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Research Article

NAVIGATING CHALLENGES: A SURVEY OF NON-SCIENCE STUDENTS' EXPECTATIONS IN BASIC PHYSICS CLASSROOM

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Abstract
This study investigated the expectations and challenges of 18 non-science track students regarding introductory physics courses at the upper secondary level in Thai schools. We employed a survey research design using a validated questionnaire to gather descriptive data. A panel of three experts validated the questionnaire. Data analysis was performed using descriptive statistics. The main findings revealed that most students (72.22%) found physics "enjoyable but sometimes not understanding," and mathematical calculations were the most significant challenge (66.67%). Students highly preferred learning support in the form of clear explanations (M=4.11, SD=0.96) and step-by-step problem-solving (M=4.06, SD=0.87). This research is unique in its focused examination of physics learning expectations among non-science track students within the Thai educational context, an area that has been understudied. The findings contribute to the field by providing specific insights into the challenges and support needs of this distinct student population. The results suggest that physics instruction for non-science students should incorporate differentiated teaching strategies, focusing on clear, step-by-step problem-solving and real-world applications to enhance conceptual understanding and engagement. This study's findings can serve as a valuable guideline for designing future physics curricula and professional development programs for teachers of non-science track students.

Keywords: Non-Science Track Students, Physics Expectations, Physics Learning

INTRODUCTION

Physics education is fundamental to nurturing scientific literacy and critical thinking across all academic disciplines. It significantly enhances students' analytical skills and their comprehension of the natural world (Aalst, 2000; Otero & Meltzer, 2016; Ajadi & Ayanlowo, 2025). In Thailand's upper secondary education system, basic physics courses are compulsory for both science and non-science track students, a reflection of the Ministry of Education's dedication to promoting scientific understanding in every academic stream (Ministry of Education Thailand, 2008; Faikhamta et al., 2018; Asmaningrum et al., 2025).

The challenges associated with physics education are especially notable for non-science track students, who often come to the subject with different expectations and learning requirements compared to their science-track peers (Naval, 2020; Ramsey, 2022). A substantial body of research has shown that students' expectations and beliefs about physics are major determinants of their learning outcomes and engagement (Wilcox & Lewandowski, 2016; Crouch et al., 2018; Lee et al., 2023; Alkilany et al., 2025; Diaz et al., 2025). These prior beliefs can frequently create obstacles to effective learning, particularly when students see physics as too abstract or unrelated to their daily lives (Harwanto, 2019; Bray & Williams, 2020).

Extensive studies have pinpointed several key factors that influence non-science students' experiences and overall engagement with physics (Moore & Rubbo, 2012; Larkin-Hein, 2000). These include their mathematical preparation, ability for conceptual understanding, and overall motivation toward science (Ambarwati et al., 2023; Masniari. S et al., 2023; Charlize et al., 2025; Demon & Santos, 2025). Recent findings highlight that traditional teaching methods, which may be effective for science-track students, may not produce similar results for non-science track students. This underscores the need for alternative pedagogical strategies that are better aligned with the needs and interests of this specific student population (Kalman, 2013, 2018; Smith et al., 2020).

Within the Thai educational context, despite significant reforms aimed at improving science education (Boonphadung & Seubsang, 2021; The Office of the Education Council (Thailand), 2025), there remains a notable knowledge gap regarding how non-science track students experience and approach physics learning. The traditional Thai classroom culture presents unique opportunities and challenges in science education (Chueamueangphan, 2021; Fetmirwati et al., 2025; Hafiz et al., 2025; Hagad & Riah, 2025), and recent research emphasizes the need for targeted studies on students' learning experiences across different academic tracks (Asis et al., 2023; Ladachart et al., 2024).

International research has demonstrated that students' epistemological beliefs about physics learning can vary considerably across different educational and cultural contexts (Lavonen et al., 2007; Gertz et al., 2025; Islami et al., 2025; Jackson & Alfaki, 2025). Understanding these beliefs is essential for developing effective teaching strategies (Dodlek et al., 2024; Klinaku et al., 2025), particularly in Asian settings where conventional teaching methods are often prevalent (Körhasan & Gürel, 2019). In Thailand, efforts to combine cultural elements with modern science teaching have shown promising outcomes in engaging students from various academic tracks (Fatmawati, 2025).

