HARNESSING THE POWER OF ARTIFICIAL INTELLIGENCE (AI) IN PHYSICS EDUCATION IN HIGH SCHOOLS: A STUDY OF TEACHERS' PERCEPTIONS AND APPLICATIONS IN VIETNAM

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ABSTRACT

This study investigates the potential of Artificial Intelligence (AI) to enhance the quality of physics education in Vietnamese high schools, aligning with the competency-based approach of the General Education Program 2018. The research employed a mixed-methods approach, surveying 82 physics teachers to assess their awareness, attitudes, and current application of AI in teaching. The findings reveal that while teachers recognize the potential benefits of AI, such as personalized learning and workload reduction, significant challenges remain, including limited AI knowledge, lack of infrastructure, and appropriate AI tools. The study suggests targeted training programs for teachers, focusing on popular AI applications like ChatGPT and Gemini and promoting active teaching models integrated with AI. It recommends further research to evaluate the practical effectiveness of AI in physics teaching and its impact on student learning outcomes. The study concludes that AI can significantly transform physics education by empowering teachers and creating engaging student learning experiences.

Keywords: Artificial Intelligence (AI); physics teaching; high school; teacher perceptions; AI applications.

1. Introduction

The advent of Industry 4.0 has ushered in a technological revolution that has profoundly impacted the field of education. The integration of information technology into teaching and learning has become an inevitable global trend, driving innovation in pedagogical methods and enhancing the quality of education. In particular, artificial intelligence (AI) has emerged as a tool offering groundbreaking solutions for modern education. The application of AI in education is rapidly advancing to support adaptive learning, personalized learning (Chen *et al.*, 2020), automated assessment, teacher assistance, and more. AI is expected to contribute to creating a more effective and equitable learning environment for everyone (Gartner *et al.*, 2023).

In Vietnam, the General Education Program 2018 (GEP), issued under Circular 32/2018/TT-BGD, aims to develop students' competencies and qualities. The program emphasizes the cultivation of digital competencies for both teachers and students, including skills in utilizing information technology, extracting information, engaging in online communication and collaboration, and fostering critical and creative thinking within the digital environment. These requirements are particularly relevant in the context of rapid technological advancements, which profoundly impact the organization of teaching and learning. Teachers need to be equipped with digital competencies to effectively utilize technological tools in teaching, thereby creating modern, engaging, and efficient learning environments for students.

This study investigates the potential of AI to address the GEP 2018 requirements within the context of physics education. Specifically, it explores how AI can be applied in teaching physics in high schools to foster the development of digital competencies and enhance the quality of learning experiences for students. The research focuses on the current state of AI access and application in physics teaching, the challenges and opportunities associated with integrating AI into the curriculum, and the potential benefits of utilizing AI tools to support teachers and students. By examining these aspects, this study aims to provide valuable insights into the effective implementation of AI in physics education to meet the goals of GEP 2018. Specifically, it addresses three critical research questions:

- What are the perceptions and attitudes of Vietnamese high school physics teachers towards using AI in their teaching?
- To what extent and in what ways are Vietnamese high school physics teachers currently using AI applications in their teaching practices?
- How can AI be effectively integrated into physics teaching in Vietnamese high schools to enhance teaching quality and student learning outcomes?

2. Literature review

2.1. Teaching Physics with a competency-based approach in the GEP 2018

The GEP 2018 emphasizes the need for innovation in teaching methods, focusing on fostering learners' competencies. In teaching physics, the emphasis should be placed on discussions, experiential learning, practical exercises, and applying knowledge to real-life contexts.

Several studies have addressed this issue. One study explored implementing inquiry-based teaching using the flipped classroom model to enhance students' physics competencies. In this model, teachers act as facilitators, actively organizing student-centred activities in an interactive learning environment and allowing students to construct knowledge (Xuan *et al.*, 2024). Another study proposed experiential learning activities based on David A. Kolb's experiential learning model to develop student competencies. The authors provided directions and methods for integrating experiential activities into teaching specific topics in physics subject (Nhi *et al.*, 2021).

Physics education also presents significant opportunities to integrate education for sustainable development, helping learners recognize and understand the interconnections between humans, the natural environment, and surrounding society. The STSE model

(Science, Technology, Society, and Environment) has been identified as a practical approach to achieving sustainable development goals, contributing to the formation of behaviours, awareness, and competencies to implement practical solutions for sustainability (Nguyen *et al.*, 2023).

