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A Systematic Literature Review of Motivation in Physics Education

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Abstract: *Learning motivation is an important factor influencing students' conceptual understanding and learning outcomes in physics education. This study aims to synthesize empirical evidence on instructional methods used to enhance students' motivation to learn physics through a Systematic Literature Review (SLR). The study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, with articles obtained exclusively from the Scopus database using a Boolean search string. The inclusion criteria comprised empirical research articles published in English between 2020 and 2025 that examined instructional interventions aimed at enhancing students' motivation to learn physics. Of the 376 articles initially identified, 15 articles met the eligibility criteria following the screening and eligibility assessment processes and were included in the analysis. The synthesis identified four major trends in instructional approaches: technology-enhanced learning, student-centered learning, contextual and culturally responsive learning, and reflective or metacognitive learning. Learning motivation was assessed through indicators such as learning engagement, self-efficacy, situational interest, curiosity, intrinsic motivation, and positive attitudes toward physics. Overall, the findings indicate that learning approaches integrating active student participation, educational technology, meaningful learning experiences, and relevant contexts are more effective in enhancing students' motivation to learn physics.*

Keywords*:Physics Education, Learning Motivation, Instructional Methods, Systematic Literature Review*

Abstrak: Motivasi belajar merupakan faktor penting yang memengaruhi pemahaman konsep dan hasil belajar peserta didik dalam pembelajaran fisika. Penelitian ini bertujuan mensintesis bukti empiris mengenai metode pembelajaran yang digunakan untuk meningkatkan motivasi belajar fisika melalui Systematic Literature Review (SLR). Penelitian mengikuti pedoman Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) dengan sumber artikel yang diperoleh secara eksklusif dari basis data Scopus menggunakan Boolean search string. Kriteria inklusi mencakup artikel penelitian empiris berbahasa Inggris yang diterbitkan pada 2020–2025 dan membahas intervensi pembelajaran untuk meningkatkan motivasi belajar fisika. Dari 376 artikel yang ditemukan, setelah proses penyaringan dan penilaian kelayakan diperoleh 15 artikel untuk dianalisis. Hasil sintesis mengidentifikasi empat kecenderungan utama, yaitu technology-enhanced learning, student-centered learning, contextual and culturally responsive learning, serta reflective or metacognitive learning. Motivasi diukur melalui keterlibatan belajar, efikasi diri, minat situasional, rasa ingin tahu, motivasi intrinsik, dan sikap positif terhadap fisika. Secara keseluruhan, pembelajaran yang mengintegrasikan partisipasi aktif, teknologi, pengalaman bermakna, dan konteks relevan lebih efektif dalam meningkatkan motivasi belajar fisika.

Kata Kunci: Pendidikan Fisika, Motivasi Belajar, Metode Pembelajaran, Systematic Literature Review

INTRODUCTION

The field of physics education has undergone significant transformation in recent decades, with growing emphasis on innovative pedagogical approaches to address persistent challenges in student engagement and conceptual understanding. Recent studies have highlighted that advances in digital technology, student-centered pedagogies, and context-based learning have reshaped physics instruction by promoting active learning, higher-order thinking skills, and students' motivation (Bond et al., 2024; González-Pérez & Ramírez-Montoya, 2022; Sappaile et al., 2024). This review

examines 15 contemporary research studies that collectively investigate the efficacy of various modern teaching methodologies in physics education across diverse cultural and institutional contexts. The selected studies, published between 2020 and 2025, represent a global perspective on physics education research, encompassing works from Africa (Babalola et al., 2020; Mrani et al., 2020), Europe (Dziob et al., 2022; Erceg et al., 2023), Asia (Aththibby et al., 2021; Ermakan et al., 2024), and the Americas (Whitcomb et al., 2023).

Current literature reveals several critical gaps in physics education that these studies collectively address. First, these remains a persistent disconnect berween abstract physical concepts and student's ability to internalize these principles (Dessie et al., 2024). Second, motivational factors continue to present challenges, particularly in maintaining student interest and self efficacy throughout physics curricula (Brakhage et al., 2023; Whitcomb et al., 2023). Third, the integration of technology in physics education often lacks pedagogical coherence, with many implementations failing to move beyond superficial adoption (Richter & Kickmeier-Rust, 2025).

The studies under examination employ diverse methodological approaches to address these challenges, including quantitative analyses of learning gains (Büyükbayraktar & Dilber, 2022), qualitative investigations of student perceptions (Abraham & Barker, 2023), and mixed methods evaluations of intervention programs (Moro & Billote, 2023). Common themes emerging from thus body of research include the effectiveness of simulation based learning (Álvarez-Siordia et al., 2025; Mrani et al., 2020), the motivational benefits of gamification strategies (Ermakan et al., 2024; Jiménez-Valverde et al., 2024), and the importance of culturally responsive pedagogy (Moro & Billote, 2023).