Recent developments in physics education research have stressed the importance of creating learning environments that address the specific needs of non-science students (Uzpen et al., 2019; Le & Aye, 2025; Linh et al., 2025; Mor, 2025). This includes incorporating real-world applications and using innovative teaching methods that take into account students' diverse career aspirations and learning preferences (Mirawati & Sikarni, 2023; Ilhami et al., 2025). Studies consistently show that appropriate teaching strategies can positively influence students' attitudes toward physics and their overall learning experience (Amin et al., 2023; Octavia et al., 2023). Understanding student expectations and experiences in physics learning requires considering both the cognitive and affective domains. Research has shown that a student's success in physics depends not only on their mathematical or scientific abilities but also on their engagement with the subject matter and the learning environment (Darmaji et al., 2024; Gonsalves et al., 2023; Nisa et al., 2025). The way physics is taught and presented can significantly impact students' perceptions and attitudes toward the subject (Karwasz & Wyborska, 2023).

STEM education integrates Science, Technology, Engineering, and Mathematics to foster problem-solving, critical thinking, and analytical reasoning (Ultay et al., 2020; Nehru et al., 2024). Meanwhile, scientific literacy refers to the ability to understand scientific concepts, evaluate information, and apply knowledge in everyday contexts (Gonsalves et al., 2023; Kusuma et al., 2025). For non-science track students, physics education acts as a bridge between these two domains. Although many will not pursue science-related careers, physics contributes to their scientific literacy and strengthens reasoning and problem-solving skills that are relevant to multiple disciplines. The role of STEM education in improving physics learning has gained increasing attention. Research suggests that integrated STEM approaches can make physics more accessible and relevant to non-science students (Ultay et al., 2020; Rahajo & Kumyat, 2025; Saindah, 2025). Studies have also highlighted the importance of considering students' identity development and career aspirations in physics education (Sheldrake et al., 2019), especially for those not pursuing science careers. Thailand's current emphasis on STEM outcomes underscores the importance of cultivating scientific competencies for all learners in a technology-driven society. Integrating STEM approaches into physics instruction for non-science track students supports both immediate learning needs and long-term goals of fostering scientifically literate citizens.

Based on the reasons, we have the question, "What are the learning expectations and support needs of non-science track students in basic physics?" To find the answer, we have set the study's main objective to investigate the expectations of non-science track students regarding basic physics courses at the upper secondary level in Thai schools. So, the research aims to 1) examine students' learning expectations and support needs, and 2) identify major challenges in physics learning. The findings will provide a guideline for designing future physics curricula and activities for non-science track students.

RESEARCH METHOD

The study employed a survey research design, which is a quantitative method. It specifically used a one-time, cross-sectional survey to gather descriptive data (Cohen, 1994; Johnson & Christensen, 2024). This design was chosen to investigate the expectations of non-science track students about basic physics learning at a single point in time. The methodology was consistent with established principles in educational research and was adapted for the Thai educational context, drawing on work by researchers such as Adams et al. (2006); Creswell & Clark (2017) and Faikhamta et al. (2018)**.** This approach allowed for the collection of a broad range of information including learning expectations, perceived challenges, and desired support from a specific population without attempting to manipulate any variables. The focus was on providing a snapshot of the current situation to inform future educational practices. The descriptive nature of the study meant that the findings would describe the characteristics of the sample population's expectations rather than establishing cause-and-effect relationships.

