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Research Article

Alternative teaching strategies and activities for non-science enthusiast learners in higher education

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ABSTRACT

Developing student interest in non-major science courses in higher education can be extremely difficult, particularly for students who do not identify as science majors. This study explores the challenges faced by non-science enthusiast learners in engaging with science courses, focusing on their perceptions and learning behaviors. Many students view science as difficult and disconnected from their daily lives, leading to decreased motivation and participation. The study aimed to identify the learning behaviors of these students and to determine effective teaching strategies to enhance their engagement. Qualitative data were collected through one-on-one interviews with 20 educators using purposive sampling, allowing for in-depth insights into their experiences with non-enthusiast learners. The findings revealed that students often displayed disengaged behaviors, such as distractibility and passive participation, which hinder their academic success. Effective teaching strategies identified included making science relatable to students' everyday experiences, creating inclusive and supportive classroom environments, and employing engaging, interactive methods like hands-on activities and collaborative projects. Additionally, fostering emotional connections between educators and students was found to be crucial in enhancing interest and participation in science. Furthermore, future research should investigate the long-term impacts of these strategies to develop effective educational frameworks.

Keywords: Non-science enthusiast learners; teaching strategies; activities; higher education

1. Introduction

Engaging non-major science students in higher education presents unique challenges, as many approaches science courses with apprehension and limited interest. These courses are often perceived as difficult, abstract, and irrelevant to everyday life, contributing to low engagement and poor academic performance[1,2]. For students who do not identify as science majors, the primary motivation for enrolling in such courses is often to fulfill graduation requirements rather than to foster an appreciation for scientific inquiry[3]. This disconnect highlights the urgent need for innovative teaching strategies that cater to the needs of non-science enthusiasts.

Traditional lecture-based methods may not effectively address these challenges, as they often lack the interactivity and relevance needed to maintain students' interest[4]. Research suggests that fostering a more

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dynamic and inclusive learning environment can enhance student motivation and outcomes. Active learning strategies—such as group discussions, collaborative projects, and hands-on experiments—are particularly effective in increasing engagement among non-science majors. For example, Midden[5] demonstrated that students in active learning settings outperformed their peers in traditional classrooms, underscoring the advantages of interactive teaching methods in improving comprehension and retention.

Experiential learning techniques, which link scientific concepts to real-world applications, resonate with students by demonstrating the practical relevance of science[6]. For instance, teaching the chemistry of cooking or the physics of everyday devices like smartphones helps students relate abstract theories to tangible experiences[7]. Quisay and Aquino[8] emphasize that integrating science with other disciplines, such as technology or the arts, creates interdisciplinary learning experiences that make science more accessible.

The Integration of technology further enhances the learning experience for non-science students. Interactive simulations, virtual laboratories, and multimedia resources simplify complex concepts and provide immersive, visually engaging experiences. Virtual labs, for instance, allow students to explore scientific phenomena in a risk-free environment, fostering curiosity and reducing anxiety[9,10]. These digital tools also ensure accessibility and flexibility in learning, catering to diverse student needs[11].

Collaborative learning is another strategy that fosters a sense of community and engagement in the classroom. Peer teaching and group projects encourage students to participate actively, share perspectives, and support one another, reducing the intimidation often associated with science courses[12]. These activities not only improve academic outcomes but also enhance critical thinking and teamwork, essential skills for lifelong learning[13].

This study investigates alternative teaching strategies and activities to enhance engagement among non-science learners in higher education. By identifying effective methods such as active learning, experiential learning, and technological integration, the research aims to provide practical solutions for educators seeking to transform science education for non-major students.

2. Literature

Research consistently underscores the need for student-centered teaching strategies to address the challenges faced by non-science majors. Active learning has emerged as a key component of effective pedagogy, with numerous studies highlighting its role in enhancing engagement and understanding[4,5]. Techniques such as problem-solving activities, group discussions, and interactive demonstrations not only increase engagement but also improve knowledge retention and critical thinking skills[14].

