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Generation alpha and the decline of motivation to learn physics

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Abstract

However, many students from Generation Alpha demonstrate low motivation to learn physics due to various factors related to the characteristics of the digital generation, the complexity of physics content, and learning processes that are not fully aligned with their needs. This study aims to analyze the factors contributing to the low motivation of Generation Alpha students in learning physics and to identify the implications for developing more contextual, interactive, and technology-based physics instruction. The study employed a qualitative approach using semi-structured interviews. The participants consisted of 10 students from SMP Negeri 81 Maluku Tengah who were selected based on their willingness and ability to provide information relevant to the research objectives. The findings revealed that low motivation to learn physics is influenced by several major factors: students' perceptions that physics is a difficult subject due to its extensive use of formulas, mathematical calculations, and abstract concepts; students' low self-confidence in solving physics problems; teaching methods that remain dominated by theoretical explanations and make limited use of digital media; the lack of connections between physics concepts and everyday life; and the high intensity of digital technology use for entertainment rather than educational purposes. The interview results also indicated that Generation Alpha students prefer learning experiences that are interactive, visual, and technology-enhanced, such as educational videos, digital simulations, simple experiments, and interactive quizzes. This study concludes that improving Generation Alpha students' motivation to learn physics requires a transformation of instructional practices toward a more student-centered, contextual, interactive, and technology-based approach. The integration of digital media, virtual simulations, and real-life applications of physics concepts can enhance students' interest, engagement, and motivation in learning physics.

Keywords: Generation Alpha; Physics Learning; Learning Motivation; Digital Technology; Student Engagement; Physics Education.

1. Introduction

Physics is a branch of science that plays a crucial role in explaining various natural phenomena and supporting the advancement of modern technology. However, numerous studies have shown that many students still experience difficulties in understanding physics concepts and applying problem-solving skills (Stern et al., 2017; Ayasrah et al., 2024). Physics is often regarded as one of the most challenging scientific disciplines and is generally considered less appealing than other science subjects, such as chemistry and biology, leading many students to require additional support to succeed in physics classes (AlArabi et al., 2022; Alarbi et al., 2024). Many students perceive physics as a complex subject from secondary school onward, and its level of difficulty is often considered to increase further at the undergraduate and postgraduate levels (Saleh, 2021). Physics seeks to explain the causes and mechanisms underlying various natural phenomena encountered in everyday life. Nevertheless, many students view physics as a difficult subject to learn. This difficulty primarily stems from the demands of physics learning, which require students to understand multiple forms of representation, including mathematical equations, numerical calculations, graphs, and abstract concepts (Angell et al., 2004; Rachman & Batlolona, 2025). In addition, several studies have indicated that students'

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motivation to learn physics remains at a relatively low level and has not yet reached the expected standard (Kácovský et al., 2023; Bøe et al., 2025). This situation has contributed to physics becoming one of the less popular subjects in schools (Johansson et al., 2023). Furthermore, many students tend to avoid physics-related fields of study, except for engineering disciplines, when pursuing higher education (Zalewski et al., 2019). Therefore, schools should encourage students to engage regularly in physics problem-solving exercises so that they can successfully tackle challenging physics questions in examinations. Such competence reflects the development of strong mathematical thinking skills, which are essential for success in physics learning (Guido, 2013).

Physics education is one of the fields of study that presents unique challenges for students during their early years of higher education. At this stage, students are required to understand a variety of fundamental concepts that serve as the foundation for mastering science and technology. The transition from secondary education to university often requires students to engage with more abstract content and apply more advanced mathematical approaches. Consequently, this period represents a critical phase that can significantly influence academic success, as students' learning motivation and self-regulation skills play a vital role in shaping both the learning process and its outcomes (Zawawi et al., 2024). Several international studies have reported similar findings. For example, in the Philippines, physics is perceived as a particularly challenging subject by many university students due to longstanding negative perceptions associated with the discipline. As a result, appreciation of the importance of physics in everyday life is generally more common among students who demonstrated strong academic performance in physics during secondary school, possessed high mathematical ability, and exhibited exceptional aptitude and achievement in science-related fields (Guido, 2013). Similarly, science teachers in Malaysian secondary schools, particularly those teaching physics, frequently observe that students experience considerable difficulties in understanding conceptual ideas in physics, which in turn contributes to a lack of interest in the subject (Saleh, 2012). revealed that only about 35% of students considered underlying physics concepts when solving physics problems, while the majority rarely used physics diagrams as supportive tools during the problem-solving process. Furthermore, students often encounter difficulties in connecting one physics concept to another, limiting their ability to develop a coherent understanding of the subject.

