of my students exhibit a preference for memorizing facts over understanding underlying principles, leading to challenges when faced with application-based questions."

> "I observed that when my students focus solely on memorization, they often disengage from the material. This lack of engagement can create a passive learning experience, where students do not take ownership of their education."

1.3 Limited curiosity

Six respondents reported that reduced curiosity was a common characteristic among learners who lacked exposure to meaningful scientific applications. This limited curiosity appeared to be closely associated with students' perception of science as irrelevant to their personal lives and future aspirations. When learners fail to see the value or usefulness of scientific concepts beyond academic requirements, their motivation to explore, question, and investigate diminishes. The respondents observed that this lack of curiosity often manifests in minimal classroom interaction, fewer questions, and limited initiative to seek additional information. Consequently, learning becomes teacher-directed rather than learner-driven, restricting opportunities for deeper engagement and sustained interest in scientific inquiry.

> "Many of my students show reduced curiosity about scientific topics, which may stem from a lack of exposure to engaging real-world applications. This disinterest can lead to a passive approach to learning, where their students are less likely to ask questions or seek out additional information."

> "When science is presented in a way that it feels irrelevant to their lives, it diminishes their motivation to explore and understand the subject matter more deeply."

Question No. 2. What are the differences between students who are exposed to real-life applications of science and technology versus those who are less exposed to them? Explain further.

2.1 Engagement and Motivation

Eight respondents emphasized that exposure to real-world science applications significantly influenced students' levels of engagement and motivation in the classroom. Learners who were able to connect lesson content to authentic experiences demonstrated heightened interest and willingness to participate in academic discussions. This engagement extended beyond passive listening, as students actively contributed ideas, posed questions, and related scientific concepts to familiar situations. In contrast, students who lacked such exposure were often described as less motivated and more task-oriented, focusing primarily on completing academic requirements rather than developing genuine interest in the subject. The respondents' observations suggested that contextualized learning experiences played a critical role in transforming science from a compulsory subject into a meaningful and motivating learning experience.

> "Students who experience real-world applications are far more engaged in lessons. They see the relevance of what they're learning and are excited to participate. In contrast, students without this exposure often seem indifferent, viewing science as just another subject to pass."

> "In my experience, students involved in projects related to their communities like environmental studies or local technology initiatives are much more active in class discussions. They come in with questions and insights because they can relate to the material."

2.2 *Real-World Problem Solving*

Three respondents noted that students who encountered real-world scientific scenarios were better equipped to analyze and address issues affecting their communities. These learners demonstrated an increased capacity to apply scientific reasoning when discussing environmental concerns and technological challenges. Exposure to community-based projects allowed students to recognize the practical implications of scientific knowledge, fostering a sense of responsibility and awareness of societal issues. In contrast, learners without real-world exposure often struggled to see the relevance of scientific concepts beyond the classroom, limiting their ability to transfer theoretical knowledge to practical contexts. The findings indicated that real-world problem-solving experiences strengthened learners' analytical skills by situating science within meaningful, community-relevant situations.

> "Students exposed to real-world scenarios often show an ability to tackle problems that affect their communities. They engage in discussions about environmental issues or technological innovations. Those without such exposure may find it challenging to connect their learning to real-world issues."

> "When students participate in projects related to local environmental challenges, like pollution or conservation, they can see the direct impact of science on their community. This helps them connect theoretical knowledge to practical applications, enhancing their understanding."

2.3 Long-Term Retention of Knowledge

Nine respondents highlighted that students who engaged with science through real-life applications exhibited stronger long-term retention of scientific concepts. Experiential learning opportunities enabled learners to internalize information by observing and applying concepts in authentic contexts, rather than merely recalling facts for assessments. This type of learning reinforced conceptual understanding, allowing students to recall and apply knowledge over extended periods. In contrast, students who relied primarily on memorization were more likely to experience rapid knowledge decay after examinations. The respondents' accounts suggested that sustained retention was closely linked to active involvement and experiential learning, which supported deeper cognitive processing and meaningful learning outcomes.