Experiential learning, which bridges theory and practice, has also proven to be an effective approach for non-science enthusiasts. Chavez[6] observes that activities such as field trips, community projects, and interdisciplinary applications of science forge meaningful connections between students and the subject matter. These hands-on experiences allow students to see the real-world relevance of science, fostering a deeper appreciation and interest in the subject[7].

Incorporating technology into the classroom further amplifies the appeal of science education. Digital simulations, virtual labs, and multimedia tools have been shown to demystify complex topics and provide students with opportunities to experiment without the fear of failure[9]. These tools not only simplify abstract concepts but also make science more inclusive and engaging by catering to diverse learning needs[10]. Chavez[11] emphasizes that multimedia resources and online platforms enable educators to present scientific information in innovative ways, appealing to students who may initially lack interest in the subject.

Collaborative and peer-based learning strategies have also been identified as key in engaging non-science majors. Group projects and peer teaching encourage active participation and create a supportive classroom environment. According to Whenham[12], these strategies alleviate feelings of isolation and intimidation, allowing students to connect with their peers and actively engage in discussions. Tanner[13] argues that collaborative learning enhances comprehension and fosters the development of essential skills such as communication and teamwork.

Collectively, these approaches emphasize the importance of adopting multifaceted teaching strategies that prioritize interactivity, relevance, and inclusivity. By integrating active learning, experiential techniques, and technological tools, educators can address the unique challenges faced by non-science learners and create a more engaging and effective science education framework.

3. Methodology

3.1. Research design

This study employed a qualitative exploratory design to investigate alternative teaching strategies for engaging non-science enthusiast learners in higher education. The qualitative framework was chosen for its effectiveness in uncovering in-depth experiences and detailed narratives[15]. To gather rich insights, exploratory interviews were conducted with participants who possessed extensive backgrounds in the subject matter[15]. This approach allows for a comprehensive analysis of the perspectives and concepts connected to the topic of interest[16].

3.2. Population and sampling

The population for this study consists of university educators who teach non-science major students. A purposive sampling method was used to select 20 participants with at least three years of experience in teaching science or science-related courses to non-science majors at the university level. These educators teach students aged 18-25, primarily in undergraduate programs in non-science fields such as humanities, business, and social sciences. The purposive sampling technique ensured that participants were selected for their direct experience with the research topic and ability to provide meaningful insights[17,18].

3.3. Instrument

The participants in this study engaged in semi-structured interviews, guided by the questions outlined in **Table 1.** These questions aimed to facilitate a comprehensive exploration of the participants' perspectives, motivations, experiences, and the factors influencing their responses[19]. Additionally, the questions reflected the foundational concepts of the study and demonstrated how the findings could be interconnected through thematic analysis[16]. To gather in-depth qualitative data, a conversational format was employed with participants[20], which aimed to deepen the understanding of how bureaucratic processes influenced management performance.

Table 1. Research instrument.

Objectives	Interview Questions
Determine the learning behaviors of non-enthusiast students in science courses.	1. What are the reasons why learners are not enthusiastic in learning science? Elaborate your observation. 2. What do you notice on the learning behaviors of students who are not science enthusiasts? Explain further. 3. How do you deal with the difficulty to teach learners who are not interested in science? Explain your actions.
Determine the alternative teaching strategies and activities for non-enthusiast students in science	1. What unique teaching strategies have you implemented to learners who are not enthusiastic on science lessons? Explain each strategy. 2. Are there specific unique teaching activities you implemented which sparked the

courses.	interest of the learners in science? 3. How do you sustain the teaching strategies and activities to students who are not science enthusiasts? Explain further.

