Correcting Students' Misconceptions in Physics Using Experiments Designed by ChatGPT

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Abstract

This study examines the impact of using ChatGPT in a physics classroom on correcting students' misconceptions via ChatGPT creation and experiment procedures. By incorporating artificial intelligence chatbots such as ChatGPT into education, teachers and students may have in-depth conversations to enhance their comprehension of physics ideas and put their knowledge into practice in real-life situations. This method provides individualised feedback and support, helping students correct misconceptions promptly and gain a more profound comprehension of the topic. ChatGPT facilitates experiment-designing activities for students to actively engage in the scientific process, test ideas, and improve their thinking based on results. Integrating ChatGPT in the classroom may improve student learning outcomes in physics by developing critical thinking abilities, boosting cooperation, and building a greater understanding of the scientific process.

Keywords: ChatGPT, Experiment, Misconceptions, Physics Education.


Introduction

Physics misconceptions among students have long been a problem for teachers. Language obstacles, cultural influences, and past knowledge are only a few of the causes of these errors (Kotsis, 2023). Studies have shown that students often retain their misconceptions even after receiving conventional training, making it more difficult to understand complex scientific topics (Kazantzidou & Kotsis, 2023a). These misconceptions may seriously hamper effective learning since they might be ingrained and hard to overcome (Qian & Lehman, 2017). To design focused treatments that meet the unique requirements of students in physics education, it is vital to comprehend the underlying causes of these misconceptions (Kazantzidou & Kotsis, 2023b). In order to dispel common misconceptions and promote a better comprehension of physics concepts, educators may customise their teaching tactics by recognising these misconceptions and their sources (Soeharto et al., 2019).

Misconceptions must be addressed in education since they may obstruct students' comprehension of basic concepts and hamper learning (Smith et al., 1994).
Misconceptions may result in incorrect interpretations of complex topics like physics as they are often ingrained in learners' thoughts and can endure over time (Vosniadou, 2020; Gavrilas & Kotsis, 2023). Teachers may assist students in developing a more accurate mental picture of the world around them and promote a better knowledge of the subject matter by actively recognising and correcting these errors (Assem et al., 2023).

According to Roumeliotis and Tselikas (2023), ChatGPT, an advanced language processing model created by OpenAI, has shown considerable potential for revolutionising several industries, including education. Learning becomes more personalised and participatory when ChatGPT uses its capacity to produce human-like replies to interact with students conversationally (Daher et al., 2023). ChatGPT may help dispel misconceptions among students by giving them immediate feedback, responding to their inquiries, and explaining things in plain words. By actively involving students in conversation, ChatGPT may assist in identifying and clearing up misconceptions and promote a more profound comprehension of complicated ideas. Beyond clearing misconceptions, ChatGPT may enhance conventional teaching techniques, provide real-time support, and create interactive learning environments. Through experiment design, ChatGPT, a conversational model driven by transformer-based technology, offers a unique chance to change students' preconceptions about physics. ChatGPT may successfully address and remedy misconceptions by directing students via hands-on experiments and real-time talks. This leads to enhanced learning outcomes and a firm foundation in physics knowledge. ChatGPT can completely change the educational system by increasing student access, engagement, and effectiveness in various subject areas. This may be achieved via its flexibility and adaptability.

### Students' Misconceptions in Physics

It is well-recognised that students learn and comprehend physics principles and concepts even from the first grades of primary school (Gresnigt et al., 2014). Children begin to develop various ideas about how the world works via their exposure to language, social interactions, and the social, cultural, and technological environment (Gee, 2005). They interpret their surroundings by using various viewpoints. Examining children's perspectives on science is a well-established concept. The term "student misconceptions" is referenced in a physics-related context in the International Bibliography 1967 by Burge.