> "Students who apply their learning in real-life contexts tend to retain information longer. They can recall concepts because they've seen them in action. Meanwhile, students who only memorize information for tests often forget it shortly after."

> "When students engage in hands-on experiments or projects, they not only learn the theory but also see how it works in practice. This experiential learning makes the information stick. Those who only memorize for tests often struggle to recall anything meaningful afterward."

Research Objectives 2. Determine teaching strategies for learners not exposed to advanced science in real-life settings.

Question No. 1. What is the importance of teaching and learning by exposing your learners to advanced science in real-life settings? Elaborate further.

1.1 Real-World Problem Solving

Twelve respondents emphasized that exposure to advanced, real-world scientific challenges played a crucial role in developing learners' ability to address complex societal issues. Such exposure encouraged students to engage with science beyond theoretical discussions by situating learning within authentic social and environmental contexts. Through these experiences, learners were required to evaluate information critically, assess the credibility of data sources, and make evidence-based judgments. These skills were viewed as essential not only for academic success but also for responsible citizenship, particularly when addressing multifaceted issues such as climate change and public health. The respondents' insights suggested that real-world problem-solving experiences fostered a more analytical and socially responsive approach to learning science.

> "Students exposed to advanced real-world challenges learn to tackle issues that affect society, like climate change or public health. This not only enhances their problem-solving skills but also encourages them to think about their role in making a difference."

> "Working on societal challenges pushes students to critically analyze data and information sources. They learn to evaluate credibility and make informed decisions based on evidence, which is essential in addressing issues like public health."

1.2 *Relevance to Future Careers*

Eight respondents highlighted that connecting science instruction to real-world applications enhanced students' awareness of potential career pathways in STEM-related fields. Exposure to advanced scientific settings allowed learners to better understand the practical skills and competencies required in professional environments, making academic learning more purposeful and goal-oriented. Hands-on projects and experiential learning opportunities enabled students to contextualize classroom knowledge within professional practices, helping them envision themselves in future scientific or technological roles. This alignment between academic content and career relevance was perceived as a motivating factor that encouraged learners to consider long-term engagement in science-related professions.

> "Students are more likely to pursue STEM careers when they understand the real-world applications of their studies. Exposure to advanced settings gives them a glimpse into potential career paths and the skills required, making their education feel more purposeful."

> "When students participate in hands-on projects or internships, they gain firsthand experience of what working in a STEM field looks like. This exposure helps them visualize themselves in those roles, making them more likely to pursue similar paths."

Question No. 2. What are your experiences in terms of teaching the students who are exposed to real life application of science and technology versus those who are not exposed to them? Explain further.

Engagement Levels

Six participants described clear differences in classroom engagement between students who were exposed to real-life applications and those who were not. Learners with experiential exposure demonstrated higher levels of participation, curiosity, and initiative, often extending their learning beyond required coursework. These students were more inclined to take responsibility for their learning, as they perceived the content to be meaningful and relevant. In contrast, students without such exposure tended to exhibit passive learning behaviors, relying heavily on external motivation to complete academic tasks. The respondents' experiences suggested that authentic learning contexts significantly influenced students' intrinsic motivation and sustained engagement.

> "I've noticed that students exposed to real-life applications are far more engaged in lessons. They ask questions, participate actively, and often go beyond the curriculum. In contrast, students who aren't exposed to these applications tend to be passive learners, simply trying to get through the material."

> "Students who engage in real-world projects often display a higher level of intrinsic motivation. They take ownership of their learning because they see its relevance, while students who only focus on textbook material often need external motivation to stay engaged."

Critical Thinking Skills

Nine participants observed that real-world problem-solving experiences contributed substantially to the development of learners' critical thinking skills. Engaging with authentic problems required students to analyze data, evaluate multiple perspectives, and apply theoretical knowledge to practical situations. This process encouraged deeper cognitive engagement and creative reasoning. Conversely, students who primarily relied on textbook-based instruction were often less equipped to transfer knowledge to unfamiliar contexts. The findings indicated that exposure to real-life scientific challenges supported higher-order thinking by requiring learners to move beyond memorization toward analytical and applied reasoning.