Table 1. *(Continued)*

3.4. Data gathering procedure

To ensure a thorough and systematic approach, the data collection process involved several standardized procedures. Participants were identified and recruited based on specific criteria including a minimum of three years of experience teaching science or science-related courses at the university level, specifically for non-science major students. Participants were also selected for their involvement in using alternative or active learning strategies to engage students who are not enthusiastic about science.

Subsequently, individual interviews were arranged to provide a comfortable environment for participants to share their insights. During these interviews, semi-structured questions were employed to encourage in-depth discussions, allowing the teachers to elaborate on their viewpoints.

To enhance the reliability of the data collected, the interviews were recorded (with the participants' consent) and later transcribed for analysis. The audio recordings were transcribed verbatim, enabling detailed examination focused on identifying common patterns, strategies, and challenges faced by the teachers. Throughout the entire process, confidentiality and anonymity were prioritized to safeguard participants' identities and ensure compliance with ethical standards. These interviews were conducted one-on-one to facilitate open and honest communication.

3.5. Data analysis

The analysis commenced with a coding process, during which specific phrases and concepts from the responses of science teachers were organized into themes aligned with the research objectives. This approach facilitated the recognition of recurring patterns and significant insights regarding the teachers' experiences, preferences, and strategies for engaging non-science enthusiast learners. Through thematic analysis, the researchers were able to construct context-specific narratives that shed light on the educational journeys of these teachers, emphasizing the practical aspects and shifts in mindset that accompany their teaching practices[21].

Following the initial coding, thematic analysis was conducted to synthesize the codes into larger themes that encapsulated the core findings. Additionally, the study analyzed a selection of chat stories shared by the teachers, which were informal, narrative accounts describing specific teaching moments and challenges faced in the classroom[22]. These stories provided personal, anecdotal insights that enriched the overall understanding of the teaching strategies used to engage non-science enthusiast learners.

4. Results

Objective 1. Determine the learning behaviors of non-enthusiast students in science courses.

Question 1. What are the reasons why learners are not enthusiastic in learning science? Elaborate your observation.

The consensus among twenty respondents underscores that a significant factor behind students' lack of enthusiasm for learning science is their perception of the subject as inherently difficult and overly abstract. Many students struggle to grasp scientific concepts, leading to frustration and a sense of inadequacy, which discourages active engagement and participation. Science is often seen as disconnected from everyday life, making it seem less relevant or applicable, thereby reducing motivation to learn. Educators observe that students commonly describe science as "boring" or "too hard to understand," further exacerbating their disinterest. Additionally, some students are deterred by the high costs associated with materials required for hands-on experiments, which restricts their ability to fully engage in interactive learning experiences.

> "Many students find science hard to understand."

> "Sometimes, my students find science boring or fail to see it as useful, viewing it as simply stressful."

> "For many students, science feels confusing and difficult to grasp, which hampers their understanding."

Question 2. What do you notice on the learning behaviors of students who are not science enthusiasts? Explain further.

Twenty individuals indicate that students who lack enthusiasm for science display several disengaged learning behaviors that hinder their educational progress. These students often appear uninterested and easily distracted, quickly losing focus during science classes and avoiding participation in group activities or discussions. This lack of involvement is typically marked by passive behaviors, such as refraining from asking questions or hesitating to engage with the material. Observations reveal that when these students lose interest, they may turn to distractions like using mobile phones or conversing with peers, which further disrupts their focus and prevents them from gaining a comprehensive understanding of the subject matter. Educators express concern over these tendencies, as such patterns of disengagement may not only affect immediate academic outcomes but could also contribute to a long-term decline in students' motivation to learn.

> "They lose interest easily, they get distracted quickly, and they are not keen on participating in activities."

> "They lose focus quickly and hesitate to participate in discussions."

> "They are often uninterested, distracted, or lack focus."

Question 3. How do you deal with the difficulty to teach learners who are not interested in science? Explain your actions.