Although previous studies have investigated various instructional approaches to enhance motivation in physics education, most have focused on evaluating the effectiveness of individual interventions, such as gamification, simulations, inquiry-based learning, or contextual instruction, within specific educational settings. Existing studies generally report the outcomes of particular instructional approaches without providing a comprehensive synthesis of how different teaching methods influence students' motivation across educational levels, learning contexts, and physics topics. Furthermore, limited review studies have systematically integrated evidence concerning instructional methods, motivational indicators, research instruments, educational levels, treatments, and physics topics into a single analytical framework. Therefore, a Systematic Literature Review (SLR) is needed to synthesize recent empirical evidence, identify research trends, and provide comprehensive recommendations for future physics education research and practice.

This review focuses on studies published between 2020 and 2025 because this period reflects recent developments in physics education, particularly following the rapid advancement of digital learning technologies and post-pandemic educational transformation. The review initially identified 376 Scopus-indexed publications. After applying predefined inclusion and exclusion criteria based on publication type, language, topic relevance, and methodological suitability following the PRISMA framework, only 15 empirical studies met all eligibility criteria and were included in the final analysis.

Accordingly, this study addresses four research questions. First, RQ1 examines what instructional methods have been employed to enhance students' motivation in physics education. Second, RQ2 investigates the motivational indicators examined in recent physics education research. Third, RQ3 explores the research instruments, educational levels, treatments, and physics topics most frequently reported in studies on motivation in physics education. Finally, RQ4 identifies research trends, implementation challenges, and potential directions for future research

based on the existing literature.

METHOD

The literature search was conducted using the Scopus database because it provides comprehensive coverage of high-quality, peer-reviewed international publications in physics education. The search was performed in March 2025 and was limited to articles published between 2020 and 2025 to capture recent developments in physics education, particularly following the rapid advancement of digital learning technologies and post-pandemic educational transformation.

The following search string was applied in the Scopus database:

("physics education" OR "physics learning" OR "physics teaching") AND (motivation OR "learning motivation" OR engagement) AND (student OR learner)

The Boolean operator OR was used to combine synonymous keywords, while AND was employed to combine the main concepts of the study. The search was restricted to the subject areas of Social Sciences and Physics and Astronomy. Only English-language journal articles and conference papers were considered, whereas book reviews, editorials, commentaries, and other non-research publications were excluded.

The initial search identified 376 records. After removing duplicate records and screening titles and abstracts according to the predefined inclusion and exclusion criteria, 36 articles were considered eligible for full-text assessment. During the eligibility stage, 21 articles were excluded because they did not specifically examine instructional methods for enhancing students' motivation in physics education or did not provide sufficient empirical evidence relevant to the objectives of this review. Consequently, 15 empirical studies met all eligibility criteria and were included in the final synthesis.

The selected studies were analyzed based on instructional methods, motivation indicators, treatments, research instruments, educational levels, and physics content covered in each study.

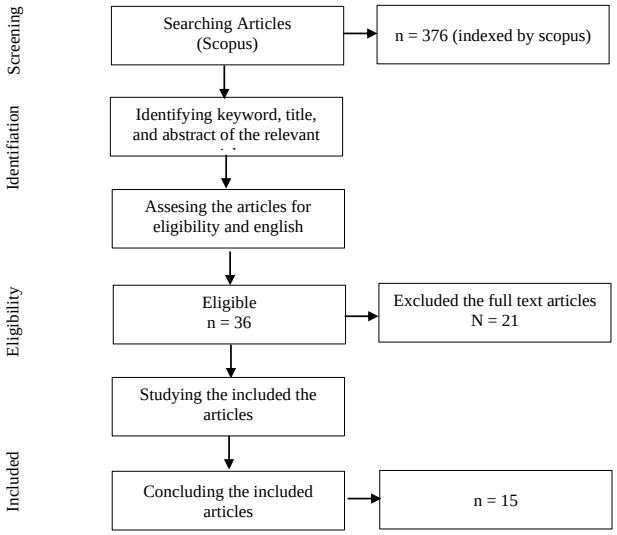

Figure 1. Research Procedure

RESULTS AND DISCUSSION

From the articles that have been analyzed using the systematic literature review method, 5 criteria will be analyzed, namely learning methods that can improve motivation, indicators of motivation, instruments used, level of education, and physiscs subjects.

Methods

Table 1 summarizes the instructional methods identified in the 15 empirical studies included in this systematic literature review. Although the reviewed studies employed diverse instructional approaches, several common patterns can be identified. The instructional methods include interactive simulations, inquiry-based learning, digital game-based learning, the Chain Experiment competition, hands-on learning, contextual learning, peer instruction, gamification, ethnoscience through traditional games, reflective learning, phenomenon-based learning, inclusive learning, and virtual laboratories. Each method appeared once in the reviewed studies, indicating that no single instructional approach has yet dominated research on motivation in physics education.