> "I've seen that students engaged in real-world problem-solving develop better critical thinking skills. They learn to analyze data and think creatively to find solutions. In contrast, students who focus on textbook learning often lack the ability to apply knowledge in practical situations."

> "When students tackle real-world problems, they have to apply theoretical concepts in practical ways. This application deepens their understanding and allows them to see the relevance of what they've learned, unlike when they simply memorize facts from textbooks."

Collaboration Skills

Five participants reported that collaborative, real-world projects played an important role in enhancing students' teamwork and communication skills. Working in group settings exposed learners to diverse viewpoints, requiring them to negotiate ideas, share responsibilities, and collectively solve problems. These interactions fostered respect for differing perspectives and strengthened interpersonal competencies essential for scientific collaboration. In contrast, students who engaged mainly in individual, traditional assignments had fewer opportunities to develop these collaborative skills. The respondents' accounts suggested that real-life, group-based learning experiences were instrumental in preparing learners for collaborative environments in both academic and professional contexts.

> "Students who work on group projects that relate to real-life scenarios often improve their collaboration skills. They learn to communicate effectively and appreciate diverse perspectives. In contrast, students who work independently on traditional assignments may struggle with teamwork."

> "Real-world projects bring together students with varied backgrounds and viewpoints. This diversity encourages them to appreciate different perspectives and ideas, enhancing their ability to think critically and creatively as a group."

Question No. 3. What teaching strategies do you use to students who are not exposed to advanced science real-life settings? Explain each teaching strategy you used.

Hands-On Experiments

Three participants described hands-on experimentation as a core strategy for supporting learners with limited exposure to real-world science. These activities provided students with concrete experiences that helped translate abstract scientific ideas into observable phenomena. Directly engaging with materials and processes, learners were able to develop a more tangible understanding of scientific principles. The participants noted that such experiential learning environments encouraged exploration and inquiry, enabling students to move beyond passive reception of information. Hands-on experiments also served as an entry point for learners to develop foundational scientific skills, such as observation, prediction, and interpretation, even in resource-limited settings.

> "I incorporate hands-on experiments that allow students to see scientific principles in action. For instance, we conduct simple chemistry experiments to illustrate reactions. This experiential learning helps them connect theory to practice, even in a limited setting."

> "Hands-on activities spark students' curiosity. They become more engaged when they can physically interact with materials, leading them to ask questions and explore concepts beyond the basic curriculum."

Problem-Based Learning

Ten participants identified problem-based learning as an effective approach for helping students connect scientific concepts to real-life contexts. Presenting learners with authentic community-related issues, this strategy encouraged students to apply scientific reasoning to meaningful situations. The participants emphasized that engaging with real-world problems promoted deeper cognitive processing, as students were required to analyze situations, consider multiple solutions, and justify their ideas using scientific evidence. This approach also strengthened students' sense of relevance and responsibility, as learning activities were directly linked to issues affecting their immediate environment. Problem-based learning thus supported both conceptual understanding and active participation in the learning process.

> "I present students with real-world problems and guide them to find solutions. For example, we might discuss local environmental issues and brainstorm potential science-based solutions. This encourages critical thinking and connects learning to their community."

> "When students work on real-world problems, such as local pollution or recycling initiatives, they see the immediate relevance to their lives. This connection increases their investment in the learning process and motivates them to engage more deeply with the material."

3.3 Integrating Technology

Seven participants reported integrating technology as a means of compensating for students' limited access to advanced scientific environments. Digital tools, simulations, and educational applications allowed learners to visualize complex processes that may not be feasible to observe directly. The use of technology also supported data collection and analysis, enabling students to engage in scientific practices commonly used in modern research settings. Participants highlighted that technology-enhanced instruction helped develop students' data literacy and analytical skills while maintaining high levels of engagement. Through these tools, students were able to experience aspects of real-world scientific inquiry within a classroom context.