Relatability

Five participants highlighted that the teacher makes science relatable by connecting scientific concepts to everyday experiences that students face. This approach helps to make science less confusing and shows how it's relevant to their lives. For example, lessons might include explaining the chemistry of cooking or the physics involved in sports. By using these relatable examples, the teacher simplifies complex ideas, helping students understand and appreciate science as something valuable and useful beyond just school.

> "I simplify lessons and connect science to daily life."

> "I make science relatable to their lives and provide practical examples."

Inclusivity

The viewpoint shared by eight participants highlights that the instructor's dedication to inclusivity establishes a learning environment where all students feel acknowledged and valued. By welcoming questions and fostering open discussions, the instructor creates a safe space where students feel free to explore their curiosity and express their ideas without fear of judgment. This inclusive approach respects each student's unique perspective and learning pace, making it easier for everyone to connect with the material at their own level.

> "I approach this by way of creating an inclusive, fun classroom experience. I welcome questions and discussions, which enables the students to freely express their ideas without feeling judged."

Engagement

Seven respondents mentioned that effective teaching methods focus on actively engaging students by linking science lessons to their personal interests and passions. By connecting topics to students' hobbies or daily activities, the teacher creates a dynamic and personalized learning experience that grabs their attention and fosters enthusiasm for the subject. Through a blend of interactive activities, discussions, and relatable content, the instructor cultivates a lively classroom atmosphere that transforms students from passive observers into active participants, making science not only accessible but also enjoyable and rewarding.

> "I try to simplify science lessons and connect them to their daily lives."

Objective 2. Determine the alternative teaching strategies and activities for non-enthusiast students in science courses

Question 4. What unique teaching strategies have you implemented to learners who are not enthusiastic on science lessons? Explain each strategy.

Twenty respondents agreed on several unique teaching strategies used to engage students who show limited enthusiasm for science. One effective approach involves using simple experiments to make science interactive and enjoyable. These hands-on activities allow students to see science in action, sparking curiosity and helping them understand complex concepts through real-world applications. Another method is storytelling, where scientific principles are woven into relatable narratives that make the material more accessible and memorable. Fun demonstrations and simple models are also used to visually explain concepts, breaking down complex ideas into tangible examples that students can easily grasp. Videos and visual aids are employed to enhance lessons, providing dynamic, multimedia content that captures attention and aids retention. Additionally, project-based learning enables students to tackle real-world problems, particularly within the STEM fields. This approach gives students a sense of purpose by showing them practical applications for their learning, inspiring greater engagement and motivation. Each of these strategies is aimed at making science more engaging, relatable, and less intimidating for students, fostering a more positive and active learning environment.

"I use videos and simple experiments to make the lessons more interesting for them."

> "I use fun demonstrations and simple models to explain concepts."

Question 5. Are there specific unique teaching activities you implemented which sparked the interest of the learners in science?

Eighteen participants agreed that specific unique teaching activities can effectively spark students' interest in science. One notable approach is the incorporation of hands-on activities, which actively engage students and allow them to explore scientific concepts in a tangible way. These activities often lead to increased curiosity and enthusiasm, as students can directly interact with the material they are learning. Group projects also play a significant role in fostering collaboration and peer learning, enabling students to work together to solve problems and share ideas, which enhances their understanding of scientific principles. Additionally, outdoor activities, such as nature walks, provide students with the opportunity to observe science in real-life contexts. These experiences help them connect classroom learning with the natural world, making science more relevant and exciting.

"Outdoor activities, like nature walks, help students see science in real life."

"Group projects and games help them learn together."

Furthermore, the consensus among two participants revealed that group projects and outdoor activities can significantly enhance students' exploration of science, allowing them to engage with the subject matter in personalized ways. Group projects foster collaboration and creativity, enabling students to investigate scientific concepts together and share their findings. Outdoor activities provide immersive experiences, allowing students to observe and interact with scientific phenomena in their natural environments. Additionally, organizing science fairs and experiments gives students the freedom to choose topics that interest them, promoting autonomy in their learning.