These studies consistently emphasize the importance of flexibility, creativity, and the integration of diverse methods and techniques in physics education to meet the requirements of the 2018 GEP while also contributing to the formation and development of learners' qualities and competencies in the context of the 4.0 industrial revolution.

2.2. Artificial Intelligence (AI)

AI is a field of computer science focused on creating intelligent machines capable of performing tasks that typically require human intelligence (Morandín-Ahuerma, 2022). In other words, AI is the ability of computers to simulate human intelligence, such as learning, problem-solving, and decision-making.

There are many ways to classify AI, but a common approach is based on their capabilities and functions (Kukshev, 2020). Accordingly, the most common type of AI today is narrow AI (or weak AI), which is designed to perform a specific task and works well within its specialized domain. Next is general AI (or strong AI), which can understand, learn, and perform any intellectual task humans can. Super AI is a hypothetical type that surpasses human intelligence in every aspect. Additionally, AI can be classified based on function, such as reactive machines, limited memory AI, theory of mind AI, and self-aware AI.

GenAI is a branch of AI focused on creating new content, such as text, images, audio, and video. It works by learning from input data and then using this knowledge to produce unique and creative outputs (DeCotis, 2023). Examples of GenAI include ChatGPT and Gemini, which help generate text, translate, write code, and answer questions. Dall-E 2 and Midjourney create images from textual descriptions, while MusicLM can generate music based on text descriptions.

2.3. Applications of AI in teaching

AI is revolutionizing education at a rapid pace, bringing diverse and practical applications for teachers and students. The following are some notable applications of AI in teaching, including helpful elements in learning:

- Personalizing learners in cognitive activity: AI demonstrates powerful capabilities in personalized learning by analyzing each student's learning data (e.g., test results, learning pace, strengths, weaknesses) to create tailored learning paths that meet individual needs and abilities (Jian, 2023).

- Automating administrative tasks: AI supports teachers by automating administrative tasks such as grading assignments, creating test questions, managing attendance, and drafting reports, thereby saving valuable time for educators (Ahmad *et al.*, 2022).

- Lecture design support: AI aids in designing engaging and effective lectures by suggesting content, images, videos, and interactive activities while analyzing learning data to provide feedback on the effectiveness of the lecture and suggesting improvements (Liu *et al.*, 2022).

- Creates interactive learning tools and evaluates: AI creates interactive learning tools and evaluates students' work through detailed analysis to offer more objective and comprehensive feedback on individual capabilities, identifying learning issues. AI helps students develop essential 21st-century skills such as critical thinking, problem-solving, creativity, and collaboration (González *et al.*, 2021).

In conclusion, AI positively changes education by personalizing learning, enhancing teaching and learning efficiency, and equipping students with the necessary skills for the future. Some commonly used AI tools in education include ChatGPT, Gemini and many other AI tools. This article mentions Gemini AI and ChatGPT, which are large language models trained on massive amounts of textual data to communicate and generate human-like text. Table 1 compares the two AI tools above on specific criteria.

Table 1: *Comparison between the two AI tools ChatGPT and Gemini*

Criteria	Gemini	ChatGPT
Developer	Google	OpenAI
Natural language processing ability	- Understands and generates text well. - Translation, summarization, and writing of various creative content. - Powerful natural language processing capabilities, can perform complex tasks.	- Understands and generates text well. - Translation, summarization, and writing of various creative content. - Natural chat and dialogue capabilities.
Knowledge and ability to access information	- Real-time access to information from Google Search. - Large context window (up to 1 million tokens), enabling the processing of large amounts of information simultaneously.	- Knowledge up to 2021 (free version - at the time of writing). - Limited internet access (Plus version). - Smaller context window than Gemini.
Creativity	- Generates new ideas and creative content. - Ability to combine ideas and create unique products.	- Generates new ideas and creative content. - Ability to learn and imitate human writing style.
Interactivity	- Tight integration with Google services. - Intuitive and user-friendly interface.	- Plugin support expands capabilities and enables more tasks. - Powerful API, enabling integration into other applications.
Applications	- Supports information search. - Content creation, translation, education, research.	- Virtual assistant. - Content creation, translation, entertainment, customer care.
Pricing & accessibility	- Gemini Pro is free with some limited features. - Gemini Advanced paid with more advanced features.	- ChatGPT is free with limited capabilities. - ChatGPT Plus paid with more advanced features.

3. Materials and methods

In this study, qualitative and quantitative methods were used in combination for analysis and evaluation, detailing that qualitative methods were employed to explore the development of AI application approaches in physics teaching and to assess teachers' needs. Quantitative methods are utilized to generate statistics and calculate value indices derived from the collected data on AI applications in physics education.

