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Influence of ChatGPT Usability as a Learning Tool and Perceptions of Using ChatGPT to Understand Cell Division among Pre-Service Biology Teachers in Malaysia

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Abstract

Artificial Intelligence (AI) is transforming education through innovations such as ChatGPT that enhance learning experiences. Despite these, understanding how ChatGPT addresses challenges in biology education remains crucial. This study utilizes quantitative methods, including correlation analysis, to determine the relationship between ChatGPT usability as a learning tool and perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia. The study involved 63 pre-service biology teachers enrolled in the Bachelor of Science with Education (Hons) program at the Faculty of Science, UPM Serdang. The study utilized a questionnaire adapted from the Usefulness, Satisfaction, and Ease of Use (USE) questionnaire and Technology Acceptance Model (TAM), with data analyzed using SPSS software. The findings indicate a strong usability of ChatGPT (M=4.18, SD=0.46) and perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia (M=4.15, SD=0.53). Correlation analysis reveal a positive and moderate correlation ($r=0.64$, $p<0.01$), indicating that pre-service teachers who perceive ChatGPT as usable are more likely to consider it a valuable learning tool for understanding cell division. This study contributes to improving learning outcomes in biology education and advancing digital education for both teachers and students.

Keywords: Cell Division, ChatGPT, Perceptions, Pre-Service Teachers, Usability

Introducation

ChatGPT in Education System

In an era marked by technological advancements, the rapid growth of Artificial Intelligence (AI) has transformed the academic landscape (George & Wooden, 2023). AI can be defined as technologies that combine to allow machines to imitate cognitive functions normally associated with the human mind (Malik et al., 2023). The introduction of the Chat-Generative Pre-trained Transformer (ChatGPT) that was launched in November 2022 by OpenAI, has significantly impacted education as it can perform various language-related tasks such as text generation, responding to queries, and translating languages, which comprehends the context to produce human-like responses (Mhlanga, 2023; Rasul et al.,

2023). ChatGPT holds immense potential in education, evidenced by its ability to revolutionize learning through personalized experiences, adaptive assessments, predictive analyses, and chatbots, leading to increased efficiency and tailored support for students and teachers (Montenegro-Rueda et al., 2023).

Recent social media trends and anecdotal evidence suggest widespread student awareness of ChatGPT, with a strong likelihood of undergraduate students utilizing this AI (Cooper, 2023). This rapid adoption of ChatGPT has transformed it into a student-driven learning tool and highlights the potential for application in Higher Education Institutions (HEIs) (Dai et al., 2023). According to Qadir (2023), ChatGPT enhances the learning experience by providing customized learning resources, accommodating different learning styles, and offering individualized feedback. Al-Sharafi et al (2022) highlight ChatGPT's role in facilitating deeper research engagement and overcoming coursework burdens among university students.

However, significant challenges emerge in applying these advancements to specific subjects. A key example is the persistent low understanding of fundamental biology concepts among high school students in Malaysia, which presents a critical barrier to their academic success (Azizah & Susantini, 2021; Basri & Abdullah, 2020). This knowledge gap extends to pre-service biology teachers who often struggle to move beyond rote memorization in the mastery of complex biological concepts (Etobro & Fabinu, 2017; Fatmawati & Fauzi, 2019). Current curriculum designs further exacerbate these challenges by inadequately catering to students' prior knowledge, resulting in insufficient instructional focus on foundational principles and perpetuating a cycle of inadequate biology education (Murtonen et al., 2020).

In this context, ChatGPT emerges as a transformative tool in reshaping biology education, particularly for university students grappling with the complexities of biology (Prayitno & Hidayati, 2022). The versatility of ChatGPT, spanning from knowledge acquisition to critical thinking skills, offers a promising opportunity for enhancing educational strategies in biology (Dao & Le, 2023). However, translating this potential into practical application remains a challenge. Effectively harnessing ChatGPT capabilities is crucial to address the persistent gaps in understanding fundamental biology concepts, especially among undergraduate students. This study aims to determine the usability of ChatGPT among pre-service biology teachers, focusing on aspects such as usefulness, ease of use, ease of learning, and satisfaction. Additionally, it examines perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia, focusing on perceived usefulness, perceived ease of use, attitude towards usage, and behavioural intention to use the AI tool. By investigating the relationship between the usability of ChatGPT and perceptions of its effectiveness, this research aims to inform the development of strategies for incorporating ChatGPT, or similar AI tools, into biology education in Malaysia. This research has the potential to address the inadequate understanding of fundamental biological concepts among pre-service teachers, ultimately improving learning outcomes for future generations of students.