Table 1. Methods

No	Author	Methods	Frequency
1	(Richter & Kickmeier-Rust, 2025)	Digital game-based learning	1
2	(Moro & Billote, 2023)	Ethnoscience	1
3	(Jiménez-Valverde et al., 2024)	Gamification	1
4	(Büyükbayraktar & Dilber, 2022)	Hands-on learning	1
5	(Aththibby et al., 2021)	Inquiry-based learning	1
6	(Brakhage et al., 2023)	Contextual learning	1
7	(Whitcomb et al., 2023)	Peer instruction	1
8	(Abraham & Barker, 2023)	Inclusive approach	1
9	(Ermakan et al., 2024)	Phenomenon-based learning	1
10	(Dziob et al., 2022)	Project-based learning	1
11	(Dessie et al., 2024)	Reflective learning	1
12	(Mrani et al., 2020)	Interactive simulation	1
13	(Álvarez-Siordia et al., 2025)	Virtual labs	1

Despite this diversity, the instructional methods share similar pedagogical characteristics. Several studies employed technology-supported approaches, including interactive simulations (Mrani et al., 2020), digital game-based learning (Richter & Kickmeier-Rust, 2025), gamification (Jiménez-Valverde et al., 2024), and virtual laboratories (Álvarez-Siordia et al., 2025). These approaches demonstrate the growing integration of digital technologies into physics education to create more interactive learning environments and to enhance students' motivation through visualization, immediate feedback, and active engagement.

Another group of studies adopted student-centered instructional approaches, including inquiry-based learning (Aththibby et al., 2021), hands-on learning (Büyükbayraktar & Dilber, 2022), peer instruction (Whitcomb et al., 2023), and the Chain Experiment competition (Dziob et al., 2022). Although implemented in different educational contexts, these methods consistently emphasize active student participation through experimentation, collaboration, discussion, and scientific problem-solving. This pattern suggests that motivation is strengthened when students actively construct knowledge rather than passively receive information.

Several studies also highlighted the importance of contextual and authentic learning experiences. Contextual learning (Brakhage et al., 2023), ethnoscience through traditional games (Moro & Billote, 2023), phenomenon-based learning (Ermakan et al., 2024), and inclusive learning (Abraham & Barker, 2023) demonstrate that connecting physics concepts with students' everyday experiences, cultural backgrounds, and diverse learning needs can increase situational interest and learning relevance. These findings indicate that meaningful learning contexts play an important role

in sustaining students' motivation.

Reflective learning was identified as another instructional approach represented by Dessie et al. (2024). Although only one study explicitly examined reflective learning, the findings suggest that encouraging students to evaluate and regulate their own learning processes contributes positively to intrinsic motivation and independent learning.

Overall, the findings presented in **Table 1** reveal that research on motivation in physics education has shifted from traditional teacher-centered instruction toward more interactive, student-centered, technology-supported, and contextually relevant learning approaches. While each instructional method possesses unique characteristics, the reviewed studies consistently indicate that learning environments promoting active participation, meaningful experiences, and learner engagement are more likely to foster students' motivation in physics learning. This synthesis also suggests that future research should move beyond evaluating individual instructional methods and instead investigate how combinations of these approaches can maximize students' motivation across different educational contexts.

Motivation Indicator

Table 2 summarizes the motivation indicators reported in the 15 reviewed studies. Although each study examined different aspects of student motivation, the identified indicators reveal several recurring dimensions, including self-belief, interest and engagement, intrinsic motivation, and learning persistence. This finding indicates that motivation in physics education is a multidimensional construct rather than a single psychological attribute.

Table 2. Motivation Indicator

No	Author	Indicator	Frequency
1	(Dziob et al., 2022)	Team enthusiasm	1
2	(Whitcomb et al., 2023)	Self efficacy	1
3	(Richter & Kickmeier-Rust, 2025)	Engagement	1
4	(Ermakan et al., 2024)	Preseverance	1
5	(Moro & Billote, 2023)	Cultural attachment	1
6	(Aththibby et al., 2021)	Activ involvement	1
7	(Brakhage et al., 2023)	Situational interest	1
8	(Mrani et al., 2020)	Interest, involvement	1
9	(Dessie et al., 2024)	Intrinsic motivation	1
10	(Abraham & Barker, 2023)	Self perception	1
11	(Büyükbayraktar & Dilber, 2022)	Curiosity	1
12	(Álvarez-Siordia et al., 2025)	Self efficacy	1
13	(Jiménez-Valverde et al., 2024)	Positive attitude	1

The first emerging dimension is self-belief, represented by self-efficacy (Whitcomb et al., 2023; Álvarez-Siordia et al., 2025) and self-perception (Abraham & Barker, 2023). These studies consistently suggest that students are more motivated when they believe in their capability to understand physics concepts and perceive themselves as competent learners. The recurrence of self-efficacy across multiple studies highlights its importance as one of the key motivational constructs investigated in contemporary physics education research.

A second pattern concerns interest and engagement, encompassing situational interest (Brakhage et al., 2023), engagement (Richter & Kickmeier-Rust, 2025), interest and involvement (Mrani et al., 2020), and active involvement (Aththibby et al., 2021). Although these indicators are described using different terminology, they collectively emphasize students' active participation

during learning activities. The reviewed studies consistently demonstrate that instructional approaches encouraging interaction, participation, and authentic learning experiences are associated with higher levels of learning motivation.