The research surveyed the opinions of physics teachers teaching at high schools in Vietnam. The questionnaire was designed using the Google Forms tool.

Survey data collected through the questionnaire were processed and analyzed using Microsoft Excel 2019. Additionally, AI was employed in the analysis to identify key factors and the necessity of integrating AI into physics teaching in high schools.

4. Results and discussion

4.1. Current state of AI application in physics teaching at schools

The aim of surveying the current application of AI in physics teaching by school teachers is to evaluate the situaton, analyze the underlying causes, and provide practical foundations for research content. This ensures the feasibility of proposing an AI application model in physics teaching. The survey focuses on teachers' perceptions and attitudes about AI in teaching, practising the application of AI in teaching Physics, and collecting opinions on promoting the application of AI in teaching Physics in high schools.

The survey was conducted with 82 physics teachers, with male participants accounting for 51.2% and female participants 48.8%. The age distribution is as follows: under 30 years old is 6.1%, from 30-40 years old is 20.7%, 41-50 years old accounts for 67.1% and 6.1% over 50 years old. A questionnaire was designed for an online survey using Google Forms, accessible via the Survey link (https://forms.gle/da2AUm3Zkmjr1j3w8).

a) The awareness of AI in physics teaching

The results indicate that 100% of the teachers surveyed answered that they had heard of the term "artificial intelligence" (AI). For the question: "How can AI be applied in teaching Physics?" the results are shown in Figure 1.

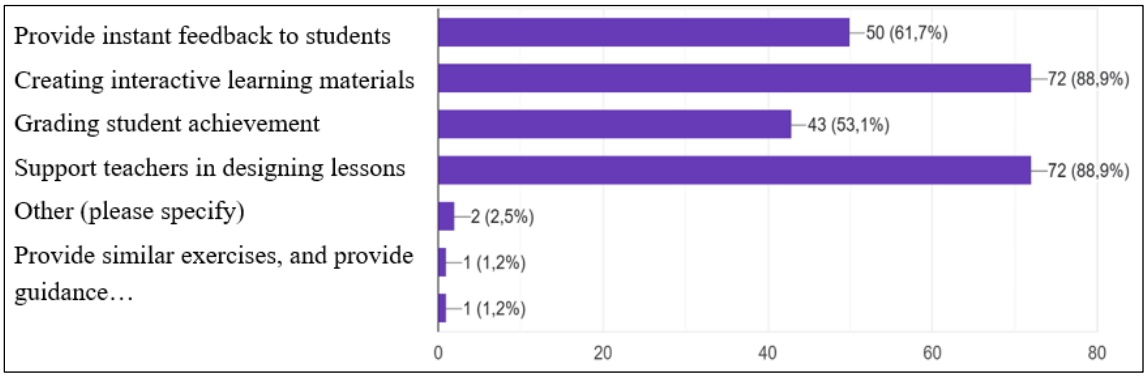

Figure 1: *How can AI can be applied in teaching physics?*

Figure 1 indicates that most teachers (88.9%) believe that AI can assist them in designing lesson plans and creating learning materials. This observation shows the demand

for AI tools that help create learning activities, choose teaching methods, create exercises, games, and simulations, and help students actively explore knowledge. Many teachers are interested in AI's ability to provide feedback from students (61.7%), helping them identify and correct errors, thereby increasing learning efficiency. Some teachers (53.1%) expect to use AI to automatically grade, analyze learning results and provide detailed assessments of each student's abilities. In addition, other applications are mentioned, such as giving similar exercises and guiding how to solve exercises, which demonstrates the creativity in applying AI.

Regarding the question "How do you assess your understanding of AI in teaching Physics?" respondents rated themselves on a scale of five levels, from "very poor" to "very good". Thus, 27.2% of teachers rated themselves as "Very good," the majority rated themselves as "Good" with 32.1%, 30.9% rated themselves as "Average", "Poor" accounted for 8.6%, and "Very poor" had only one teacher self-assessed (1.2%). Thus, the majority of teachers (59.3%) rated their level of understanding of AI in physics teaching as "Very good" and "Good". However, there is still a significant proportion (40.7%) of teachers self-assessing at the "Average," "Poor," and "Very poor" levels.