According to Holubova (2015), physics instruction can become more effective when the problems presented to students are connected to real-world situations that are relevant to their everyday lives. Nevertheless, the implementation of more innovative instructional approaches continues to face several challenges, including teachers' limited readiness to adopt new teaching methods and the large number of students in a single classroom, which may reduce student attention and participation during the learning process (Shalgimbekova et al., 2024; Awang et al., 2025). Several studies have also indicated that female students tend to perceive physics as a more difficult subject than male students. This perception may be influenced by various factors, including the classroom environment, the quality of instruction, and students' learning experiences. Students who view learning physics as a process of understanding concepts and gaining new perspectives are more likely to adopt a deep learning approach, whereas those who focus primarily on examinations and memorization tend to employ a surface learning approach. Therefore, fostering more constructive conceptions of learning should become a central focus of physics education in order to enhance both the quality of the learning process and student learning outcomes (Chiou et al., 2013). Although physics makes significant contributions to technological advancement and economic development, it is still regarded as a difficult subject by many students, particularly female students. Evidence from Serbia, for example, shows that female students exhibit lower motivation to learn physics, especially in recognizing the importance of physics as a scientific discipline and in developing confidence in their own abilities. The use of virtual experiments has been shown to be more effective than hands-on experiments in enhancing female students' motivation to learn physics. In contrast, female students who participated in real laboratory experiments tended to fear being ridiculed by their male peers and were generally less confident in their knowledge and abilities (Radulović et al., 2022).

These difficulties are influenced by various factors, including teachers' limited mastery of subject content, the use of less effective instructional strategies, and suboptimal classroom management. Therefore, integrated efforts are needed to improve the quality of physics education through the implementation of more engaging teaching methods, the incorporation of real-life contexts into the learning process, and the creation of an inclusive learning environment that supports the needs of all students regardless of gender. This study highlights the importance of enhancing the quality of physics education to enable all students to better understand and master physics concepts while actively participating in the learning process (Zulkiffli et al., 2024). Research conducted by Mowling et al. (2004) demonstrated that low student learning motivation is influenced by various factors originating from both the students themselves and the learning environment. Six major factors were identified as barriers to motivation: low intrinsic motivation, the inappropriate use of extrinsic motivation, teaching practices, curriculum design, school administrative support, and learning environment conditions. Therefore, improving student motivation requires learning experiences that are more engaging, meaningful, student-centered, and supported by a conducive school environment. Similarly, Kamba et al. (2020) found that family background, teachers' attitudes toward their profession, instructional methods, and gender significantly influence students' achievement in physics. Consistent findings were also reported in a study conducted in the United Arab Emirates, which showed that factors such as students' interest in and awareness of the importance of physics, the influence of physics on students' daily habits, and teachers' professionalism in engaging students play important roles in shaping students' learning experiences and achievement in physics (Yehya, 2023). The findings of Chan & Norlizah (2017) revealed that students demonstrated a moderate level of motivation toward science learning and achieved moderate-to-low academic performance in science subjects. Female students were found to be significantly more motivated than male students in learning science. In contrast, a study by Kwarikunda et al. (2020) reported no significant gender differences in motivation to learn physics. Therefore, increasing students' interest in physics should remain a primary concern in efforts to enhance both motivation and academic achievement in physics. Furthermore, research by Salta & Koulougliotis (2020) indicated that university students exhibit different levels of motivation toward chemistry and physics, with motivation toward chemistry consistently higher than motivation toward physics. This motivation was found to be significantly influenced by students' academic programs, whereas the effect of gender was relatively small. These findings suggest that learning motivation is discipline-specific, implying that instructional approaches should be tailored to the unique characteristics of each scientific field.