Another important dimension is intrinsic motivation, reflected in intrinsic motivation itself (Dessie et al., 2024), curiosity (Büyükbayraktar & Dilber, 2022), and positive attitudes toward physics (Jiménez-Valverde et al., 2024). These indicators suggest that students become more motivated when learning activities stimulate curiosity, enjoyment, and personal interest rather than relying solely on external rewards. Furthermore, Moro and Billote (2023) identified cultural attachment as an important motivational factor, indicating that integrating local cultural contexts into physics instruction can strengthen students' emotional connection with learning.

The remaining indicators, including perseverance (Ermakan et al., 2024) and team enthusiasm (Dziob et al., 2022), highlight the role of persistence and collaborative learning in sustaining motivation. Rather than focusing exclusively on academic achievement, these studies demonstrate that motivational outcomes also include students' willingness to persist when facing challenging physics problems and to collaborate effectively with peers. Overall, Table 2 demonstrates that motivation in physics learning extends beyond students' interest in the subject. The reviewed studies collectively indicate that effective instructional approaches foster multiple dimensions of motivation simultaneously, including students' confidence, engagement, intrinsic interest, persistence, and collaborative attitudes. This synthesis also reveals that future research should investigate the relationships among these motivational dimensions and examine how they interact to influence students' long-term learning outcomes across different educational contexts.

Treatment

Table 3 presents the instructional treatments implemented in the 15 reviewed studies. Although each treatment appeared only once, the interventions can be synthesized into four broader categories: technology-based interventions, active and experiential learning, contextual and inclusive learning, and psychological and metacognitive support. This classification reveals that recent studies have increasingly adopted diverse instructional treatments to enhance students' motivation in physics learning rather than relying on conventional teaching approaches.

Table 3. Treatment

No	Author	Treatment	Frequency
1	(Büyükbayraktar & Dilber, 2022)	Active learning tools	1
2	(Aththibby et al., 2021)	Lab experiments	1
3	(Jiménez-Valverde et al., 2024)	Fantasy Class game	1
4	(Dziob et al., 2022)	Chain Exp. Competition	1
5	(Brakhage et al., 2023)	Life Content	1
6	(Abraham & Barker, 2023)	Gender neutral curriculum	1
7	(Whitcomb et al., 2023)	Academic mentoring	1
8	(Moro & Billote, 2023)	Traditional game modules	1
9	(Dessie et al., 2024)	Metacognition training	1
10	(Richter & Kickmeier-Rust, 2025)	Educational game prototypes	1
11	(Mrani et al., 2020)	PhET simulations	1
12	(Álvarez-Siordia et al., 2025)	Virtual simulator	1
13	(Ermakan et al., 2024)	Digital reward system	1

Technology-based interventions were the most frequently represented category, including PhET simulations (Mrani et al., 2020), virtual simulators (Álvarez-Siordia et al., 2025), educational game prototypes (Richter & Kickmeier-Rust, 2025), Fantasy Class games (Jiménez-Valverde et al., 2024), and digital reward systems (Ermakan et al., 2024). Despite employing different digital platforms, these treatments shared a common objective of creating interactive learning environments that actively engage students with physics concepts. The reviewed studies consistently reported that technology-supported interventions increased students' engagement, positive attitudes, and motivation by providing immediate feedback, visualization of abstract concepts, and enjoyable learning experiences.

The second pattern comprises active and experiential learning interventions, including active learning tools (Büyükbayraktar & Dilber, 2022), laboratory experiments (Aththibby et al., 2021), and the Chain Experiment Competition (Dziob et al., 2022). These treatments emphasize direct participation through experimentation, collaborative problem-solving, and scientific inquiry. The synthesis indicates that students are more motivated when they are actively involved in constructing knowledge through authentic learning experiences rather than receiving information passively.

Another important category involves contextual and inclusive learning interventions. Life-content instruction (Brakhage et al., 2023), traditional game modules (Moro & Billote, 2023), and gender-neutral curriculum design (Abraham & Barker, 2023) demonstrate efforts to connect physics learning with students' daily experiences, cultural backgrounds, and diverse identities. These treatments highlight that contextual relevance and inclusive learning environments can strengthen students' sense of belonging, increase learning relevance, and promote greater motivation toward physics.

The final category includes psychological and metacognitive interventions, represented by academic mentoring (Whitcomb et al., 2023) and metacognitive training (Dessie et al., 2024). Unlike the previous treatments that primarily modify instructional activities, these interventions focus on supporting students' self-regulation, confidence, and reflective thinking. The findings suggest that strengthening students' psychological readiness and metacognitive awareness contributes to sustained motivation and improved learning outcomes.

Overall, Table 3 indicates that contemporary physics education employs increasingly diverse instructional treatments to foster students' motivation. Rather than relying on a single intervention, the reviewed studies collectively demonstrate that combining technology-enhanced instruction, active participation, contextual relevance, and psychological support creates more meaningful learning experiences. This synthesis also suggests that future research should examine the effectiveness of integrating multiple treatment approaches across different educational levels and physics topics to achieve more sustainable motivational outcomes.