Teachers, represented in Figure 2, responded to the benefits that AI brings to teaching physics. Based on the survey, AI's main benefits to improving teaching effectiveness (88.9%) are supporting teachers in personalizing learning, providing feedback, and creating interactive learning materials. Thanks to AI applications, learning physics can become more vivid and engaging, increasing students' learning interest (87.7%). In addition, AI helps reduce teachers' workload (86.4%) in activities such as designing lesson plans, creating exercises, test questions, and automatic grading. Many teachers believe that AI helps personalize learning (63%) thanks to its ability to analyze students' learning data to develop learning paths that suit their abilities and individual needs.

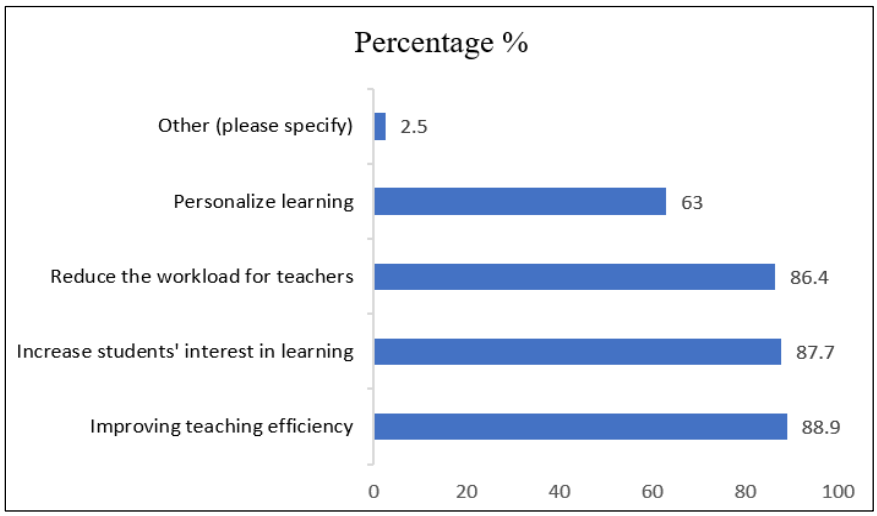

Figure 2: *The benefits that AI brings in physics teaching*

Teachers responded to difficulties applying AI in physics teaching, as shown in Table 2, illustrating the most common difficulties teachers face when applying AI. Specifically, surveyed teachers reported a lack of knowledge about AI (75.3%), highlighting the need for training and professional development in AI. Lack of

infrastructure and equipment (60.5%) and Lack of appropriate AI software and tools (76.5%) were frequently mentioned by teachers. The application of AI requires teachers to change their teaching methods (38.3%), which can be difficult for some teachers.

Table 2: *The difficulties of applying AI in teaching physics*

Criteria	Difficulties in applying AI	Number of options	Percentage
C.1	Lack of knowledge about AI	61	75.3
C.2	Lack of infrastructure and equipment	49	60.5
C.3	Lack of suitable AI software and tools	62	76.5
C.4	Changing teaching methods	31	38.3
C.5	Other (please specify)	0	0.0

b) Teachers' attitudes towards AI in teaching physics

Regarding the question "Are you interested in applying AI in teaching physics?", respondents rated themselves on a five-level scale, from the highest "very interested" to "not interested". The answers illustrated in the chart are shown in Figure 3. The results show that most teachers (63%) are highly interested in applying AI in physics teaching. Only a small number of teachers (1.2%) are not interested in applying AI. Teachers are generally positive and interested in applying AI in physics teaching.

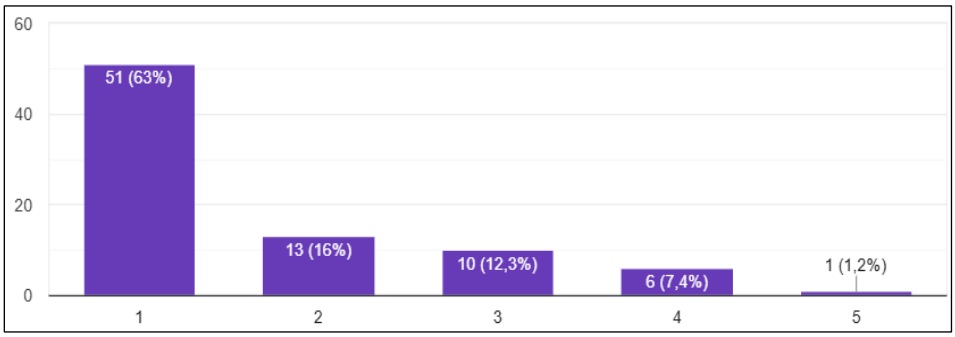

Figure 3: *Teachers self-assess the level of interest in applying AI*

Regarding the question: "Do you believe that AI will change the way physics is taught and learned in the future?" the respondents rated themselves on a five-point scale, from "Strongly agree" to "Strongly disagree". The survey results showed that most teachers (60.5%) believe that AI will change how physics is taught and learned in the future. Meanwhile, only 7.4% think that AI may not change how physics is taught and learned, and 6.2% believe that AI will not change how physics is taught and learned.