Empowering Education with ChatGPT in Malaysian Education System

Globally, education standards are a cornerstone of progress, with teachers playing a pivotal role in the transformative process (Pushpanadham, 2020). Upholding education quality necessitates enhanced focus on teacher training, nurturing personal and professional growth of pre-service teachers (Albakri, 2021). In Malaysia, teacher education courses are offered by three distinct institutions: Public Higher Learning Institutions, Private Institutes of

Higher Education, and Teacher Training Institutes (Nordin, Ahmad, Mohd Noor, Abd Mutalib, & Sidek, 2021). Ministry of Education (MOE) through the Malaysia Education Blueprint 2013-2025 prioritizes the significance of pre-service training, recognizing it as essential for effective classroom engagement (MOE, 2013). Currently, the teaching profession in Malaysia exhibits a significant gender disparity, with 300,524 female teachers compared to 117,539 male teachers (MOE, 2024).

In pre-service training, individuals undergo academic programs to become qualified teachers, emphasizing the importance of strong subject knowledge, steadfast commitment, and authentic enthusiasm for effective teaching (McComas et al., 2018). Pre-service teachers, defined by Bağcı and Pösteki (2019) as individuals undergoing an academic program to obtain the necessary qualifications for a future teaching career, often struggle to apply theoretical knowledge from university to real classroom settings (V. Sathasivam, Abdullah, & Abdul Rauf, 2024). At Universiti Putra Malaysia (UPM), pre-service teachers participate in teaching practicum programs, offering hands-on teaching experience in secondary schools. This includes assisting trainee teachers in lesson planning, utilizing various teaching methods, evaluating learning progress, and applying teaching theories in classrooms (Ahmad, 2024). Addressing the disparity between theory and practice among pre-service teachers may require ongoing professional development, similar to the approach suggested for teachers by Mat et al (2022), which prioritize the efficient utilization of instructional strategies and technological tools for meaningful learning experiences using technology.

Despite the challenges associated with managing student-driven adoption, ChatGPT's user-friendliness has facilitated its rapid integration as a learning tool among students. Consequently, the use of ChatGPT within local HEIs has been authorized, emphasizing the necessity of strict adherence to established guidelines (Fam, 2023). Furthermore, Shariff (2023) from Centre for Academic Development at UPM has outlined guidelines on how ChatGPT can enhance education. These guidelines encourage educators to integrate AI into assessments and guide students in collaborative activities, prioritizing experiential learning, personalized approaches, and ethical AI usage. This aligns with the goal of the Digital Education Policy (DEP) by the MOE to develop a competitive, digitally fluent generation capable of meeting the demands of the digital era (MOE, 2023).

Nguyen et al (2023) found that ChatGPT has potential in improving high school biology learning through personalized experiences tailored to individual students' needs, offering explanations, feedback, and answering queries. Meanwhile, Dao and Le (2023) investigated ChatGPT's performance alongside other models like BingChat and Bard in handling biology questions, identifying strengths in Higher-order Thinking Skills (HOTS) but also noting challenges in consistency and effectiveness, especially with complex queries. Bard achieved the highest accuracy rate (16.7%), followed closely by ChatGPT (29.1%), while BingChat did not provide correct responses. Williams and Fadda (2023) evaluated ChatGPT's performance in scientific literature and examination inquiries, showcasing its strengths in descriptive tasks but fluctuations in performance compared to ChatGPTPlus, cautioning against overreliance without careful assessment.

Gender differences can significantly influence technology adoption and learning preferences. Research suggests that male students often demonstrate greater confidence and proficiency in technology usage, whereas female students may voice concerns about inadequate training and the reliability of software and hardware (Aruleba et al., 2023). These dynamics can impact the utilization of educational tools like ChatGPT among pre-service biology teachers in Malaysia, underscoring the importance of considering gender-specific

perspectives and needs. Additionally, specific usage patterns in ChatGPT have been observed (Bouzar et al., 2024). Females tend to use ChatGPT more frequently but for shorter durations, while males engage with it for longer sessions. Moreover, males perceive ChatGPT as more user-friendly and beneficial compared to females, influencing their academic utilization. However, both genders exhibit similar positive attitudes towards ChatGPT, highlighting its broad appeal as an educational tool.