Research Instrument

Table 4 summarizes the research instruments employed in the 15 reviewed studies. Although each study utilized different data collection techniques depending on its research objectives, the instruments can be synthesized into four major categories: questionnaires and surveys, achievement and conceptual assessments, observation and qualitative instruments, and specialized assessment instruments. This diversity indicates that motivation in physics education has been investigated using both quantitative and qualitative approaches, providing complementary evidence regarding students' cognitive and affective learning outcomes.

Table 4. Research Instrument

No	Author	Instrument	Frequency
1	(Ermakan et al., 2024)	Active log analysis	1
2	(Brakhage et al., 2023)	Interest questionnaire	1
3	(Jiménez-Valverde et al., 2024)	Attitude questionnaire	1
4	(Dziob et al., 2022)	Project documentation	1
5	(Abraham & Barker, 2023)	Student focus group discussion	1
6	(Aththibby et al., 2021)	Worksheets, observation	1
7	(Moro & Billote, 2023)	Participatory observation	1
8	(Mrani et al., 2020)	Pretest-posttest, questionnaire	1
9	(Whitcomb et al., 2023)	Longitudinal survey	1
10	(Büyükbayraktar & Dilber, 2022)	Conceptual test	1
11	(Álvarez-Siordia et al., 2025)	Understanding test	1
12	(Dessie et al., 2024)	Standar test	1
13	(Richter & Kickmeier-Rust, 2025)	Usability test	1

The most frequently employed category consists of questionnaires and surveys, including interest questionnaires (Brakhage et al., 2023), attitude questionnaires (Jiménez-Valverde et al., 2024), pretest–posttest questionnaires (Mrani et al., 2020), and longitudinal surveys (Whitcomb et al., 2023). These instruments primarily assess students' motivation, attitudes, engagement, and perceptions toward physics learning. Their widespread use demonstrates that self-reported measures remain the predominant approach for examining motivational constructs in physics education research.

The second category comprises achievement and conceptual assessments, including conceptual tests (Büyükbayraktar & Dilber, 2022), understanding tests (Álvarez-Siordia et al., 2025), and standardized tests (Dessie et al., 2024). These instruments evaluate students' conceptual understanding and learning outcomes following instructional interventions. The combination of cognitive assessments with motivational measures suggests that many studies attempt to examine the relationship between students' motivation and academic achievement.

Another group of studies employed observation and qualitative instruments, such as classroom observations and worksheets (Aththibby et al., 2021), participatory observation (Moro & Billote, 2023), student focus group discussions (Abraham & Barker, 2023), and project documentation (Dziob et al., 2022). These instruments provide richer contextual information regarding students' learning experiences, classroom interactions, and behavioral engagement that cannot be fully captured through questionnaires alone.

Finally, several studies adopted specialized assessment instruments, including activity log analysis (Ermakan et al., 2024) and usability testing (Richter & Kickmeier-Rust, 2025). These instruments reflect the increasing use of technology-supported learning environments in physics education, where digital learning analytics and usability evaluation provide additional evidence of students' interaction with instructional media.

Overall, Table 4 demonstrates that recent research on motivation in physics education increasingly adopts multiple sources of evidence rather than relying on a single research instrument. The integration of questionnaires, cognitive assessments, qualitative observations, and technology-based evaluation tools enables researchers to obtain a more comprehensive understanding of how instructional interventions influence students' motivation, engagement, and conceptual learning. Nevertheless, the reviewed studies also reveal that self-report questionnaires remain the dominant

measurement approach, indicating opportunities for future research to incorporate more objective measures, such as learning analytics, classroom observations, and longitudinal assessments, to capture changes in students' motivation over time.

Research Subject

Table 5 summarizes the educational levels of research participants included in the reviewed studies. The findings indicate that physics education research on learning motivation has primarily focused on senior high school students, followed by participants in higher education and junior high school. This distribution suggests that motivation has been most extensively investigated during educational stages where physics concepts become increasingly abstract and cognitively demanding.

Table 5. Research Subject

No	Level	Frequency
1	Higher Education	4
2	Senior High School	7
3	Junior High School	3

Senior high school students constituted the largest group of research participants. Studies conducted by Mrani et al. (2020), Büyükbayraktar and Dilber (2022), Brakhage et al. (2023), Moro and Billote (2023), and several other reviewed articles examined various instructional interventions at this educational level. The predominance of senior high school participants reflects the importance of this stage in physics education, where students encounter more advanced concepts and where maintaining learning motivation is considered essential for improving conceptual understanding and academic achievement.

Higher education represented the second most frequently investigated educational level. Studies involving undergraduate students and pre-service teachers (Whitcomb et al., 2023; Jiménez-Valverde et al., 2024; Álvarez-Siordia et al., 2025) primarily examined motivational development in relation to self-efficacy, professional identity, digital learning environments, and instructional innovation. These studies emphasize the preparation of future educators and scientists by fostering positive attitudes and sustained motivation toward physics learning.