The research focused on a specific and well-defined population: non-science track students at the upper secondary level in Thai schools. The sample consisted of **18** students in their final year of secondary education. This sample size was considered appropriate for an exploratory study in educational research, aligning with recommendations from experts like Patton (2014) and taking into account the specific context of Thai schools (Ladachart et al., 2024). The participants were predominantly female, with demographic data showing a slight majority of female students (**61.11%).** This allowed for a gender-based analysis to explore any potential differences in learning expectations (Ladachart et al., 2024), interests, and challenges between male and female students within the non-science track. The selection of this specific group was crucial to the study's objective, as it addressed a knowledge gap in the literature concerning the experiences of this distinct student population (Hammersley & Traianou, 2012).

The research procedure involved several key steps to ensure a systematic and ethical approach (Denscombe, 2017; Mertler, 2024). First, the necessary permissions were obtained from school administrators and teachers. Informed consent was also secured from all participating students. The survey was administered anonymously and was a one-time event, conducted near the end of the students' upper secondary education. This timing was strategic, as it captured their full experience with the basic physics course. All data collection procedures adhered to established protocols for maintaining participant confidentiality and research integrity. This included ensuring the voluntary nature of participation and separating the research from any academic assessments. Data was securely maintained and was intended to be used solely for research purposes, with the assurance that no individual-identifying information would be disclosed (Hammersley & Traianou, 2012).

The primary instrument used for data collection was a structured questionnaire. This instrument was meticulously developed to be transparent and reliable. It was initially based on existing physics education expectation surveys (Adams et al., 2006) and then adapted to be culturally appropriate for the Thai educational context. The questionnaire was divided into three main sections covering demographic and academic characteristics of participants, physics learning experience and challenges, and learning support expectations. It used a variety of response formats, including a 5-point Likert scale, multiple-choice questions, and open-ended items (Creswell, 2015; Johnson & Christensen, 2024). To ensure the quality of the instrument, its content validity was established through a rigorous expert review process involving three specialists: two physics education researchers and one educational researcher. All questions were presented in the Thai language.

Data analysis was performed using descriptive statistics (Creswell, 2015; Johnson & Christensen, 2024). This method was chosen because the research design was a survey aiming to describe the characteristics of a population. Descriptive statistics were used to summarize and organize the data collected from the questionnaire. This included calculating measures such as percentages and mean scores

(M) and standard deviations (SD). This type of analysis provided a clear, quantitative overview of the students' experiences and expectations, directly addressing the research objectives (Bogdan & Biklen, 1997; Erickson, 2012).

RESULTS AND DISCUSSION

This section presents the findings from an analysis of the demographic characteristics, learning experiences, and expectations of non-science track students regarding their physics education. The primary aim of this study was to examine students' learning expectations and support needs, and identify major challenges in their physics learning.

Using descriptive statistics to analyze data collected from a validated survey questionnaire, we present a detailed overview of the results in the following subsections. These findings provide valuable insights into the specific needs of this unique student population and form the basis for the subsequent discussion on how instructional strategies can be improved to better support their learning. The discussion section will integrate these results with existing literature to highlight their significance and practical implications for physics education in the Thai context.

Demographic and Academic Background

The demographic and academic characteristics of the participants will be presented in Table 1. The study involved 18 non-science track students, with a female majority (61.11%). The average GPAX shows a slight gender difference, with females (M = 2.75, SD = 0.39) performing marginally better than males (M = 2.44, SD = 0.58).

Table 1. Demographic and Academic Characteristics of Participants (N=18)

Characteristic	Category	n	Percentage	Mean GPAX (SD)
Gender	Male	7	38.89	2.44 (0.58)
	Female	11	61.11	2.75 (0.39)
Age	17	6	33.33	2.54 (0.52)
	18	11	61.11	2.65 (0.48)
	19	1	5.56	2.90 (-)

Physics Learning Experience and Challenges

The analysis of students' learning experiences and challenges (Table 2) reveals several significant patterns. The majority of students (72.22%) reported having an "enjoyable but sometimes not understanding" experience with physics, with minimal gender differences in this perception. This finding corresponds with previous research indicating that non-science students can maintain positive attitudes toward physics despite facing comprehension challenges (Bray & Williams, 2020).