> "I incorporate technology through tools like interactive simulations and educational apps that simulate real-world scientific processes. This not only makes learning more engaging but also exposes students to modern scientific practices."

> "I encourage students to use digital tools for collecting and analyzing data, such as using apps to measure temperature or pH levels during experiments. This hands-on experience with technology builds their data literacy and analytical skills."

5. Discussion

Objective 1. Identify learning characteristics of learners who are less exposed to science in real-life settings.

The study reveals that many students struggle to grasp scientific concepts without practical examples, often viewing science as disconnected from daily life. This finding aligns with existing research that emphasizes the importance of connecting science to real-world applications. Jiménez-Valverde [37] suggests that incorporating real-world scenarios into science education can bridge the gap between theoretical knowledge and practical application, making science more relatable and engaging for students. Therefore his notion, advocating for the use of real-world examples and hands-on activities to make abstract scientific concepts more accessible and meaningful.

The study's participants note that many students exhibit a preference for memorizing facts over understanding underlying principles. This reliance on rote memorization often results in difficulty when they need to apply their knowledge to real-world scenarios. This finding aligns with research on the limitations of rote learning. Dwyer [38] emphasizes the need for deeper understanding and critical thinking skills, which are often lacking when students rely solely on memorization. Blyznyuk and Kachak [39] further highlights the importance of engaging students in active learning activities that encourage critical thinking and problem-solving skills. Participants show concern about the limited curiosity of students who have not been exposed to engaging real-world applications of science. This lack of curiosity can lead to a passive approach to learning, where students are less likely to ask questions or seek out additional information. suggests that inquiry-based learning can help to spark students' curiosity and encourage them to actively investigate scientific concepts.

Objective 2. Determine teaching strategies for learners who are less exposed to advanced science in real-life settings.

Participants consistently emphasize the importance of hands-on experiments in making science more engaging and relevant for students. This finding aligns with research on the benefits of experiential learning. May et al. [40] suggests that students who participate in hands-on experiments are more likely to retain information and apply their knowledge to real-world situations. Ješková et al. [41] further highlights the importance of active engagement in science education, emphasizing that students who are able to work with materials and carry out experiments develop a deeper understanding of scientific concepts. Additionally, the effectiveness of problem-based learning (PBL) in engaging students and fostering critical thinking skills.

This finding aligns with research on the benefits of PBL in science education. PBL can help students develop problem-solving skills and a deeper understanding of scientific concepts [42]. The role of PBL in promoting active learning and helping students build a fundamental knowledge base. The study's participants highlight the potential of technology to enhance science education for students who have limited exposure to advanced science [43]. This finding aligns with research on the benefits of technology integration in science education. Zou et al. [44] suggests that digital tools and virtual simulations can provide engaging and accessible learning experiences for students. The study's respondents also emphasize the importance of fostering collaboration among students. The advantages of cooperative learning settings, where peer interactions promote deeper conversations and widen viewpoints on scientific subjects. Cooperative learning fosters a sense of ownership, promotes social skills, deepens understanding, enhances retention, and prepares students for the diverse workforce [45].

6. Conclusion

This study provided a comprehensive understanding of how limited exposure to real-life scientific contexts influenced learners' engagement with and comprehension of advanced science concepts in higher education. The findings demonstrated that difficulties experienced by least-exposed learners were not merely a result of insufficient content knowledge, but were closely linked to the absence of contextualized and experiential learning opportunities. When science instruction remained abstract and disconnected from authentic experiences, learners were more likely to rely on memorization and exhibit reduced curiosity toward scientific inquiry. The study further emphasized that the effectiveness of science teaching for least-exposed learners depended largely on the intentional use of learner-centered and context-driven instructional strategies. Approaches such as hands-on experimentation, problem-based learning, technology integration, and collaborative learning enabled learners to actively construct understanding, apply scientific concepts to real-world situations, and engage more meaningfully with scientific content. These strategies served not only to increase motivation and participation but also to bridge experiential gaps that often hinder conceptual development in science learning. In the context of higher education, the findings underscored the responsibility of educators to design inclusive learning environments that acknowledge students' varied levels of exposure to scientific practice. Embedding science instruction within authentic, real-life contexts, educators can support deeper learning, promote critical thinking, and enhance the relevance of science to students' academic and future professional pursuits. Such pedagogical practices contribute to a more equitable and accessible science education that empowers learners to engage with science beyond the classroom. While this study generated valuable qualitative insights into teaching strategies for least-exposed learners, it was limited by its descriptive and exploratory nature. Future research may build on these findings by employing mixed-methods or quantitative designs to examine the measurable impact of specific instructional strategies on student performance, conceptual understanding, and long-term retention of scientific knowledge. Further studies may also explore learners' perspectives directly, compare outcomes across disciplines, or investigate institutional factors that influence the implementation of real-life science teaching strategies in higher education settings.