The students' ideas are viewpoints derived from their observations and judgements about the world rather than from erroneous information (Bada & Olusegun, 2015). As they seek to comprehend their environment, they evolve. They draw from their experiences and then analyse and juxtapose different elements to establish relational frameworks. Knowledge is organised into complex representations that control knowledge's encoding, storage, and retrieval, as described by Rumelhart (1984) and Marshal (1995). Students extrapolate their experiences to interpret physics phenomena according to their perceived truths. For example, students often associate mobility with an object's tendency to halt (Halloun & Hestenes, 1985). Children may not know the exact concept of friction or the underlying physics principles, but they understand that pushing a heavy box will make it stop quickly. Students build models and collect data to examine events and make predictions. Ideas are actively shaped and inferred from direct experiences in the actual world and social interactions. Students were found to
create concepts, such as perceptions, mental representations, and mental models, rather than having an instantaneous comprehension of reality. When objects and events are not present, mental representations act as images of them and usually differ from the perspective of science. These perceptions are usually inaccurate. Students collect data and build models to comprehend occurrences and forecast outcomes. Students may better illustrate certain ideas and explain particular reasons in specific settings using these mental models. They also help them discover solutions to typical questions in and out of the classroom.

Common misconceptions in physics concepts often arise due to the abstract and complex nature of the subject matter (Vosniadou, 2002). One prevalent misconception is the confusion between weight and mass (Galili, 1993). Weight is the force exerted on an object due to gravity, while mass is the amount of matter in an object. Students often incorrectly use these terms interchangeably, leading to misconceptions in various physics problems. Another common misconception is understanding Newton's third law of motion (Mongan et al., 2020). This law states that for every action, there is an equal and opposite reaction. However, students frequently misinterpret this law to mean that forces always cancel each other out, which is invalid in all situations. By identifying and addressing these misconceptions through experimental design, students can gain a deeper understanding of fundamental physics concepts (Kotsis, 2024).

Factors contributing to student misconceptions in physics are multifaceted (Neidorf et al., 2020). One key element is the lack of prior knowledge or foundational understanding, leading students to construct misconceptions based on incomplete information. Cognitive biases and heuristics can significantly influence how students interpret and apply physics concepts (Kliegr et al., 2021). These mental shortcuts can lead to errors in reasoning and understanding. Moreover, how physics concepts are taught and communicated can contribute to student misconceptions. If teachers use ambiguous language or fail to clarify sufficiently, students may misinterpret key ideas (Assem et al., 2023). By identifying and addressing these factors, educators can work towards mitigating student misconceptions and fostering a deeper understanding of physics concepts.

Misconceptions can have a significant impact on student learning outcomes in physics (Stylos & Kotsis, 2023). When students hold misconceptions about a particular concept, it can hinder their understanding of related topics and lead to inaccurate problem-solving approaches. These misconceptions can persist through formal education and beyond if not addressed effectively (Sadler et al., 2013). Research has shown that students often rely on misconceptions as shortcuts to understanding complex concepts, which can result in persistent misconceptions (Das et al., 2023). By identifying and addressing these misconceptions early on through targeted interventions and experiment design, educators can help improve student learning outcomes and promote a deeper understanding of physics principles (De La Hoz et al., 2022).

Existing approaches to addressing misconceptions in physics education range from traditional methods like lectures and textbooks to more innovative strategies such as interactive simulations and peer instruction. Research has shown that simply providing correct information to students is often ineffective in dispelling deeply held misconceptions (Ferrero et al., 2020). Instead, interventions that actively engage students in sense-making activities, encouraging them to confront and resolve their misconceptions through experimentation and reflection, have successfully promoted
conceptual understanding (Smith III et al., 1994). By combining the power of artificial intelligence with hands-on experimentation, the ChatGPT system aims to leverage these effective strategies to transform student misconceptions in physics education.

Role of Experiment Design in Physics Education

Hands-on learning in physics is crucial for students to comprehend the subject matter better and apply theoretical ideas effectively (Haury & Rillero, 1994). According to research, children who engage in hands-on physics activities are better able to think critically, solve problems, and have a solid understanding of scientific concepts (Shieh & Chang, 2014). By participating in experiments, students may better understand the underlying ideas and see the principles in action. Hands-on learning is a successful way to teach physics because of the increased retention and understanding of active engagement. Furthermore, students may develop their analytical abilities and learn from their errors by participating in experimental activities (Vlachos et al., 2024). For students to get a comprehensive grasp of the topic and be ready for future scientific endeavours, experiential learning experiences in physics are crucial (Bao & Koenig, 2019).