In contrast, relatively fewer studies focused on junior high school students. Although this educational level represents an important stage for developing early interest in science, only a limited number of reviewed studies investigated motivational interventions among younger learners. This imbalance indicates that research on motivation in physics education has concentrated more heavily on secondary and higher education than on lower secondary education.

Overall, Table 5 demonstrates that current research is predominantly directed toward senior high school and higher education contexts, while studies involving junior high school students remain comparatively limited. This finding suggests an important research opportunity to investigate motivational strategies at earlier educational stages, where positive attitudes toward physics and science can be developed before students encounter more advanced scientific concepts. Expanding research across different educational levels would provide a more comprehensive understanding of how learning motivation evolves throughout students' educational trajectories.

Physics Material

Table 6 summarizes the physics topics investigated across the 15 reviewed studies. The findings indicate that the reviewed literature covers a broad spectrum of physics content, ranging from fundamental concepts to advanced and applied physics. Although the distribution of topics is

relatively balanced, mechanics and modern physics appear most frequently, each represented in two studies. This pattern suggests that researchers tend to focus on topics that students commonly perceive as conceptually challenging and therefore require innovative instructional approaches to improve both conceptual understanding and learning motivation.

Table 6. Physics Material

No	Physics Material	Frequency
1	Physical Phenomenon	1
2	Advanced Physics	1
3	Modern Physics	2
4	Applied Physics	1
5	Fisika Umum	1
6	Kinematics	1
7	Basic Concept	1
8	Magnetism	1
9	Mechanics	2

Mechanics emerged as one of the most frequently investigated topics, particularly in studies involving Newtonian mechanics, motion, and energy concepts. Dziob et al. (2022) employed the Chain Experiment Competition to facilitate students' understanding of energy transformation and motion through collaborative problem-solving, whereas Richter and Kickmeier-Rust (2025) implemented game-based learning to support students' understanding of Newton's laws. Despite utilizing different instructional approaches, both studies demonstrate that mechanics provides a suitable context for implementing active and technology-enhanced learning strategies because many of its concepts benefit from visualization, experimentation, and interactive learning activities.

Modern physics also received considerable attention within the reviewed studies. Álvarez-Siordia et al. (2025) utilized virtual simulators to facilitate learning in higher education, while several technology-supported learning environments were designed to improve students' understanding of advanced physics concepts that are often difficult to observe directly. The growing emphasis on modern physics reflects the increasing demand for instructional innovations capable of making abstract scientific concepts more accessible to learners.

Several studies focused on specific physics topics such as magnetism (Büyükbayraktar & Dilber, 2022), kinematics (Mrani et al., 2020), applied physics (Aththibby et al., 2021), and general physics concepts (Dessie et al., 2024). These studies consistently demonstrate that innovative instructional approaches including active learning, laboratory-based activities, simulations, and metacognitive strategies can improve students' conceptual understanding while simultaneously strengthening their motivation to learn physics.

Another emerging trend involves the integration of physics content with authentic contexts and real-world phenomena. Moro and Billote (2023) connected physics concepts with traditional Ivatan games, while Ermakan et al. (2024) emphasized learning through real-life physical phenomena. These studies indicate that contextualizing physics concepts within students' cultural backgrounds and everyday experiences enhances learning relevance and increases students' motivation to engage with scientific concepts.

Overall, Table 6 demonstrates that contemporary research no longer concentrates solely on particular physics topics but increasingly emphasizes how instructional approaches can be adapted across different content areas. Regardless of whether the subject matter involves mechanics, modern

physics, magnetism, or applied physics, the reviewed studies consistently indicate that meaningful learning experiences, contextual relevance, and active student participation are more influential in promoting motivation than the specific physics topic itself. This finding suggests that future research should investigate whether particular instructional approaches are equally effective across different domains of physics or whether specific content requires specialized pedagogical strategies.

The findings of this systematic literature review demonstrate that contemporary physics education has undergone a significant transition from conventional teacher-centered instruction toward student-centered, technology-enhanced, and context-oriented learning. Across the fifteen reviewed studies, instructional approaches such as inquiry-based learning, laboratory activities, simulations, gamification, and culturally responsive learning consistently improved students' motivation and conceptual understanding (Mrani et al., 2020; Aththibby et al., 2021; Büyükbayraktar & Dilber, 2022; Moro & Billote, 2023; Jiménez-Valverde et al., 2024; Richter & Kickmeier-Rust, 2025). Although these studies implemented different instructional interventions, they reached a similar conclusion that meaningful learning experiences encourage greater student engagement and facilitate deeper understanding of physics concepts. This pattern indicates that learning motivation is strongly influenced by instructional design rather than by the instructional method alone.