Mathematical calculations emerged as the primary challenge (66.67% of students), followed by formula applications (55.56%). This hierarchy of difficulties is consistent with earlier studies on non-science students' physics learning (Moore & Rubbo, 2012). Interestingly, male students reported slightly higher difficulties with mathematical calculations (71.43%) compared to females (63.64%), though this difference was not statistically significant.

Table 2. Physics Learning Experience and Challenges (N=18)

Aspect	Category	Overall (%)	Male (%)	Female (%)
Learning Experience	Enjoyable but sometimes not understanding	72.22	71.43	72.73
	Not clear/Cannot do	16.67	14.29	18.18
	Not enjoyable but can understand	11.11	14.29	9.09
Main Challenges*	Mathematical calculations	66.67	71.43	63.64
	Formula applications	55.56	57.14	54.55
	Theoretical understanding	44.44	42.86	45.45
	Mathematical proofs	33.33	28.57	36.36
	Connecting with real life	27.78	28.57	27.27

*Multiple responses allowed

Learning Support Expectations

Table 3 demonstrates students' expectations regarding learning support and their interest levels in physics. Clear explanations received the highest mean rating (M = 4.11, SD = 0.96), followed by step-by-step problem solving (M = 4.06, SD = 0.87). Female students consistently showed higher expectations across all support categories, particularly in step-by-step problem solving (M = 4.18, SD = 0.85) compared to males (M = 3.86, SD = 0.90).

The relatively high ratings for real-world applications (M = 3.94, SD = 0.80) suggest students' desire to connect physics concepts with practical situations, supporting findings from previous research on effective physics teaching strategies for non-science students (Busch, 2010).

Table 3. Learning Support Expectations and Interest Levels (5-point Likert scale)

Aspect	Overall Mean (SD)	Male Mean (SD)	Female Mean (SD)
Clear explanations	4.11 (0.96)	4.00 (1.00)	4.18 (0.94)
Step-by-step problem solving	4.06 (0.87)	3.86 (0.90)	4.18 (0.85)
Real-world applications	3.94 (0.80)	3.71 (0.95)	4.09 (0.67)
Concept connections	3.89 (0.83)	3.71 (0.95)	4.00 (0.74)
Interest in physics learning	3.53 (1.07)	3.43 (1.13)	3.59 (1.04)

Gender-Based Analysis

The gender-based analysis reveals subtle but noteworthy differences in learning preferences and challenges. While both genders showed similar patterns in overall learning experiences, females demonstrated higher interest levels (M = 3.59, SD = 1.04) compared to males (M = 3.43, SD = 1.13).

A key finding regarding the physics learning experience and challenges for non-science students is that the majority of students (72.22%) reported an "enjoyable but sometimes not understanding" experience. This finding may stem from recent reforms in science education in Thailand, which have encouraged a more meaningful, joyful, and applicable approach to learning. Although the survey results indicate that most students find their basic physics learning experience enjoyable, they still struggle with understanding core concepts. This lack of comprehension may be due to learning designs that fail to connect with the real world and students' daily lives (Raj Chetri, 2022; Srisawat & Yuenyong, 2021; Yuenyong, 2019). Such an approach can prevent students from recognizing the value and meaning of what they are learning, making it difficult for them to truly grasp the material.

Survey responses on students' physics learning experiences also indicate that mathematical calculations are a major challenge. In fact, they were identified as the primary challenge by *66.67%* of students. Past research has pointed in the same direction: students struggle with physics due to difficulties applying abstract mathematical concepts to physical situations, a lack of foundational mathematical skills like algebra and calculus, poor problem-solving skills, and a weak conceptual understanding of physics principles. Overcoming these challenges often requires improving mathematical proficiency, developing strong problem-solving strategies, and receiving guidance to connect abstract ideas to real-world phenomena (Levi et al., 2025). Promoting mathematical solutions in physics may can be done in many ways, such as: Connection to the Real World (A positive attitude is linked to seeing physics as relevant to understanding the world around them, making the subject more engaging), Enjoyment of Learning (Students who enjoy physics are more likely to actively participate in lessons, ask questions, and persevere through challenges), Enthusiasm for the Subject (Feeling enthusiastic about physics lessons can lead to higher motivation and better engagement.), Confidence in Math Skills (A positive attitude includes the belief that one can use and apply mathematical skills effectively in physics) (Aprilia et al., 2023; Ibrahim et al., 2019; Raj Chetri, 2022)