The answers to the question "Are you concerned that AI will replace the role of teachers in the future?" collected on a scale of 1 (strongly agree) to 5 (strongly disagree) are shown in Figure 4.

Most respondents (21.0%) selected level 3, indicating a neutral view. The second and third most common answers were level 2 (16.0%) and level 4 (16.0%), corresponding to those slightly concerned and not very concerned, respectively. Many respondents expressed very little concern (23.5%) or high concern (23.5%). The results indicate that

most respondents are concerned to varying degrees. This concern may stem from the growing capabilities of AI technologies and the potential for automating many tasks currently performed by teachers.

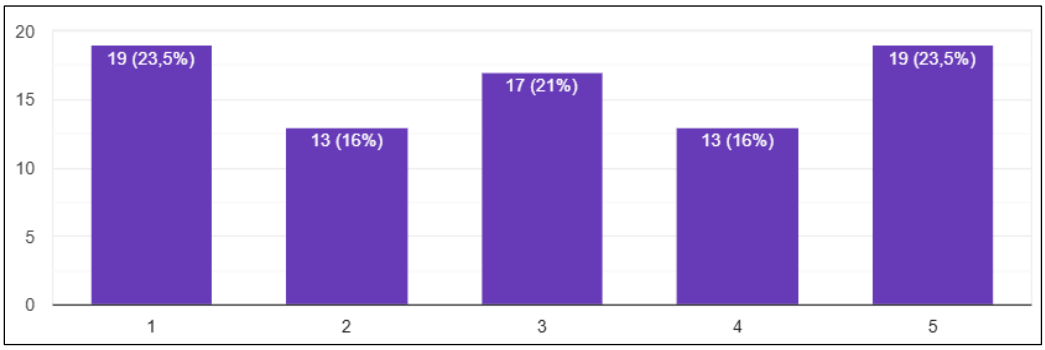

Figure 4: *Teachers' opinions on whether AI will replace the role of learning in the future*

c) Practicing the application of AI in teaching physics

The answer to the question "Have you ever used AI in teaching physics?" is categorical, with the options being "Yes", "No", and specific AI tools. The results show that the number of respondents who have used AI in teaching physics (44.4%) and those who have not (44.4%) are equal. This suggests that the adoption of AI in physics education is still in its early stages, with many teachers yet to explore its potential. However, those who have used AI in everyday activities were mentioned, including ChatGPT (85.5%), Gemini (53.9%), Canva (52.6%), and Copilot (6.6%). The diversity of these tools suggests that teachers are experimenting with different AI applications to support their teaching.

Teachers' feedback on using AI to support activities in teaching physics is shown in Table 3. The results show that AI is mainly used for lesson planning (67.5%), creating exercises (67.5%), designing educational games (61.0%) and creating learning materials (57.1%). This shows that AI tools are very useful in supporting effective teaching and developing engaging learning resources. These results can provide information for AI implementation strategies in physical education in high schools.

Table 3: *AI supports activities in teaching physics*

Criteria	Activities supported by AI	Amount	Percentage
C.1	Building a lesson plan	52	67.5
C.2	Creating exercises and assessment tests	52	67.5
C.3	Learning game design	47	61.0
C.4	Creating digital learning materials	44	57.1
C.5	Student assessment	22	28.6
C.6	Other (answers, finding documents...)	2	2.6

In addition, the survey received feedback on the conditions for practical AI application in physics teaching, such as increased training for teachers, investment in infrastructure and equipment, and development of appropriate AI software. Furthermore,

some other opinions suggest that it is necessary to develop AI software suitable for the physics curriculum, have a strong wifi connection, provide training for teachers and students to access AI tools for free, and share knowledge through expert seminars and online platforms to promote AI application in physics teaching.

4.2. Applying AI in physics teaching in high schools

Based on the survey results and an analysis of individual teacher feedback, it is evident that AI provides teachers with powerful tools to enhance teaching effectiveness and reduce workload. Studying how to craft clear, specific prompts and providing sufficient context for AI to understand and accurately fulfil requests is essential. Referring to the research by (Clarisó *et al.*, 2023), the following important factors can be identified for creating effective AI prompts:

(1) Assigning AI to a role: Define the AI's role relevant to the topic of interest, such as a teacher, expert, friend, or assistant.