Conflict of interest

The authors declare no conflict of interest

References

1. Jedishkem, E., Dlamini, P., & Jedishkem, J. (2023). Teacher Perceptions and professional experience of E-Learning and practical Subjects: Views of selected teachers in the Shiselweni region of Eswatini. Journal of Education and Practice. https://doi.org/10.7176/jep/14-3-09
2. Ariza, M. R., Christodoulou, A., Van Harskamp, M., Knippels, M. P. J., Kyza, E. A., Levinson, R., & Agesilaou, A. (2021). Socio-Scientific Inquiry-Based Learning as a Means toward Environmental Citizenship. Sustainability, 13(20), 11509. https://doi.org/10.3390/su132011509
3. Mena-Guacas, A. F., López-Catalán, L., Bernal-Bravo, C., & Ballesteros-Regaña, C. (2025). Educational Transformation Through Emerging Technologies: Critical Review of Scientific Impact on Learning. Education Sciences, 15(3), 368. https://doi.org/10.3390/educsci15030368
4. Rossi IV, de Lima JD, Sabatke B, Nunes MAF, Ramirez GE, Ramirez MI. Active learning tools improve the learning outcomes, scientific attitude, and critical thinking in higher education: Experiences in an online course during the COVID-19 pandemic. Biochem Mol Biol Educ. 2021 Nov;49(6):888-903. Doi: 10.1002/bmb.21574. Epub 2021 Oct 15. PMID: 34652877; PMCID: PMC8653153.
5. Castro, F. L. T., Ventura, B. L. O., Estajal, R. S., Timpangco-Macario, J., Limen, M. V., Garil, B. A., & Chavez, J. V. (2024). Teachers handling multiple subject areas: Difficulties and adaptive attributes in the delivery of instructions. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2520
6. Espartero, M. M., Caldaza, K. P. D., & Del Prado, R. T. (2024). Analyzing the level of interest of high school students in solving mathematical problems in the modular and face-to-face learning. Environment and Social Psychology, 9(4). https://doi.org/10.54517/esp.v9i4.2167
7. Leu, J., Tay, Z., Van Dam, R. M., Müller-Riemenschneider, F., Lean, M. E., Nikolaou, C. K., & Rebello, S. A. (2022). 'You know what, I'm in the trend as well': understanding the interplay between digital and real-life social influences on the food and activity choices of young adults. Public Health Nutrition, 25(8), 2137–2155. https://doi.org/10.1017/s1368980022000398
8. Veen, M., & Cianciolo, A. T. (2023). Helping a field see itself: Envisioning a Philosophy of Medical Education.
9. Savellon, K. I. S., Asiri, M. S., & Chavez, J. V. (2024). Public speaking woes of academic leaders: resources and alternative ways to improve speaking with audience. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2871
10. Del Mundo, M. A., Reyes, E. F. D., Gervacio, E. M., Manalo, R. B., Book, R. J. A., Chavez, J. V., Espartero, M. M., & Sayadi, D. S. (2024a). Discourse analysis on experience-based position of science, mathematics, and Tech-Voc educators on generative AI and academic integrity. Environment and Social Psychology, 9(8). https://doi.org/10.59429/esp.v9i8.3028
11. Briggs, T. (2024). How to expect the unexpected: the science of Making Predictions—And the art of knowing when not to. Math Horizons, 31(4), 29. https://doi.org/10.1080/10724117.2024.2312034
12. Wu, Z., Guo, K., Wang, L., Hu, M., & Ren, S. (2023). A collaborative learning-based urban low-light small-target face image enhancement method. ACM Transactions on Sensor Networks. https://doi.org/10.1145/3616013
13. Jessup, S. (2022). How does pedagogical change affect teachers at different stages of their careers? In Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.6416122
14. Walden University. (2023, December 7). Student Engagement Strategies for science Educators. Walden University. https://www.waldenu.edu/programs/education/resource/the-importance-of-learning-science-teaching-strategies-for-todays-educators
15. S, M. (2024, January 4). Exploring the role of science laboratories in modern schools. Genie Scientific. https://www.geniescientific.com/exploring-the-role-of-science-laboratories-in-modern-schools/
16. Gholam, & Petro, A. (2019). Inquiry-Based Learning: student teachers' challenges and perceptions. Journal of Inquiry and Action in Education, 10(2), 6. https://digitalcommons.buffalostate.edu/cgi/viewcontent.cgi?article=1165&context=jiae
17. Kerimbayev, N., Umirzakova, Z., Shadiev, R., & Jotsov, V. (2023). A student-centered approach using modern technologies in distance learning: a systematic review of the literature. Smart Learning Environments, 10(1). https://doi.org/10.1186/s40561-023-00280-8
18. Garil, B. A. (2024). Socio-cultural factors affecting reading comprehension levels and demographic-based grammatical competence of higher education students. Forum for Linguistic Studies, 6(3), 184–197. https://doi.org/10.30564/fls.v6i3.6564
19. Bucoy, R. M., Enumerabellon, K. M., Amilhamja, A. J., Sisnorio, C. B., Manalo, R., Chavez, J. V., Sabbaha, N. A., & Albani, S. E. (2024). Knowledge deficits and analysis on comprehension of teachers on their common legal rights as teachers. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2559