In addition to providing insights into their physics learning experiences, the student questionnaire also revealed their need for support from physics teachers. The survey identified three key areas where students most desired assistance, ranked by mean score: clear explanations (M=*4.11)*, step-by-step problem-solving (M = *4.06)*, and real-world applications (M = *3.94)*. In order to support students effectively, providing clear explanations is essential for helping them build a strong foundation of knowledge. Teachers can employ several strategies to achieve this, such as using analogies and metaphors, connecting new information to students' prior knowledge, utilizing visualizations, and encouraging students to ask questions (Kulgemeyer & Geelan, 2021).

Students also requested step-by-step solutions to problems. Physics problem-solving is particularly challenging for novice students, who often focus on finding the correct equation rather than comprehending the underlying physics. To address this, teachers can implement structured activities that guide students through a consistent framework for problem-solving. A five-step method is highly effective, including: Focus the Problem, Describe the Physics, Plan the Solution, Execute the Plan, and Evaluate the Answer. Additionally, incorporating activities like pair-and-share or having students explain their reasoning can help them internalize the process, learn diverse problem-solving strategies, and construct meaning from their peers' insights (Park, 2020).

In terms of real-world applications, linking real-life stories to science or basic physics is another approach that may help students better learn basic physics. Benefits of incorporating real-world applications into lessons include increased engagement, deeper understanding, and enhanced skill development. When educators connect academic concepts to practical, real-life contexts, they make learning more relevant and meaningful for students (Rahmawati et al., 2021; Taylor, 2014).

In conclusion, a key finding is that many non-science students find physics enjoyable but struggle to understand the concepts. This is likely because the learning designs fail to connect to the real world, despite recent reforms promoting a more engaging approach. A major challenge for students is mathematical calculations, identified as a primary difficulty. Students struggle to apply abstract math to physics problems due to poor foundational skills and a weak grasp of concepts. To overcome this, educators need to improve students' mathematical proficiency and problem-solving strategies and connect abstract ideas to real-world phenomena. Students also desire support from teachers, specifically in three key areas: clear explanation, step-by-step problem-solvin, and real-world application. Providing this support can help students build a strong foundation and better grasp physics principles.

CONCLUSION

This study surveyed the expectations of high school non-science students in Thailand regarding basic physics. It was found that most students face significant challenges, particularly in applying mathematics, but still hold a positive attitude toward the subject. These findings suggest that physics instruction for non-science students should be adapted to their specific needs, with a strong focus on clear, step-by-step problem-solving (Aprilia et al., 2023; Ibrahim et al., 2019; Kulgemeyer & Geelan, 2021). The findings indicate that teachers should employ different instructional strategies to address the varying mathematical abilities of non-science students. Providing clear, step-by-step explanations for problem-solving is crucial (Kulgemeyer & Geelan, 2021; Park, 2020). Integrating real-world physics applications into lessons can also help students engage with the subject and see its value (Kulgemeyer & Geelan, 2021; Levi et al., 2025; Park, 2020; Salsabila et al., 2024). Implementing these approaches can help teachers effectively design a curriculum that develops both conceptual understanding and student engagement. This study has a limitation due to its relatively small sample size, which restricts the ability to generalize the findings. Future research should consider a larger and more diverse sample from various schools. Longitudinal studies could explore how student expectations change over time (Ladachart et al., 2024). Additionally, comparative research between science and non-science students, as well as studies on the effectiveness of new teaching strategies based on these findings, would be beneficial for the field of physics education.

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AUTHOR CONTRIBUTIONS

Authors 1, 2, and 4 create articles and instruments and are responsible for research. Author 3 analyzes research data that has been collected, conducts research data analysis and instrument validation, and inputs research data as the corresponding author.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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