(2) Tasking the AI: List the specific steps the user wants the AI to perform, such as “first”, “next”, “finally”, etc.

(3) Formatting results: Specify the desired format for the output, such as text, tables, lists, or other formats.

(4) Providing additional context: Offer information about the target audience and the intended purpose of the task.

With prompts aligned with teachers' pedagogical intentions, AI can significantly enhance physics teaching in secondary schools. AI can generate detailed lesson plans and design engaging lectures by integrating diverse media such as images, videos, audio, interactive games, and assessment tools that meet specific learning outcomes. Teachers can use AI's strengths to create digital teaching materials such as mind maps, flashcards, and infographics. For instance, tools like ChatGPT and Gemini can assist in drafting lecture content, developing review questions, preparing exam materials, and sourcing references. Applications like SlidesAI and Beautiful.ai can automate the creation of visually appealing presentation slides from textual content, while Canva excels in designing images, videos, and infographics to illustrate lessons.

For example, by using ChatGPT to design an introductory activity for the “Free fall” lesson in Physics 10 (Hung *et al.*, 2022), teachers can base their activity on a textbook suggestion. This involves the famous experiment by American astronaut David Scott, who simultaneously dropped a feather and a hammer on the moon. By inputting this scenario as a prompt, ChatGPT can propose suggestions for organizing an engaging opening activity as follows:

(1) Act as an outstanding 10th-grade physics teacher in Vietnam in organizing an introductory activity to spark students' interest before starting the lesson.

(2) Please design a problem-based situation to teach the “Free Fall” lesson in the 10th-grade physics curriculum, utilizing a video featuring the American astronaut David Scott at the same time dropping a feather and a hammer on the moon.

(3) Employ videos, images, and physics terminology appropriate for 10th-grade students.

(4) This introductory scenario is intended for 10th-grade students learning the lesson on free fall, following the "Connecting Knowledge with Life" textbook series.

Based on ChatGPT's response to the above prompt and the structure of the opening activity in teaching, the teaching process takes place as follows:

(1) Objectives

- Spark students' curiosity and interest in the "Free Fall" lesson.
- Connect real-world (daily observations) and physics knowledge (free fall).
- Lead students to the main topic of the lesson naturally and engagingly.

(2) Implementation

a) Task assignment

- The teacher displays an image of astronaut David Scott on the Moon and asks: Do you know who this is? He conducted a fascinating experiment on the Moon!
- The teacher briefly introduces David Scott and his experiment, then says: To better understand this experiment, we will watch a short video together.

b) Task implementation

- The teacher plays the video of David Scott's experiment (dropping a feather and a hammer on the Moon).
- After watching, the teacher asks students to discuss in groups:

"What happened to the feather and the hammer when they were dropped?"

"In your opinion, is this similar to what we observe daily on Earth? Why or why not?"

"So, what creates the difference between the falling motion of objects on Earth and the Moon?"

c) Reporting discussion results

- Representatives from each group take turns presenting their group's discussion results.
- The teacher listens and takes note of the students' opinions.

d) Conclusion and comments

- The teacher summarizes the students' ideas and concludes: David Scott's experiment showed us something exciting about the falling of objects. In a vacuum, all objects fall with the same acceleration, regardless of their mass.
- The teacher connects with reality: On Earth, we see a feather fall slower than a hammer because of air resistance. However, in a vacuum environment like on the Moon, this resistance does not exist; therefore, the feather and the hammer fall simultaneously.
- The teacher leads into the new lesson: To understand this phenomenon better, today we will learn about the lesson "Free Fall".

ChatGPT can be used to find links, download videos suitable for the lesson to the computer, and use video editing tools to create a highly pedagogical video. In addition, still using the existing context, the teacher can ask ChatGPT to suggest how to conduct the opening activity of the lesson in a different and more impressive style.

AI provides teachers with powerful tools to enhance efficiency and reduce workload in the teaching process. Table 4 below contains several proposals for applying AI in teaching physics at secondary schools.