Because it offers a methodical way to test ideas and verify hypotheses, experiment design is essential for making sense of physics concepts (Kulgemeyer et al., 2020). Improved knowledge of the underlying causes is made possible by well-designed experiments, which aid in isolating specific variables and controlling confounding variables. Experiment design allows researchers to determine causal linkages and make meaningful findings by methodically adjusting independent factors and analysing their effect on dependent variables (Hoehn & Lewandowski, 2020). Experiments may also provide unexpected results or anomalies that cast doubt on preconceived notions and inspire additional research, which in turn helps to refine and build new ideas. Overall, experiment design is a valuable instrument for inquiry and knowledge growth in a variety of disciplines, and its advantages in clarifying ideas go beyond the field of physics (Vakarou et al., 2024).

Students’ misconceptions may be transformed into a thorough grasp of essential ideas via inquiry-based learning (IBL) in the physics curriculum (Senyigit et al., 2021). IBL assists in bridging the knowledge gap between theory and practical application by involving students in creating experiments to test their theories. With this method, students are encouraged to actively create and explore their knowledge, which results in a deeper understanding of the fundamental ideas of physics (Assem et al., 2023). IBL also develops creativity, critical thinking, and problem-solving abilities—all necessary for success in scientific domains. Teachers may provide a dynamic learning environment where students can actively engage in their education by incorporating IBL into the physics curriculum (Yawo, 2020).

To guarantee efficacy, educators must overcome some obstacles while using experiment design in the classroom. One major obstacle is the paucity of supplies and tools required to conduct experiments in a classroom environment. The application of theoretical ideas may be limited in many schools due to a lack of access to laboratories and equipment required for experiment-based learning (Nedungadi et al., 2015). Teachers could also find it challenging to commit enough time to perform experiments due to time restrictions and curricular requirements. Furthermore, measuring student learning via experiments might be difficult because proper evaluation of the results
depends on developing trustworthy metrics. In order to overcome these obstacles, experiment design must be integrated into the current educational framework, resource constraints must be addressed, and evaluation alignment with learning goals must be ensured (Lake et al., 2024).

ChatGPT: Overview and Capabilities

Knowing ChatGPT’s features is essential to using it effectively in educational contexts. According to Wu et al. (2023), ChatGPT is a cutting-edge language processing model that can discuss various subjects with humans. Its capacity to produce replies depending on the information it receives by fusing user-provided context with pre-trained knowledge is essential to its functioning (Kalla et al., 2023). ChatGPT's ability to dispel student preconceptions by customising answers to specific questions and delivering precise knowledge gives it such transformational potential in educational settings. Educators may enhance students' comprehension of intricate topics like physics by using this technology to create customised learning experiences that meet their requirements (West, 2023).

Using ChatGPT in education creates new opportunities for meaningful learning experiences for students, going beyond standard classroom teaching (Adeshola & Adepoju, 2023). Teachers may engage with students in real time with ChatGPT by utilising artificial intelligence to provide personalised feedback and coaching based on each student's unique learning requirements (Lo, 2023). ChatGPT can help students in physics education create experiments that clear up their doubts and help them comprehend important ideas more thoroughly (Bitzenbauer, 2023). In order to provide a more dynamic and immersive learning environment, ChatGPT may mentor students via a conversational interface by developing hypotheses, organising experimental methods, and analysing outcomes (Liang et al., 2023). Additionally, by providing a fresh and dynamic method of instruction, ChatGPT in the classroom may raise student interest and engagement (Bruneau, 2023).

Considering limitations and ethical issues while using ChatGPT in a learning environment is important. One drawback of ChatGPT is that it might provide students with false or incorrect information, particularly in difficult areas like physics (Rane et al., 2023). Owing to the algorithm's design, ChatGPT could not always comprehend the subtleties or context of a student's inquiry, which might result in answers that are either inaccurate or incomplete (Baidoo-Anu & Ansah, 2023). In addition, there are moral questions about student interactions with ChatGPT and data security and privacy. Ensuring the protection of student data and monitoring interactions with ChatGPT is essential to avoid any potential abuse or exploitation of sensitive information. To successfully address these limits and ethical problems, it is imperative to establish clear rules for using ChatGPT in education (Md Shamsudin & Syed Aris, 2023).

Integrating ChatGPT with Experiment Design

When it comes to using experiment design to solve physics misconceptions among students, ChatGPT has some benefits. First, by conversing with the AI model, students can clarify their misconceptions and offer the model more precise justifications and corrections. Furthermore, students will be able to ask follow-up
questions and seek additional explanations on subjects they find difficult, thanks to ChatGPT’s interactive aspect, which will personalise their learning process. Additionally, depending on the students’ misconceptions, ChatGPT may provide a range of experiment design ideas that will strengthen their experimental abilities and reinforce basic physics concepts. ChatGPT is a helpful method for identifying and correcting physics misconceptions among students because it combines conversational AI technology with experimental design (Perera & Lankathilaka, 2023).