Another important finding is that students' motivation was consistently represented through multiple dimensions, including engagement, situational interest, curiosity, self-efficacy, intrinsic motivation, and positive attitudes toward physics. These dimensions frequently appeared together across the reviewed studies, suggesting that motivation is a multidimensional construct that encompasses cognitive, affective, and behavioral aspects of learning (Brakhage et al., 2023; Whitcomb et al., 2023; Dessie et al., 2024; Jiménez-Valverde et al., 2024). Consequently, instructional innovations should be designed not only to improve students' academic achievement but also to strengthen their confidence, curiosity, and willingness to participate actively in physics learning.

The synthesized findings are supported by recent developments in learning and motivation theories. Recent reviews of constructivist learning emphasize that students develop stronger conceptual understanding when they actively construct knowledge through inquiry, experimentation, collaboration, and authentic learning experiences rather than through passive information transfer (Arega et al., 2025). Likewise, recent applications of Self-Determination Theory indicate that learning environments supporting students' autonomy, competence, and relatedness significantly enhance intrinsic motivation and learning engagement (White et al., 2021; Zhou et al., 2025). These theoretical perspectives explain why technology-enhanced learning, contextual instruction, and student-centered pedagogies consistently generated positive motivational outcomes across different educational settings.

The review also reveals several emerging trends in physics education research. Technology-enhanced learning remains the dominant instructional direction, particularly through simulations, virtual laboratories, educational games, and digital learning environments. At the same time, increasing attention has been given to contextual and culturally responsive instruction, where physics concepts are connected to students' daily experiences, local culture, and authentic phenomena (Moro & Billote, 2023; Ermakan et al., 2024). This shift reflects a broader movement toward designing meaningful and inclusive learning experiences rather than simply delivering disciplinary content. The diversity of research instruments identified in this review also indicates a growing emphasis on evaluating both cognitive achievement and motivational development

simultaneously.

Despite these positive developments, several research gaps remain evident. Most studies examined the short-term effects of instructional interventions, while evidence regarding the long-term sustainability of students' motivation is still limited. Furthermore, the reviewed literature was dominated by studies conducted at the senior high school and higher education levels, with relatively few investigations involving junior high school students. Another notable limitation is that most studies evaluated individual instructional approaches rather than comparing multiple approaches across different physics topics and educational contexts. Addressing these gaps would contribute to a more comprehensive understanding of how motivation develops throughout students' learning trajectories.

Overall, this review highlights that improving students' motivation in physics requires an integrated instructional approach combining active learning, educational technology, contextual relevance, and psychological support. The findings provide practical implications for teachers to design more engaging learning experiences, for curriculum developers to integrate culturally relevant instructional materials, and for researchers to investigate sustainable motivational strategies across diverse educational settings. Future studies are encouraged to employ longitudinal and mixed-methods designs while exploring emerging technologies, such as artificial intelligence and adaptive learning systems, to further strengthen motivation and conceptual understanding in physics education.

CONCLUSION

This article provides information on efforts to improve students' motivation in physics learning at the junior high school, senior high school, and higher education levels across different countries. The study focuses on the use of instructional methods, motivational indicators, treatments, research instruments, participants, and physics topics examined in previous studies. Various instructional approaches can be employed to enhance students' learning motivation, particularly through engaging learning activities supported by current educational technologies. The findings indicate that active, student-centered, contextual, and technology-enhanced learning environments can encourage greater student engagement and interest in physics. These findings provide teachers and educators with useful information for selecting and implementing instructional models that are appropriate for increasing students' motivation and supporting meaningful physics learning. In addition, the study highlights the importance of considering students' characteristics, educational contexts, and learning needs when designing motivational interventions. Future researchers are encouraged to expand systematic reviews beyond Scopus by incorporating databases such as Web of Science, Google Scholar, ERIC, and ScienceDirect. Further studies should also examine long-term effects, diverse educational settings, and emerging technologies to develop more sustainable strategies for improving students' motivation in physics education.

REFERENCES

Arega, A., Asfaw, M., & Alemu, T. (2025). *Constructivist instructional approaches in science education: A systematic review*. Review of Education, **13**(1), e70040. https://doi.org/10.1002/rev3.70040

Abraham, J., & Barker, K. (2023). Students' Perceptions of a "Feminised" Physics Curriculum. *Research in Science Education, 53*(6), 1163–1183. https://doi.org/10.1007/s11165-023-

10128-3

Álvarez-Siordia, F. M., Merino-Soto, C., Rosas-Meléndez, S. A., Pérez-Díaz, M., & Chans, G. M. (2025). Simulators as an Innovative Strategy in the Teaching of Physics in Higher Education. *Education Sciences, 15*(2), 1–19. https://doi.org/10.3390/educsci15020131

American Society for the Prevention of Cruelty to Animals. (2019, November 21). Justice served: Case closed for over 40 dogfighting victims. https://www.aspca.org/news/justice-served-case-closed-over-40-dogfighting-victims

Aththibby, A. R., Yogyakarta, U. N., Kuswanto, H., Yogyakarta, U. N., Mundilarto, M., Yogyakarta, U. N., Prihandono, E., Metro, U. M., Planning, H. E., & Board, C. (2021). *Cypriot Journal of Educational laboratory-based learning model. 16*(5), 2292–2299.