Table 4: *Several proposals for applying AI in teaching physics at secondary schools*

Using AI to create simulations of physical phenomena	AI can help create simulations of physical phenomena, allowing students to visualize abstract concepts (e.g., Brownian motion, light waves, magnetic fields). It also provides virtual experiments that are safe and cost-effective, eliminating the need for physical laboratories. Additionally, AI enables parameter adjustments to explore their effects on outcomes. AI further supports the creation of dynamic instructional videos, illustrative images, and interactive games, making learning more engaging and easier to comprehend.
Developing self-learning, problem-solving, and creative thinking skills	AI can provide exercises and questions tailored to each student's level, encouraging them to explore independently and tackle challenges. AI-powered chatbots can answer students' questions, helping them solve problems independently. Moreover, AI can generate open-ended scenarios and questions that prompt students to think critically, analyze, evaluate, and propose solutions.
Integrating AI with active teaching models	Combining AI with active teaching models like project-based learning and flipped classrooms can revolutionize education and optimize teaching and learning outcomes. In project-based learning, AI supports students in accessing information, analyzing data, and conducting simulations, thereby enabling the acquisition of knowledge and skills through completing learning tasks. Through AI, teachers can track progress, evaluate outputs, and provide personalized support for each student during project implementation. In flipped classrooms, alongside learning management systems, AI facilitates self-study at home through instructional videos, interactive games, and online exercises. This allows teachers to assess each student's level of understanding before class, enabling them to design suitable activities, guide discussions, solve problems, and apply knowledge effectively.

4.3. Discussion

This study surveyed the opinions of 82 physics teachers from high schools in Vietnam. The results indicate that physics teachers' perceptions and attitudes towards AI vary significantly, with some expressing confidence in their understanding. At the same time, a significant number lack clear or moderate understanding. Teachers' feedback on using AI in physics teaching is quite diverse, with no consistency in direction and roadmap. This highlights the need to propose approaches and develop AI skills for physics teachers to exploit the potential of this technology effectively.

The results obtained from teachers' perceptions of AI suggest training strategies for them on the most interesting AI applications, such as designing lectures, providing instant feedback, creating learning materials, and assessing students. Enhance the provision of knowledge about AI and guide teachers in using specific AI tools in physics teaching. Create opportunities for teachers to share ideas and experiences of applying AI and connect teachers with AI experts to exchange, support and update knowledge.

The proposed contents are intended to support physics teachers in using AI, based on the survey results and overall analysis, including the following:

- Introduction to popular AI applications in Physics teaching: Help teachers understand how AI can assist them in teaching.
- Instructions for using specific AI tools: Provide teachers with practical skills to use AI tools in designing lectures, creating learning materials, assessing students, learning games, etc.
- Changing teaching methods: Guide teachers in applying new teaching methods in line with AI's application, enhancing interactivity and personalization in the classroom.
- Increase knowledge about AI: Organize training courses, fostering basic knowledge about AI, applications of AI in education in general and teaching Physics in particular.
- Proposing solutions for infrastructure and equipment: Proposing solutions to improve infrastructure and equip necessary equipment for the application of AI in Physics teaching.

The application of AI in physics teaching is gaining widespread attention from teachers. By developing appropriate strategies, teachers can be supported in accessing and applying AI effectively, improving the quality of physics teaching and learning. Based on the analysis results, some measures can be proposed to support teachers in applying AI in physics teaching as follows:

- Focus on the group of teachers with high interest (levels 1 and 2): Prioritize the design of intensive support programs, providing knowledge and practical skills on applying AI in teaching Physics for this group of teachers.
- Enhance awareness for the remaining teachers (levels 3, 4, and 5): Organize workshops and seminars to introduce the benefits, potential, and practical applications of AI in Physics teaching to raise awareness and encourage participation from this group of teachers.
- Build a learning community: Create an environment and favourable conditions for teachers to exchange, share experiences, and learn from each other about applying AI in Physics teaching.
- Provide supporting materials and tools: Develop sets of instructional materials, video lectures, software, and AI tools to assist teachers in designing lessons, creating interactive learning activities, and assessing students.
- Focus on AI applications that complement, not replace, teachers. AI should be used to automate time-consuming or repetitive tasks for teachers, such as grading assignments or providing personalized feedback to students. This will free teachers to focus on more creative and engaging activities, such as designing experiments and facilitating discussions.
- Foster collaboration among stakeholders: Encourage teacher training institutions, technology companies, and education administrators to collaborate on researching, developing, and applying AI in physics education, creating an innovative and efficient education ecosystem.
- Engage with stakeholders to address concerns about AI. It is important to have open and honest conversations with teachers, students, and parents about AI's potential benefits and risks in education. This will help build trust and ensure that AI is used to benefit everyone.