A crucial component of scientific research is experimenting design, which influences the data gathered and the inferences made from the findings (Chang et al., 2020). Many aspects of the experiment design might be improved by including ChatGPT. Teachers may ensure clarity and accuracy in their planning by using ChatGPT’s natural language capabilities to express their experimental hypotheses and design parameters better. In order to optimise ChatGPT’s effectiveness in promoting physics learning among students, the model must be tailored to address physics education explicitly. Teacher engagement and understanding may be improved by customising ChatGPT’s prompts and replies to target common physics misconceptions. Adding vocabulary, examples, and domain-specific knowledge to ChatGPT for physics instruction can help it better fit the curriculum and learning goals. Furthermore, by integrating real-world physics issues and experiments into the discussion, teachers may help students better comprehend and remember theoretical ideas by showing how they are used in the real world. With its individualised approach, ChatGPT may help correct misconceptions students hold and foster conceptual comprehension in physics education.

A viable strategy for improving student comprehension and clearing up physics misconceptions is collaborative learning using ChatGPT and experiment design. Teachers use ChatGPT’s features to facilitate a better understanding of complex ideas via conversations and debates. By incorporating experiment design into this cooperative learning process, students may reinforce their mastery of essential concepts by applying their theoretical knowledge to real-world situations. Using this inventive amalgamation, educators get assistance and evaluations while engaging in the active construction of knowledge via practical trials. This interactive learning environment promotes the development of a more robust conceptual framework for physics and critical thinking and problem-solving abilities. Essentially, experiment design provides a helpful application that improves the learning experience for students, while ChatGPT promotes meaningful interactions and knowledge generation.

**Examples of Successful Integration**

Successful integration examples provide valuable insights into the effectiveness of using AI-powered tools like ChatGPT to transform students' misconceptions. These case studies underscore the potential of leveraging advanced technologies for personalised learning experiences that effectively address student misconceptions. All examples have been done using the ChatGPT of Open AI.

*Example 1. Students believe humans can see objects because rays leave the eyes and travel to them. Which Experiment can change this misconception?*

**ChatGPT:**
To address the misconception that rays leave the eyes and travel to objects for humans to see them, you could conduct the following experiment:

**Experiment: Pinhole Camera Demonstration**

**Materials Needed:**
1. Cardboard box
2. Aluminium foil
3. A small pin or needle
4. White paper or screen
5. Light source (e.g., flashlight)

**Procedure:**
1. Take the cardboard box and cut out a small square opening on one side.
2. Cover this square opening with aluminium foil.
3. Use a pin or needle to poke a small hole in the centre of the aluminium foil.
4. Place the white paper or screen inside the box opposite the pinhole.
5. Place an object in a darkened room in front of the pinhole.
6. Shine a light source (e.g., flashlight) on the object.
7. Observe the image formed on the white paper or screen inside the box.

**Explanation:** When light from the object enters the pinhole, it creates an inverted image on the white paper or screen inside the box. This demonstrates that light rays do not leave the eyes and travel to objects, but rather, light from objects enters the eyes and forms images on the retina. The pinhole camera is a simple model of how light enters the eye through the pupil and forms an image on the retina.

By observing this phenomenon, students can understand that vision is a process of light entering the eyes and forming images on the retina rather than rays leaving the eyes to interact with objects. This experiment can help dispel misconceptions and promote a more accurate understanding of vision.

**Example 2:** Students believe a continuous force is needed for continuous motion. Which experiment can change this misconception?

ChatGPT:

To address the misconception that continuous motion requires a continuous force, you could conduct an experiment demonstrating the concept of inertia. Inertia is the tendency of an object to resist changes in its motion. Here is a simple experiment you could use to demonstrate this concept:

**Materials Needed:**
1. A smooth, flat surface (such as a tabletop)
2. A small toy car or a ball bearing
3. A ruler or a flat stick
4. Stopwatch or timer

**Procedure:**
1. Place the smooth surface on a level table or floor.
2. Place the toy car or ball bearing at one end of the surface.
3. Use the ruler or flat stick to gently tap the toy car or ball bearing for a quick initial push.
   Alternatively, you can give it a quick flick with your finger.
4. Use the stopwatch or timer to measure the time the toy car or ball bearing takes to stop.
5. Repeat the experiment several times, giving the object a different initial push (varying the force applied).