Babalola, F. E., Lambourne, R. J., & Swithenby, S. J. (2020). The Real Aims that Shape the Teaching of Practical Physics in Sub-Saharan Africa. *International Journal of Science and Mathematics Education, 18*(2), 259–278. https://doi.org/10.1007/s10763-019-09962-7

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2024). Digital transformation in higher education teaching and learning: A systematic review. *Educational Technology Research and Development, 72*(2), 845–872.

Brakhage, H., Gröschner, A., Gläser-Zikuda, M., & Hagenauer, G. (2023). Fostering Students' Situational Interest in Physics: Results from a Classroom-Based Intervention Study. *Research in Science Education, 53*(5), 993–1008. https://doi.org/10.1007/s11165-023-10120-x

Büyükbayraktar, F. N., & Dilber, R. (2022). Teaching of Magnetism Unit Topics Via Active Learning Applications. *Participatory Educational Research, 9*(6), 286–311. https://doi.org/10.17275/per.22.140.9.6

Dessie, E., Gebeyehu, D., & Eshetu, F. (2024). Motivation, conceptual understanding, and critical thinking as correlates and predictors of metacognition in introductory physics. *Cogent Education, 11*(1). https://doi.org/10.1080/2331186X.2023.2290114

Dziob, D., Górska, U., Kołodziej, T., & Čepič, M. (2022). Physics competition to inspire learning and improve soft skills: a case of the Chain Experiment. *In International Journal of Technology and Design Education 32*(1). Springer Netherlands. https://doi.org/10.1007/s10798-020-09620-y

Erceg, N., Jelovica, L., Mešić, V., Nešić, L., Poljančić Beljan, I., & Nikolaus, P. (2023). Causes of the Shortage of Physics Teachers in Croatia. *Education Sciences, 13*(8), 1–17. https://doi.org/10.3390/educsci13080788

Ermakan, N. A., Ualikhanova, B. S., Rakhashev, B. K., & Ramazanova, S. A. (2024). Effectiveness of the Gamification Method in the Process of Phenomenon-Based Learning in Secondary School (in the Example of Kazakhstan). *Journal of Ecohumanism, 3*(8), 1330–1344. https://doi.org/10.62754/joe.v3i8.4814

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of education 4.0 in 21st century skills frameworks: Systematic review. *Sustainability, 14*(3), 1493. https://doi.org/10.3390/su14031493

Hsu, Y. S., Lin, S. S., & Yang, K. K. (2023). Recent trends in science education research: A systematic review of teaching innovations. *International Journal of Science Education, 45*(8), 1015–1036

Jiménez-Valverde, G., Heras-Paniagua, C., Fabre-Mitjans, N., & Calafell-Subirà, G. (2024). Gamifying Teacher Education with FantasyClass: Effects on Attitudes towards Physics and Chemistry among Preservice Primary Teachers. *Education Sciences, 14*(8), 1–21.

https://doi.org/10.3390/educsci14080822

Moro, K. C. H., & Billote, W. J. S. M. (2023). Integrating Ivatan Indigenous Games to Learning Module in Physics: Its Effect to Student Understanding, Motivation, Attitude, and Scientific Sublime. *In Science Education International, 34*(1), 3–14. https://doi.org/10.33828/sei.v34.i1.1

Mrani, C. A., El Hajjami, A., & El Khattabi, K. (2020). Effects of the integration of PhET simulations in the teaching and learning of the physical sciences of common core (Morocco). *Universal Journal of Educational Research, 8*(7), 3014–3025. https://doi.org/10.13189/ujer.2020.080730

Richter, K., & Kickmeier-Rust, M. (2025). Gamification in Physics Education: Play Your Way to Better Learning. *International Journal of Serious Games, 12*(1), 59–81. https://doi.org/10.17083/ijsg.v12i1.858

Sappaile, B. I., Djukri, D., & Wilujeng, I. (2024). Student-centered learning in science education: A systematic literature review. *Journal of Baltic Science Education, 23*(1), 35–51.

White, R. L., Bennie, A., Vasconcellos, D., Cinelli, R., Hilland, T., Owen, K. B., & Lonsdale, C. (2021). Self-determination theory in physical education: A systematic review of qualitative studies. *Teaching and Teacher Education, 99*, 103247. https://doi.org/10.1016/j.tate.2020.103247

Whitcomb, K. M., Maries, A., & Singh, C. (2023). Progression in Self-Efficacy, Interest, Identity, Sense of Belonging, Perceived Recognition and Effectiveness of Peer Interaction of Physics Majors and Comparison with Non-Majors and Ph.D. Students. In Research in Science Education (Vol. 53, Issue 3, pp. 525–539). https://doi.org/10.1007/s11165-022-10068-4

Zhou, X., Li, Y., & Wang, H. (2025). Applying self-determination theory to student motivation in physical education: A systematic review. *Retos, 69*, 1123–1136.