Research conducted by Pečiuliauskienė (2022) examined the relationship between instructional clarity in physics lessons and students' motivation to learn physics using TIMSS 2019 data from Lithuania and Finland. The findings indicated that the quality and clarity of instruction play an important role in shaping students' motivation toward physics learning. Similarly, a study by Alfahel (2023) investigated the level of motivation among Arab students in Israel to learn science and found that their overall motivation was relatively high. However, significant differences in motivation were observed based on gender, school level, academic achievement, and teacher gender. Science learning motivation was higher among female students, high-achieving students, primary school students, and students taught by female teachers. These findings highlight the important role of both individual characteristics and learning environment factors in shaping students' motivation to learn. Furthermore, the quality of instruction provided by teachers in physics classes has a positive and significant influence on students' motivation to learn physics. Teachers who are able to explain concepts clearly, provide understandable answers, and support students in comprehending physics concepts can substantially enhance students' learning motivation. Therefore, improving the quality of instruction through greater instructional clarity represents an important strategy for increasing students' interest in and motivation for learning physics. In addition, fostering students' understanding of the nature of scientific knowledge and the scientific processes underlying physics may serve as an effective strategy for enhancing both motivation and learning outcomes in physics education (Alpaslan, 2019).

This situation differs considerably from that of the current generation, namely Generation Alpha (Gen Alpha). This cohort, born between 2010 and 2024, is often referred to as "screengagers" because they have been highly familiar with digital technology from an early age (Drugaș, 2022; Kumar, 2026). Global data on online video game addiction among adolescents reveal a concerning trend. A survey conducted across four developed countries—Germany, the United Kingdom, Canada, and the United States—found that approximately 0.3% to 1% of respondents met the criteria for video game addiction (Przybylski & Weinstein, 2017). In South Korea, this issue has also become a major concern, with more than six million children and adolescents reported to experience difficulties associated with video game addiction. Furthermore, a study by Kolhar et al. (2021) found that 52% of social media users reported that social media had affected their learning activities, while 66% indicated that they were more interested in social media than in academic activities. In addition, 74% reported spending their leisure time on social media platforms. The most widely used platforms were Snapchat (45%), Instagram (22%), Twitter (18%), and WhatsApp (7%). The study further revealed that 46% and 39% of participants typically went to sleep between 11:00 p.m. and 12:00 a.m. and between 1:00 a.m. and 2:00 a.m., respectively. Notably, 68% attributed their delayed sleep schedules to social media use, while 59% reported that social media had negatively affected their social interactions. These findings are consistent with the study conducted by Demuyakor (2021) which demonstrated that online gaming platforms can lead to excessive addiction and have significant negative effects on students' academic achievement, social relationships, and physical and mental health. Although digital technology offers numerous educational opportunities, excessive use can also create serious challenges. Onguner et al. (2024) found that 33% of children began using mobile devices between the ages of 5 and 9 years, and 18.4% exhibited symptoms of problematic internet use or internet addiction. The consequences were also evident in self-care abilities, with 11% of parents reporting delays in their children's ability to maintain personal hygiene and meet basic self-care needs. Moreover, digital addiction may adversely affect both physical and mental health while increasing exposure to cyber-related risks. Excessive consumption of short-form video content has also been associated with learning difficulties, reduced attention span, and hindered development of children's social skills (Akar & Özer, 2025).

Generation Alpha, whose members are currently no older than approximately 13 years of age, has begun to transform traditional approaches to learning and play that have long been practiced in schools. Growing up amidst rapid technological advancement and a strong culture of consumption, technology has become an inseparable part of their daily lives. Generation Alpha is also recognized as the first generation to be born and raised entirely in the twenty-first century, and many of its members are expected to live into the twenty-second century. Unlike the Millennial generation, whose childhood experiences were largely shaped by physical play and face-to-face interactions, Generation Alpha spends a greater portion of its time interacting with digital devices and technological tools. As a result, members of this generation tend to rely heavily on technology and virtual experiences. Consequently, some children in this generation may be more susceptible to boredom, anxiety, and emotional distress than those of previous generations. Technology has simplified many aspects of daily life and enables individuals to access information rapidly with just a single click. However, despite these advantages, it remains essential for parents and educators to teach children how to use technology wisely and responsibly. Furthermore, several instructional methods that are still widely used today are increasingly viewed as inadequate for meeting the needs of a rapidly evolving modern society. Although students' learning processes are now heavily supported by the internet and various digital resources, traditional teaching methods should not be abandoned. These methods play a crucial role in fostering students' understanding of history, culture, and moral values, thereby contributing to a more balanced and holistic educational experience (Kumari et al., 2025). Generation Alpha is developing within a learning environment that integrates digital tools with hands-on activities, emotional support, and real-world relevance. Such an approach is essential for addressing the unique characteristics and learning needs of this generation while promoting meaningful and sustainable learning experiences.