**Observations:**
- Students will observe that regardless of the force applied during the initial push, the object eventually stops due to friction and other resistive forces acting on it.
However, they will also notice that the object travels farther when a stronger initial push is given, indicating that the initial force affects the speed and distance travelled before coming to a stop.

Discussion:

- Use the observations to discuss the concept of inertia with the students. Emphasise that the object's tendency to resist changes in its motion (i.e., to keep moving at a constant velocity or to remain at rest) is due to its inertia.
- Explain that once the initial force is removed, the object continues in motion at a constant velocity unless acted upon by an external force (such as friction).
- This experiment illustrates that continuous motion does not necessarily require a continuous force; instead, an initial force is sufficient to initiate motion, and inertia keeps the object in motion until external forces act upon it.

By conducting this experiment and discussing the observations and concepts with the students, you can help dispel the misconception that continuous motion requires a continuous force.

Example 3. Students believe heavier objects fall faster than lighter ones. Which Experiment can change this misconception?

Chat GPT:

One classic experiment that can help change this misconception is "Galileo's inclined plane experiment." This experiment demonstrates that objects of different masses fall at the same rate when subjected to the same gravitational force. Here is how you can set it up:

Materials Needed:

- Inclined plane (a simple wooden board or ramp)
- Stopwatch or timer
- Objects of different masses (e.g., balls of various weights)

Setup:

- Set up the inclined plane at an angle. Ensure it is sturdy and stable.
- Place a starting point at the top of the inclined plane and a finishing point at the bottom.
- Ensure a way to release the objects from the same height at the top of the inclined plane.

Procedure:

- Select objects of different masses (but similar sizes) to use in the experiment.
- Release each object from the same height at the top of the inclined plane and start the stopwatch simultaneously.
- Record the time it takes for each object to reach the bottom of the inclined plane.
- Repeat the experiment multiple times with different objects to ensure accuracy.

Observation:

- Students should observe that all objects, regardless of their mass, reach the bottom of the inclined plane in approximately the same amount of time.
- This demonstrates that objects fall at the same rate regardless of their mass without air resistance.

Discussion:

- Use this experiment to discuss the concept of acceleration due to gravity and how it affects all objects equally, regardless of their mass.
- Encourage students to think about why heavier objects might appear to fall faster in everyday situations (e.g., air resistance, friction) and how those factors can be minimised in experimental setups like this.

By conducting this experiment, students can directly observe and experience the principle that heavier objects do not fall faster than lighter ones when subjected to the same
gravitational force. This hands-on approach can effectively challenge and change misconceptions.

Example 4. Students believe batteries have electricity inside them. Which Experiment can change this misconception?

Chat GPT:
To dispel the misconception that batteries contain electricity inside them, you could conduct an experiment that demonstrates how batteries work to produce electricity rather than store it. Here is a simple experiment you could try:

Experiment: Building a Simple Circuit

Materials:
1. A small flashlight bulb or LED
2. One battery (such as an AA battery)
3. Two pieces of insulated wire (about 6 inches each)
4. A battery holder or electrical tape to hold the wires to the battery terminals.

Procedure:
1. Begin by discussing with students the misconception that batteries contain electricity. Emphasise that batteries are devices that produce electricity through chemical reactions.
2. Explain the concept of a circuit - a closed loop or pathway through which electricity can flow.
3. Using the materials provided, demonstrate how to build a simple circuit. Connect one end of each wire to the battery's terminals (positive and negative) using the battery holder or electrical tape.
4. Connect the other ends of the wires to the bulb or LED. Make sure the wires are securely attached to the bulb or LED.
5. When the circuit is complete, the bulb or LED should light up, demonstrating electricity flowing through the circuit.
6. Ask students to observe what happens when you break the circuit by disconnecting one of the wires from the battery terminal. The bulb or LED should stop glowing, indicating that the flow of electricity has been interrupted.
7. Emphasize that the battery is not "full of electricity". Instead, it provides the energy necessary to power the circuit and produce the flow of electricity.