20. Entong, M. B. M., Garil, B. A., Muarip, V. C., & Chavez, J. V. (2024a). Language Delivery Styles in Academic Trainings: Analysis of Speaker' s Emotional Connection to Audience for Lasting Learning. Forum for Linguistic Studies, 6(3), 326–342. https://doi.org/10.30564/fls.v6i3.6533
21. Zhang, X., Zhang, B., & Zhang, F. (2023). Student-centered case-based teaching and online–offline case discussion in postgraduate courses of computer science. International Journal of Educational Technology in Higher Education, 20(1). https://doi.org/10.1186/s41239- 022-00374-2
22. Murro, R. a. R. A., Lobo, J. G., Inso, A. R. C., & Chavez, J. V. (2023). Difficulties of parents with low educational attainment in assisting their children in modular distance learning during pandemic. Environment and Social Psychology, 9(1). https://doi.org/10.54517/esp.v9i1.1957
23. Verstegen, D. M. L., De Jong, N., Van Berlo, J., Camp, A., Könings, K. D., Van Merriënboer, J. J. G., & Donkers, J. (2015). How e-Learning can Support PBL Groups: A literature review. Advances in Medical Education, 9–33. https://doi.org/10.1007/978-3-319-08275-2_2
24. Yang, D., Wang, H., Metwally, A. H. S., & Huang, R. (2023). Student engagement during emergency remote teaching: A scoping review. Smart Learning Environments, 10(1). https://doi.org/10.1186/s40561-023-00240-2
25. Verdeflor, R. N. (2024). Choosing science and mathematics programs in college: practical and psychological arbiters in career-pathing. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2777
26. Quisay, A. R. C., & Aquino, M. E. C. (2024a). Stress levels of science teachers when delivering distance education instruction in a state college during the COVID-19 pandemic. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2916
27. Wang, S., & Zhang, D. (2018). Student-centred teaching, deep learning and self-reported ability improvement in higher education: Evidence from Mainland China. Innovations in Education and Teaching International, 56(5), 581–593. https://doi.org/10.1080/14703297.2018.1490662
28. Reyes, R. B. D., Tongkoh, A. L., & Chavez, J. V. (2023). Transitional Challenges and Factors Affecting English-Speaking Learners in Learning the Filipino Language. Journal of Namibian Studies. History Politics Culture, 33, 1720-1744
29. Chavez JV and Prado RTD (2023) Discourse analysis on online gender-based humor: Markers of normalization, tolerance, and lens of inequality. Forum for Linguistic Studies 5(1): 55–71. DOI: 10.18063/fls.v5i1.1530
30. Knott, E., Rao, A. H., Summers, K., & Teeger, C. (2022). Interviews in the social sciences. Nature Kotsis, K. T. (2024). Significance of experiments in inquiry-based science teaching. European Journal of Education and Pedagogy, 5(2), 86–92. https://doi.org/10.24018/ejedu.2024.5.2.815. Reviews Methods Primers, 2(1), 73.