Therefore, educators are increasingly challenged to bridge the gap between conventional teaching practices and the learning needs of digital-generation learners (Saifuddin et al., 2026). The distinctive characteristics of Generation Alpha, including growing up in a highly digital environment, becoming accustomed to instant access to information, preferring visual and interactive learning experiences, and showing limited interest in activities that require sustained concentration, have the potential to influence their motivation to learn physics. On the other hand, physics instruction in schools continues to be largely dominated by conventional approaches that emphasize the memorization of formulas, procedural problem-solving, and the verbal delivery of content. This mismatch between the learning characteristics of Generation Alpha and current physics teaching practices may contribute to students' low interest in and motivation for learning physics. Consequently, there is a need for a more in-depth examination of the factors underlying Generation Alpha students' low motivation to learn physics. Such an investigation is essential for developing instructional strategies that are more closely aligned with the needs and learning preferences of today's digital generation. Accordingly, this study aims to analyze the factors contributing to the low motivation of Generation Alpha students in learning physics and to identify the implications of these factors for the development of more contextual, interactive, and technology-enhanced physics instruction.

2. Methodology

2.1. Research Design

This study employed a qualitative approach, which enabled the researcher to gain a more comprehensive understanding of the phenomenon under investigation than could be obtained through numerical data alone. According to Lim (2025), qualitative research is an approach used to explore and understand the meanings that emerge from various social and human-related issues. Similarly, Bhangu et al. (2023) explain that qualitative research refers to investigative techniques that utilize non-statistical and non-numerical methods of data collection, analysis, and evidence presentation. This approach provides researchers with the opportunity to examine phenomena that are difficult to measure quantitatively, such as experiences, language, culture, history, and social interactions within society. One of the primary characteristics of qualitative research is its focus on the perspectives and experiences of participants. Through this approach, the researcher was able to obtain detailed information from students regarding the instructional practices implemented by their teachers. Data were collected through semi-structured interviews conducted individually between the researcher and each participant. In semi-structured interviews, the researcher prepares an interview guide containing key questions aligned with the objectives of the study while allowing participants the flexibility to express their opinions and experiences in greater depth. Butler et al. (2021) state that semi-structured interviews are an effective method for understanding individuals' experiences, perspectives, and interpretations of a particular phenomenon and are therefore widely used in qualitative research. Through these interviews, the researcher obtained in-depth information regarding the factors contributing to the low motivation of Generation Alpha students in learning physics, as well as potential strategies for developing physics instruction that is more contextual, interactive, and technology-enhanced.

2.2. Population and Sample

The population of this study consisted of 80 students enrolled at SMP Negeri 81 Maluku Tengah. The sample comprised 10 students from Grades 7 to 9. The involvement of these students as participants was expected to assist the researcher in obtaining a comprehensive understanding of their experiences, perceptions, and perspectives regarding the phenomenon under investigation. As noted by Dahal et al. (2019), participant selection in qualitative research should consider the participants' ability to provide rich and meaningful information (information-rich cases), thereby ensuring that the data collected effectively support the achievement of the research objectives. The inclusion criteria for participants in this study were as follows: (1) being actively enrolled as a student at SMP Negeri 81 Maluku Tengah at the time of data collection; (2) willingness to participate in the study; and (3) the ability to provide information relevant to the focus of the research. By involving students who met these criteria, this study sought to generate in-depth, diverse, and meaningful data that accurately reflect the conditions and experiences within the school environment.

2.3. Research Procedure

This study was conducted through four main stages: preparation, data collection, data analysis, and report writing. During the preparation stage, the researcher identified the research problem, reviewed relevant literature, developed the interview guide, and obtained the necessary research permissions from SMP Negeri 81 Maluku Tengah. The data collection stage was carried out through interviews with 10 students who participated in the study. The interviews were conducted to obtain in-depth information regarding participants' perspectives, experiences, and factors related to the focus of the research. Throughout the interview process, the researcher recorded and documented the information obtained to facilitate subsequent data analysis. The data analysis stage involved transcribing the interview data, organizing the data into emerging themes, and interpreting the meanings embedded within the participants' responses. Data analysis was conducted continuously throughout the research process to identify patterns and develop a deeper understanding of the phenomenon under investigation. According to Miles & Huberman (1994), qualitative data analysis consists of three interrelated processes: data reduction, data display, and conclusion drawing and verification. The final stage involved preparing the research report by systematically presenting the findings, relating them to relevant theories and previous studies, and drawing conclusions based on the analyzed data. This procedure was guided by the qualitative research framework proposed by Creswell (2007), which emphasizes the importance of systematic data collection and analysis in achieving a comprehensive understanding of a particular phenomenon.