Discussion: After experimenting, engage students in a discussion to reinforce the concept that batteries do not contain electricity but serve as electrical energy sources. You can also discuss the chemical reactions within the battery that produce this energy. Encourage students to ask questions and think critically about their prior misconceptions.

Example 5: Students believe light is reflected from smooth mirror surfaces, not non-shiny ones. Which Experiment can change this misconception?

Chat GPT:
To address the misconception that light is only reflected from smooth, shiny surfaces, you can conduct an experiment demonstrating reflection from various surfaces, including non-shiny ones. Here is a simple experiment you can try:

Materials Needed:
1. A smooth, shiny mirror
2. A piece of rough, matte cardboard or paper
3. A flashlight or laser pointer
4. White paper or a screen to project the reflections onto
5. Tape or a clamp to hold the materials in place
6. A darkened room for better visibility

Procedure:
1. Set up the materials in a darkened room. Secure the mirror and the rough surface (cardboard or paper) on a flat surface, ensuring they are stable and will not move during the experiment.
2. Aim the flashlight or laser pointer towards the mirror at an angle so the light beam hits the mirror and reflects onto the white paper or screen.
3. Observe and discuss the reflection of light from the smooth, shiny surface of the mirror. Ask the students to describe what they see and note any reflection characteristics.
4. Next, aim the flashlight or laser pointer at the same angle on the rough, matte surface (cardboard or paper). Allow the light to hit the rough surface and observe the reflection on the white paper or screen.
5. Compare and contrast the reflections from the smooth mirror surface and the rough surface. Guide the students to notice that light is reflected from both surfaces, but the quality and direction of the reflections may differ.
6. Encourage students to discuss why they may have initially believed that only smooth, shiny surfaces reflect light. Use this opportunity to introduce concepts such as diffuse reflection and specular reflection.
7. Conclude the experiment by emphasising that light can be reflected from various surfaces, not just smooth, shiny ones, and that understanding the differences in reflection properties can help understand light's behaviour.

By conducting this experiment and discussing the observations with the students, you can effectively challenge their misconceptions about light reflection and help them better understand how light interacts with different surfaces.

**Implementing ChatGPT-Driven Experiment Design in Physics Curriculum**

In order to improve student learning outcomes in physics, strategies for curricular integration are essential (Fidan & Tuncel, 2019). By including topics like biology, chemistry, and mathematics in the physics curriculum, students may better understand scientific ideas and how they relate to one another. Project-based learning, in which students collaborate on interdisciplinary projects requiring them to integrate knowledge from several topics, is one successful technique for curricular integration (Gao et al., 2020). This method develops students' critical thinking and problem-solving abilities while applying physics to everyday situations. Furthermore, integrating many courses within the physics curriculum may be improved by using technological tools like data analysis software and simulations (Banda & N'zahabimana, 2021). Curriculum integration techniques provide students with a comprehensive education that equips them to succeed in a scientific environment that is changing quickly.

To optimise ChatGPT’s potential influence on student learning, educators must get training on how to apply it in the classroom (Rahman & Watanobe, 2023). Teachers must be able to negotiate the complexities of natural language processing and modify their ChatGPT interactions to meet the unique learning goals of their students. Technical topics like how ChatGPT interprets language and produces replies, as well as pedagogical approaches for incorporating ChatGPT into current teaching methods, should be covered in this session. We may enable educators to use ChatGPT to correct student misconceptions and improve the overall learning experience in the classroom by giving them thorough training on how to use it (Gill et al., 2024).

Resistance is one of the biggest obstacles to the effective use of technology in the classroom (Liu et al., 2024). Lack of resources, support, time, teacher confidence, classroom environment, and student concerns are essential elements that contribute
to this resistance (Nikolopoulou et al., 2023). Giving teachers the necessary guidance and assistance to use technology in the classroom is crucial to overcoming this reluctance. Including educators in making decisions about technology deployment may also help allay their concerns and improve their buy-in. Educators may also use technology as a helpful tool in the classroom by showcasing how it enhances student engagement, academic results, and the overall educational experience.

In order to successfully adapt and integrate new treatments or technologies across various contexts, educational institutions must use tactics known as "scaling up implementation." One strategy is creating a thorough implementation plan that considers each institution’s particular requirements and circumstances. To monitor progress and results, this plan should include well-defined objectives, roles and duties, deadlines, and assessment measures. Building a solid support network at the grassroots and senior levels is essential to promoting an innovative and continuous improvement culture. In order to generate good change and achieve sustainable impact, educational institutions may successfully scale up implementation efforts by involving stakeholders at all levels, offering continuous training and assistance, and encouraging cooperation and communication.