- Prioritize AI applications that enhance student learning. AI should be used to create more personalized and engaging learning experiences for students. This can include providing students with customized feedback, creating interactive simulations, and facilitating collaborative learning activities.

- Continuously evaluate the impact of AI on teaching and learning. It is important to monitor the impact of AI on student learning outcomes and teacher satisfaction. This will help ensure that AI is being used effectively and sustainably.

In the following, the authors proposed some recommendations for the application of AI in teaching Physics:

- Prioritize training and support for ChatGPT, Gemini and Canva. As these are the most popular AI tools among participants, it is important to ensure that teachers have the knowledge and skills to use them effectively in the classroom.

- Explore the potential of other AI tools for physics education. While ChatGPT, Gemini and Canva are currently the most popular AI tools, many other AI tools can enhance teaching and learning in physics. Teachers should be encouraged to experiment with AI tools and share their experiences with colleagues.

- Develop guidelines for the ethical use of AI in physics education. As AI becomes increasingly prevalent in education, addressing ethical issues such as data privacy, bias, and accountability is important. Schools and districts should develop clear guidelines for the ethical use of AI in physics education.

Thus, it can potentially transform how physics is taught in many positive ways. By providing teachers with the necessary training, support, and resources to use AI effectively, we can ensure that AI is used to create a more engaging, effective, and equitable learning experience for all students. Furthermore, the application of AI in physics education has great potential to improve the quality of education. By implementing the above-mentioned measures, the application of AI can be facilitated, helping teachers and students harness the potential of this technology effectively.

This study provides an overview of teachers' current state and perceptions regarding AI applications in physics teaching. It proposes solutions and directions for AI implementation to enhance teaching quality, meeting the educational innovation requirements of the GEP 2018. However, further research is needed to assess the practical effectiveness of AI applications in physics teaching and evaluate the impact of AI on students' learning and development processes.

5. Conclusion

The study revealed that physics teachers have a positive perception of the immense potential of AI in education; however, their knowledge and skills in applying AI tools remain limited. While the application of AI in physics teaching has been implemented, it is still spontaneous and lacks systematic and comprehensive investment. These findings emphasize the need to enhance teachers' technological competencies, invest in infrastructure, and develop digital learning resource repositories through AI applications. The study also suggests expanding the scope of surveys and conducting in-depth research on the effectiveness of various types of AI applications in physics teaching.

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TÓM TẮT

KHAI THÁC SỨC MẠNH CỦA TRÍ TUỆ NHÂN TẠO (AI) TRONG DẠY HỌC VẬT LÝ Ở TRƯỜNG PHỔ THÔNG: NGHIÊN CỨU VỀ NHẬN THỨC VÀ ỨNG DỤNG CỦA GIÁO VIÊN TẠI VIỆT NAM

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Nghiên cứu này khảo sát tiềm năng của Trí tuệ nhân tạo (AI) trong việc nâng cao chất lượng dạy học vật lý ở các trường phổ thông Việt Nam, phù hợp với tiếp cận dựa trên năng lực của Chương trình giáo dục phổ thông 2018. Nghiên cứu sử dụng phương pháp hỗn hợp, bằng việc khảo sát 82 giáo viên vật lý để đánh giá nhận thức, thái độ và ứng dụng hiện tại của AI trong dạy học vật lý. Kết quả cho thấy, trong khi giáo viên nhận thức được những lợi ích tiềm năng của AI, chẳng hạn như học tập cá nhân hóa và giảm tải công việc, thì vẫn còn những thách thức đáng kể, bao gồm kiến thức hạn chế về AI, thiếu cơ sở hạ tầng và các công cụ AI phù hợp. Nghiên cứu đề xuất chương trình tập huấn, bồi dưỡng có mục tiêu cho giáo viên, tập trung vào các ứng dụng AI phổ biến như ChatGPT và Gemini, và thúc đẩy các mô hình dạy học tích cực được tích hợp với AI. Nghiên cứu khuyến nghị cần có thêm nghiên cứu để đánh giá hiệu quả thực tế của AI trong giảng dạy vật lý và tác động của nó đối với kết quả học tập của học sinh. Nghiên cứu kết luận rằng AI có thể giúp đổi mới phương pháp dạy học vật lý bằng cách trao quyền cho giáo viên và tạo ra trải nghiệm học tập hấp dẫn hơn cho học sinh.

Từ khóa: Trí tuệ nhân tạo (AI); Dạy học vật lý; Trung học phổ thông; Nhận thức của giáo viên; Ứng dụng AI.