2.4. Data Analysis

The data in this study were analyzed using the qualitative data analysis model proposed by Miles & Huberman (1994). Data analysis was conducted continuously throughout the research process, beginning with data collection and continuing until the completion of the study. The first stage was data reduction, which involved selecting, focusing, simplifying, and categorizing interview data that were relevant to the research objectives. During this stage, the researcher identified and retained essential information while eliminating data that were not related to the purpose of the study. The second stage was data display. The reduced data were then organized and presented in the form of descriptive narratives based on the themes that emerged during the interview process. The purpose of data display was to facilitate the researcher's understanding of patterns, relationships, and meanings embedded within the data. The third stage was conclusion drawing and verification. At this stage, the researcher interpreted the displayed data to identify meanings, patterns, and findings that addressed the research objectives. The conclusions were subsequently verified through repeated examination of the collected data to ensure the credibility and accuracy of the research findings. Through these stages, the researcher was able to develop a comprehensive understanding of the phenomenon under investigation.

3. Results and Discussion

Based on interviews conducted with 10 students belonging to Generation Alpha, the findings revealed that low motivation to learn physics is influenced by various interrelated factors originating from the nature of physics content, instructional practices, and the rapid development of technology that has become an integral part of students' daily lives. In general, most participants reported that physics is a difficult subject to understand because it involves numerous formulas, mathematical calculations, and abstract concepts. As a result, students tend to show limited interest in studying physics in greater depth. One student stated:

"I rarely feel motivated to study physics outside class hours because the material is too difficult. Dynamic electricity requires understanding many formulas, which makes me quickly become bored and less motivated to study independently. I am more interested in subjects that can be understood through real-life examples than in topics that involve a lot of calculations." (S1)

The interview findings indicate that difficulties in understanding physics concepts and applying formulas contribute to a decline in students' self-confidence during the learning process. This condition leads some students to feel incapable of solving physics problems, which ultimately affects their learning motivation. This pattern was reflected in the statements of several participants.

Similar views were expressed by S4 and S8. Both students reported that difficulties in understanding electrical circuits and applying formulas often resulted in unsatisfactory academic performance. These experiences reduced their confidence when participating in physics lessons. S4 explained that whenever the teacher assigned practice problems, he or she frequently worried about being unable to answer them correctly. Over time, these feelings diminished both interest in and motivation for learning physics. Likewise, S8 stated that rather than reviewing physics material that was perceived as difficult, he or she preferred spending time on entertainment activities using a smartphone.

In addition to the complexity of the subject matter, students identified instructional methods dominated by theoretical explanations as another factor contributing to low learning motivation. *S2 and S7 stated that physics lessons would be more engaging if teachers incorporated visual media, educational videos, or digital simulations into instruction. According to these students, topics in optics were difficult to understand because they were expected to imagine the path of light rays without being provided with clear visual representations. S2 explained that understanding was easier when concepts were presented through animations or videos rather than through verbal explanations alone. This finding suggests that the characteristics of Generation Alpha, who are accustomed to obtaining information through digital media, influence the ways in which they learn and comprehend academic content.*

Another factor identified was the limited connection between physics concepts and students' everyday experiences.

S5 reported frequently questioning the practical value of learning concepts such as speed and acceleration. According to this student, physics lessons would be more interesting if teachers provided examples closely related to students' daily activities. A similar view was expressed by S9, who reported difficulty understanding Archimedes' Principle because its real-world applications were difficult to visualize. Consequently, students perceived physics content as less relevant to their needs and experiences, which contributed to lower levels of learning motivation.

Regarding technology use, most students acknowledged that they primarily used smartphones for social media, video streaming, and gaming rather than for educational purposes.

S3 explained that most leisure time was spent watching entertainment content rather than studying physics. Nevertheless, this student also indicated a greater willingness to learn physics if interactive and user-friendly digital learning media were available. A similar opinion was expressed by S10, who preferred learning through videos and simulations rather than reading textbook materials.