"Group projects and outdoor activities so they can explore science in their own way."

Question 6. How do you sustain the teaching strategies and activities to students who are not science enthusiasts? Explain further.

Variety

The perspective shared by four participants underscores that educators prioritize student involvement by implementing a diverse array of interactive activities tailored to different learning styles and interests. This includes incorporating hands-on experiments, creative demonstrations, and digital resources, which enable students to connect with the material on multiple levels. By actively engaging students in discussions and collaborative projects, the educator encourages them to share their perspectives and experiences, thereby making the learning experience more relatable. As students become more involved in the learning process, they are likely to cultivate a newfound interest in science, leading to improved academic performance and a more positive attitude toward the subject.

"I mix activities and keep lessons engaging regularly."

"I keep activities fresh, using group work and asking for their input."

Responsiveness

The viewpoint shared by ten participants highlights the teaching quality essential for addressing the diverse needs and preferences of students, particularly those who do not have a natural inclination toward science. The educator exemplifies this quality by soliciting feedback from students through surveys, informal discussions, and reflective activities. This feedback loop enables the educator to adapt lessons based on student input, ensuring that the material resonates with the audience. For instance, when students express a preference for specific topics or formats, the educator adjusts future lessons to incorporate these elements, fostering a more personalized learning experience. According to them, by actively listening to students' suggestions and concerns, they create an inclusive atmosphere where all voices are valued, significantly enhancing students' engagement and willingness to explore scientific inquiries.

"I change teaching styles and ask for feedback."

"I change the types of activities weekly to keep them engaging and interesting for the students."

Collaboration

Six individuals answered that the educator integrates group work into the curriculum, allowing students to collaborate on projects and share ideas with their peers. Through teamwork, students not only learn from one another but also develop essential social and communication skills crucial for their personal and professional growth. The emphasis on collaboration encourages students to engage with the content meaningfully, transforming science from a solitary subject into a shared exploration. Through joint problem-solving and peer teaching, students can approach scientific concepts from different angles, enhancing their understanding and igniting collective curiosity. Consequently, students are more likely to appreciate the relevance of science in their daily lives and develop a more positive attitude toward the subject.

> "I adapt my teaching methods based on their preferences and keep introducing new topics and challenges to sustain engagement throughout the course."

5. Discussion

The findings of this study underscore the challenges faced by non-enthusiast students in science courses, highlighting key factors that contribute to their disengagement.

Objective 1: Determine the learning behaviors of non-enthusiast students in science courses.

The study identifies several factors contributing to students' lack of enthusiasm for science, particularly their perception of the subject as inherently difficult and overly abstract. This aligns with Castro et al.[23], who emphasize that such perceptions often stem from the disconnection students feel between scientific concepts and everyday life. This disconnection, coupled with frustration over the difficulty of grasping abstract ideas, discourages active engagement and participation. Similarly, educators frequently report that students describe science as "boring" or "too hard to understand," as McFarlane and Richeimer[24] highlighted the emotional and intellectual barriers to student engagement in science courses.

Disengagement behaviors, including destructibility and passive participation, were also prominently identified. The tendency of students to turn to distractions, such as mobile devices, further underscores the contemporary challenge of maintaining focus in science classrooms. This reflects similar findings in previous research, where the use of technology for non-academic purposes during lessons hindered engagement and retention[25]. Moreover, the financial barriers associated with hands-on experiments—such as the high cost of materials—add to the difficulties students face in fully engaging with interactive learning experiences.

Emotional responses to learning science, such as boredom, confusion, and frustration, were found to be significant barriers. Recognizing and addressing these emotional challenges is critical, as they can shape students' overall attitudes toward the subject. For instance, Garil et al.[22] emphasize the role of emotional engagement in fostering positive learning outcomes. This study's findings suggest that creating relatable and inclusive classroom environments can help mitigate negative emotions and increase students' willingness to participate. Educators who connect scientific concepts to real-world applications or incorporate student interests into lessons often observe greater motivation and curiosity among learners. These findings are consistent with prior studies highlighting the trans-formative impact of emotional engagement on students' attitudes and achievements in science courses.