**Future Directions and Implications**

Prospective advancements in ChatGPT technology may improve capacities for comprehending and interacting with students in a more customised manner. These breakthroughs might include advances in contextual understanding to customise explanations to specific learning styles and better natural language processing algorithms to analyse student replies better and deliver more accurate feedback. Furthermore, adding multimedia components to the ChatGPT interface, such as pictures, movies, and simulations, can improve the student experience and encourage a more dynamic learning environment (Javaid et al., 2023). Through the ongoing refinement and expansion of ChatGPT technology, educators may harness its potential to revolutionise how students approach physics and other topic misconceptions via experiment design (Thompson et al., 2023).

The use of ChatGPT to construct experiments that challenge students' misconceptions about physics significantly influences educational research and teaching methodologies. By efficiently addressing misconceptions and facilitating student learning via AI technology, teachers may improve their teaching strategies and better meet the requirements of each student. Moreover, ChatGPT’s incorporation into educational environments yields valuable information that academics studying education may use to assess how well AI-driven interventions enhance students' comprehension and recall of scientific ideas. This creative method improves instruction while adding to the current conversation in educational research on how well AI technologies support student learning outcomes (Zhu & Kaiser, 2022).

Ensuring equitable educational opportunities for all students in technology-driven education requires addressing equity and inclusion. If deliberate efforts address equality concerns, technology can close the achievement gap between wealthy and impoverished kids (Ali, 2023). Inequalities in existing schooling may be made worse by disparities in access to technology (Afzal et al., 2023). Therefore, while developing technology-driven instructional tools, it is crucial to consider varied student groups' demands. Teachers may provide a more equitable learning environment for all students
and increase learning outcomes and academic achievement by putting inclusion first when creating and using educational technology (Shahvaroughi & Ghasemi, 2024).

Prospective joint research prospects may include broadening the present study's purview to explore ChatGPT's applicability in STEM fields outside physics. Furthermore, investigating ChatGPT's efficacy in clearing misconceptions among students with different academic backgrounds may provide insightful results. Furthermore, comparing ChatGPT to other AI-powered platforms or conventional teaching techniques to dispel myths may provide a more thorough grasp of its effectiveness. Additionally, examining the sustained retention of conceptual knowledge attained by ChatGPT treatments may provide insight into the tool's long-term viability as a teaching aid. Collaborating across disciplines with specialists in artificial intelligence, education, and cognitive science might improve future research projects' theoretical foundation and methodological rigour.

**Conclusion**

This study shows that misconceptions in physics education may be efficiently addressed and corrected using practical experimentation and AI-enabled conversational assistance. These findings imply that including ChatGPT in physics instruction might help students develop more vital conceptual comprehension. The use of ChatGPT to dispel students' misconceptions has essential ramifications for physics education. Teachers may improve students' learning by utilising ChatGPT to create experiments that address frequent misconceptions in physics learning objectives. This method helps dispel myths and encourages students to think critically, plan experiments, and use scientific reasoning. Furthermore, ChatGPT's interactive features may draw students into group learning settings and help them grasp physics ideas more deeply. Enhancing physics teaching using ChatGPT-based experiments may lead to better student performance and a deeper understanding of the scientific process (Safaryan, 2023).

Future implementation recommendations include providing students with a hands-on experience even in remote locations, allowing them to study physics topics more dynamically and interactively, and incorporating interactive simulations or virtual laboratories into the learning environment. By implementing these suggestions, teachers may provide a dynamic and engaging learning environment that encourages students' critical thinking, problem-solving abilities, and a firmer conceptual grasp of physics.

In conclusion, it will be shown that integrating ChatGPT with experiment design may effectively change students' misconceptions about physics. Students might learn more about the underlying ideas and principles by devising experiments to challenge their assumptions. Because ChatGPT is interactive, it provides individualised feedback and direction, which improves the learning process even more. In order to fully realise the promise of AI-powered tools in education and promote a more interactive and collaborative learning environment for students, more research and development in this field will be essential going ahead.
Acknowledgement
The author must acknowledge Dr. George Stylos for the valuable discussions about parts of this study.

Conflict of interests
No conflict of interest.

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