The interview findings further revealed that Generation Alpha students tend to favor learning experiences that are interactive, engaging, and technology-enhanced. Most participants reported feeling more motivated when teachers incorporated instructional videos, simple experiments, interactive quizzes, or digital simulations into classroom activities. In contrast, lessons that relied primarily on lectures and routine problem-solving exercises tended to make students feel bored quickly and lose interest in learning.

Low motivation to learn physics among Generation Alpha students can be understood through the unique characteristics of this generation, which has grown up in a digital environment since birth. Generation Alpha is the first generation to be raised entirely within an ecosystem of smart technologies, high-speed internet, social media, and artificial intelligence. These conditions have shaped the ways in which they acquire information, process knowledge, and construct learning experiences, distinguishing them from previous generations (Ziatdinov & Cilliers, 2021). Consequently, when physics instruction continues to be dominated by traditional teaching methods such as lectures, formula memorization, and repetitive problem-solving exercises, Generation Alpha students often experience a mismatch between their learning expectations and the educational experiences provided in schools. One of the primary factors contributing to low motivation to learn physics is the perception that physics is a difficult and complex subject. Physics requires students to understand abstract concepts such as force, energy, electric fields, waves, and quantum mechanics, many of which cannot be directly observed. Furthermore, physics is closely associated with mathematics, requiring students to simultaneously develop numerical competence and logical reasoning skills. According to Potvin & Hasni (2014), students' perceptions of the difficulty level of a subject constitute one of the most influential factors affecting their interest in and motivation for learning. When students perceive their likelihood of success as low, their intrinsic motivation to engage with the subject tends to decline.

From the perspective of educational psychology, this phenomenon can be explained through the expectancy-value theory developed by (Eccles & Wigfield, 2020). his theory proposes that learning motivation is influenced by two primary factors: students' beliefs about their ability to succeed (expectancy of success) and the value they assign to a learning task (task value). For many Generation Alpha students, both components tend to be relatively low in the context of physics learning. They often perceive physics as difficult to understand while simultaneously failing to recognize the direct relevance or practical benefits of the subject in their everyday lives. As a result, they are less willing to invest the time and effort required to learn physics. In addition to cognitive factors, the digital culture surrounding Generation Alpha also plays an important role in shaping their learning motivation. Their daily lives are immersed in applications designed to provide instant gratification, such as social media platforms, short-form videos, and digital games. This digital environment conditions students to expect rapid and continuous feedback. In contrast, learning physics often requires deep thinking, persistence in solving problems, and a considerable amount of time to develop a meaningful understanding of concepts. According to Twenge & Campbell (2018), increased exposure to digital technologies can alter the attention patterns and learning preferences of younger generations, making them more inclined toward activities that provide immediate stimulation and rewards rather than those requiring sustained cognitive effort over an extended period.

Another factor contributing to low motivation to learn physics is low self-efficacy. Self-efficacy refers to an individual's belief in their ability to successfully perform a task or achieve a specific goal. In the context of physics learning, many students lack confidence when faced with problems that require mathematical analysis or complex problem-solving skills. Research by Bandura (1978) demonstrated that students with low self-efficacy are more likely to avoid tasks perceived as difficult, give up more easily when encountering obstacles, and exhibit lower levels of learning motivation. This finding is supported by numerous studies in physics education, which have consistently shown that self-efficacy is a significant predictor of students' academic achievement and persistence in learning physics. The motivation of Generation Alpha students to learn physics is also influenced by the perceived relevance of the subject matter to their lives. Many students view physics as a collection of formulas and theories that are disconnected from everyday reality. However, learning motivation tends to increase when students understand how the knowledge they acquire can be applied to explain phenomena in their surrounding environment. According to Osborne et al. (2010), one of the primary reasons for declining student interest in science is the failure of curricula to establish meaningful connections between scientific concepts and students' lived experiences. In the context of Generation Alpha, whose lives are closely intertwined with technology, physics instruction that connects scientific concepts to smartphones, electric vehicles, renewable energy technologies, robotics, artificial intelligence, and space exploration has the potential to enhance students' perceptions of the usefulness and relevance of the subject.