Furthermore, this study reveals distinctions between cohorts, emphasizing that non-science majors often require different teaching approaches compared to those traditionally used for science majors. Unlike prior research, which primarily focuses on science enthusiasts or general students, this study specifically addresses the unique needs of non-science enthusiasts. For instance, while previous studies[26] have highlighted the value of interactive classroom activities, this study further underscores their importance in fostering inclusive and reducing feelings of isolation among non-science majors.

Objective 2. Determine the alternative teaching strategies and activities for non-enthusiast students in science courses.

The findings emphasize the effectiveness of alternative teaching strategies that prioritize relatability, inclusivity, and active engagement. A critical element is contextualizing scientific concepts within everyday experiences[7]. For example, linking lessons to familiar topics, such as the physics of everyday gadgets or the chemistry behind cooking, makes science more accessible and relevant. These connections not only improve comprehension but also foster a sense of curiosity and appreciation for the subject.

Inclusivity is another vital strategy. By creating environments that accommodate diverse learning needs, educators can ensure that all students feel valued and supported. Peer teaching, collaborative projects, and team-based learning activities have been shown to improve engagement and reduce anxiety associated with challenging scientific topics[12]. These activities provide students with opportunities to share ideas, learn from one another, and build a supportive community[13].

The integration of technology has also proven highly effective in engaging non-science enthusiasts. Tools such as virtual labs, multimedia presentations, and online simulations not only make learning more interactive but also allow students to experiment with scientific concepts in a low-pressure environment. Duhaylungsod & Chavez[21] highlight how digital tools can enhance the appeal of science, particularly for students who may initially find the subject intimidating. For instance, interactive simulations and gamified learning experiences have been shown to increase motivation and retention, as they cater to diverse learning preferences.

Compared to prior studies, this research provides deeper insights into the specific preferences and needs of non-science enthusiasts. While previous literature[27] broadly emphasizes active learning and technology integration, this study further explores how these strategies can be tailored to non-science majors. For example, incorporating relatable examples and peer collaboration into lessons can help bridge the gap between abstract scientific concepts and students' lived experiences.

Finally, the repetitive nature of findings across multiple studies underscores the universal applicability of these strategies. However, this study makes a unique contribution by focusing on the cohorts being taught—non-science enthusiasts in higher education—and by identifying the distinct challenges they face. Educators should consider these findings when designing curricula and activities to ensure that science courses are not only engaging but also inclusive and accessible to all students.

6. Conclusion

This study highlights the significant impact that students' attitudes and emotions toward science have on their willingness to engage with the subject. Many non-science enthusiast learners see science as difficult and disconnected from their everyday lives, which makes them less interested in learning. To address this, teachers need to adapt their methods.

Effective strategies include making science relatable by connecting it to students' everyday experiences and interests, creating inclusive environments where all students feel valued, and using engaging, interactive teaching methods. Building emotional connections between educators and learners is also crucial for increasing student interest and participation in science. Using engaging methods—like hands-on activities, multimedia resources, and collaborative projects—gives students various ways to connect with the material. These approaches cater to different learning styles and promote critical thinking, turning the classroom into a lively space for exploration and discovery.

Moreover, addressing the emotional and cognitive barriers faced by non-enthusiast students requires a comprehensive approach that links teaching strategies, student perceptions, and emotional engagement. By fostering a relatable and inclusive learning atmosphere, educators can enhance academic outcomes and help students develop a lasting appreciation for science. Future research should explore the long-term effects of these strategies to create more effective educational frameworks that empower all students to engage meaningfully with science.

Conflict of interest

The authors declare no conflict of interest.

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