31. Naz, N., Gulab, F., & Aslam, M. (2022). Development of qualitative semi-structured interview guide for case study research. Competitive Social Science Research Journal, 3(2), 42-52.
32. Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. Journal of advanced nursing, 72(12), 2954-2965.
33. Taherdoost, H. (2022). How to conduct an effective interview; a guide to interview design in research study. International Journal of Academic Research in Management, 11(1), 39 51.
34. Murray, M. (2018). Narrative data. The SAGE handbook of qualitative data collection, 264-279.
35. Corsley, J. (2021). What (Exactly) Is Thematic Analysis?. GradCoach [Online]. https://gradcoach.com/what-is-thematic-analysis/
36. Clarke, V., & Braun, V. (2017). Thematic analysis. The journal of positive psychology, 12(3), 297- 298.
37. Jiménez-Valverde, G. (2025). Narrative Approaches in Science Education: From Conceptual Understanding to Applications in Chemistry and Gamification. Encyclopedia, 5(3), 116. https://doi.org/10.3390/encyclopedia5030116
38. Dwyer CP. An Evaluative Review of Barriers to Critical Thinking in Educational and Real-World Settings. J Intell. 2023 May 31;11(6):105. Doi: 10.3390/jintelligence11060105. PMID: 37367507; PMCID: PMC10300824.
39. Blyznyuk, Tetyana & Kachak, Tetiana. (2024). Benefits of Interactive Learning for Students' Critical Thinking Skills Improvement. Journal of Vasyl Stefanyk Precarpathian National University. 11. 94-102. 10.15330/jpnu.11.1.94-102.
40. May, D., Terkowsky, C., Varney, V., & Boehringer, D. (2023). Between hands-on experiments and Cross Reality learning environments – contemporary educational approaches in instructional laboratories. European Journal of Engineering Education, 48(5), 783–801. https://doi.org/10.1080/03043797.2023.2248819
41. Ješková, Z., Lukáč, S., Šnajder, Ľ., Guniš, J., Klein, D., & Kireš, M. (2022). Active Learning in STEM Education with Regard to the Development of Inquiry Skills. Education Sciences, 12(10), 686. https://doi.org/10.3390/educsci12100686
42. Nawal, D. (2024). Effectiveness of using content- based instruction on elementary school learners' vocabulary proficiency. https://dspace.univ-ouargla.dz/jspui/handle/123456789/36866

43. Atandi, C. B. K. (2019). Effectiveness of teaching methods on students' academic performance in kiswahili subject in public and private secondary schools in lang'ata sub county, nairobi - kenya. /Bitstream. http://ir.cuea.edu/jspui/handle/1/6821
44. Zou Y, Kuek F, Feng W and Cheng X (2025) Digital learning in the 21st century: trends, challenges, and innovations in technology integration. Front. Educ. 10:1562391. Doi: 10.3389/feduc.2025.1562391
45. Deysolong, Josephine. (2023). Assessing the Benefits of Cooperative Learning or Group Work: Fostering Collaboration and Enhancing Learning Outcomes. International Journal of e-Collaboration. 10.6084/m9.figshare.23009159.