In addition, social factors also influence students' motivation to learn physics. Several studies have shown that the classroom environment, teacher support, and peer interactions contribute significantly to students' interest in science. According to Palmer (2009), teachers who are able to create a positive learning atmosphere, provide opportunities for exploration, and encourage active student participation can substantially enhance students' motivation to learn science. Conversely, learning environments that place excessive emphasis on examination performance, academic competition, and formula memorization may suppress students' curiosity, which is a fundamental element of physics learning. The highly visual nature of Generation Alpha is another important factor to consider. Students from this generation tend to process and understand information more effectively through images, videos, simulations, and interactive experiences than through lengthy texts or verbal explanations. Consequently, physics instruction that fails to incorporate modern visualization technologies may be perceived as uninteresting or monotonous. Research on the use of virtual simulations and digital laboratories has demonstrated that visual representations of physics concepts can improve students' conceptual understanding, engagement, and learning motivation (Smetana & Bell, 2012). These findings suggest that the low motivation of Generation Alpha students to learn physics cannot be attributed solely to student-related characteristics. Rather, it is also influenced by instructional designs that have not yet been fully optimized to accommodate the learning preferences, needs, and expectations of this digitally oriented generation.

Overall, the low motivation of Generation Alpha students to learn physics is a multidimensional phenomenon influenced by cognitive, psychological, social, and technological factors. The perception that physics is a difficult subject, low levels of self-efficacy, the culture of instant gratification fostered by digital technology use, the limited relevance of physics content to students' everyday lives, and instructional approaches that are not fully aligned with the characteristics of digital-native learners are among the primary factors contributing to declining motivation to learn physics. Therefore, enhancing Generation Alpha students' motivation to learn physics requires a transformation of instructional practices toward approaches that are more contextual, interactive, and technology-enhanced. Such approaches should explicitly demonstrate the relevance of physics to real-world situations and everyday experiences, enabling students not only to understand scientific concepts but also to recognize the value, significance, and practical applications of learning physics.

4. Conclusion

This study demonstrates that the low motivation of Generation Alpha students to learn physics is influenced by various interrelated factors originating from student characteristics, the nature of physics content, and instructional practices implemented in schools. The interview findings revealed that most students perceive physics as a difficult subject because it involves numerous formulas, mathematical calculations, and abstract concepts that are challenging to understand. These perceptions contribute to low levels of self-confidence in solving physics problems, which subsequently reduce students' interest in and motivation for learning physics. Furthermore, instructional methods that continue to rely heavily on theoretical explanations and make limited use of digital media are perceived as insufficiently aligned with the characteristics of Generation Alpha, a generation that has grown up in a technology-rich environment and is accustomed to obtaining information through visual, interactive, and instant means. The limited connection between physics concepts and students' everyday experiences also prevents them from fully appreciating the relevance and practical value of physics learning. In addition, the tendency to use digital technology primarily for entertainment rather than academic purposes further affects students' attention and motivation to learn. The findings of this study highlight the need for a shift in educational practices from teacher-centered instruction toward more student-centered, contextual, interactive, and technology-enhanced learning approaches. Physics instruction that effectively connects scientific concepts to real-world experiences and integrates digital technologies in meaningful ways has the potential to increase student engagement, conceptual understanding, and learning motivation.

Based on the findings, physics teachers are encouraged to develop instructional strategies that align with the characteristics of Generation Alpha through the use of digital learning media, interactive videos, virtual simulations, digital laboratories, and technology-based learning platforms. Teachers should also relate physics concepts to phenomena that are familiar to students' daily lives in order to make learning more meaningful and relevant. Schools are expected to provide adequate infrastructure to support digital learning, including reliable internet access, educational technology resources, and professional development opportunities that enable teachers to effectively integrate technology into instructional practices. In addition, collaboration among schools, teachers, and parents should be strengthened to encourage the productive use of digital technology in ways that support students' learning processes.

This study has several limitations. First, it involved a relatively small number of participants from a single school, limiting the generalizability of the findings. Therefore, future research should include larger samples and involve schools from diverse geographical regions to obtain a more comprehensive understanding of Generation Alpha students' motivation to learn physics. Furthermore, future studies may employ a mixed-methods approach that combines qualitative and quantitative data to provide deeper insights into the factors influencing physics learning motivation. Future research may also examine the effectiveness of various technology-based instructional models, such as virtual simulations, gamification, Artificial Intelligence (AI), and project-based learning, in enhancing both learning motivation and academic achievement in physics among Generation Alpha students.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

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