According to the Curriculum and Assessment Document of biology (MOE, 2018), the topic of cell division holds significant importance within the fundamentals of the Standard Based Curriculum for Secondary Schools (KSSM) for biology subject. Cell division, as defined by Urry et al (2018), is a process performed by eukaryotic cells to split their nuclei into five stages. Understanding cell division is crucial as it serves as a foundational concept in biology, with its comprehension directly impacting other interconnected topics (Basri & Abdullah, 2020). Extensive research conducted from 2018 to 2022, as evidenced by studies from Basri and Abdullah (2020); Fauzi and Mitalistiani (2018); Hadiprayitno et al (2019); Matawali et al. (2019); Rosli and Ishak (2022); Salleh et al (2021), consistently highlights cell division as a challenging subject for students. Particularly, difficulties in grasping cell division concepts are noted to hinder students' proficiency in addressing gametogenesis-related problems (Salleh et al., 2021). Moreover, concepts associated with the cell cycle, chromosomes, and homologous chromosomes are deemed essential for university-level biology (Mocan, 2021), emphasizing the integral role of understanding cell division in the fundamentals of biology within the KSSM syllabus.

Students and teachers encounter various challenges in teaching and learning biology, such as understanding abstract concepts, clarifying complex terminology, and memorizing extensive information. These challenges persist from high school to university levels (Fauzi & Mitalistiani, 2018; Salleh et al., 2021). Traditional teaching methods are seen as inadequate for preparing students for success in today's complex world, leading to a shift towards 21st-century teaching methods (Eslit, 2023). Ganguly et al (2019) advocate for adapting to the preferences of 21st-century students, many of whom are e-learners, emphasizing the importance of promoting self-directed learning through digital technology integration. This aligns with Mat et al (2023) assertion that digital learning is crucial in 21st-century education, particularly for enhancing Higher-Order Thinking Skills (HOTS) in science education. In active learning environments, students engage in constructing their understanding by linking new information with prior knowledge (Lazonder, 2023; Loyens et al., 2023). ChatGPT can function as a beneficial learning aid in these settings, accommodating individualized learning paces and providing direct responses to students seeking skill acquisition (Chinonso et al., 2023).

Pratiwi and Suprihatin (2020) define usability as the practical application of a product during its use, emphasizing that products with higher usability are user-friendly and easy to operate. In this study, the usability of ChatGPT is determined based on its usefulness, ease of use, ease of learning, and satisfaction. Usability testing involves participants who represent the target user base, evaluating a product against specific usability criteria (Fadhilah et al., 2022). One commonly employed tool for such evaluations is the Usefulness, Satisfaction, and Ease of Use (USE) questionnaire, as outlined by (Lund, 2001). Faria et al (2016) emphasizes the questionnaire as highly effective due to its well-structured evaluation dimensions, which are pivotal in assessing usability. Furthermore, research by Shaikh et al (2023) demonstrates the usability benefits of ChatGPT, particularly its user-friendly interface that participants found easy to use and satisfying during English tasks. This suggests its potential as a helpful tool for formal English learning. However, some user satisfaction limitations exist. Mulia et al.

(2023) point out that ChatGPT's information is limited at 2021 and may not always be accurate or comprehensive due to its training on internet data, where it cannot differentiate facts from opinions.

Perceptions shape technology use and it involve gathering information and construction of representation (Friedman, 2022). In the context of this study, perceptions among pre-service biology teachers regarding the use of ChatGPT for understanding cell division are evaluated as a process involving the retrieval of information and the construction of representations. This process is assessed based on their perceived usefulness, perceived ease of use, attitude towards usage, and behavioural intention to use the ChatGPT. Understanding students' perceptions on ChatGPT is vital because it reveals their experiences and how ChatGPT aligns with their needs (Xiao & Zhi, 2023). Findings from Xu et al (2024) show both undergraduate and postgraduate students find ChatGPT useful. However, undergraduate students trust it more for simple tasks, while postgraduates are unsure about its ability for complex tasks. These different perceptions are likely relating to their focus areas as undergraduate students prioritize foundational knowledge and skill development. Additionally, students might worry about ChatGPT's impact on skill development, critical thinking, and preference for human interaction in learning (Singh et al., 2023). The Technology Acceptance Model (TAM) is a key tool for evaluating user acceptance of technologies (Surendran, 2012). TAM's popularity stems from its conciseness and efficiency in comprehending technology adoption, as demonstrated by its application in numerous studies across a wide range of technologies (Xu et al., 2024).

The findings of this study are expected to benefit various stakeholders, especially future researchers and pre-service teachers. By aiming to enhance the quality of teaching to align with ongoing technological advancements, the study addresses current educational needs while also setting the stage for future developments in pedagogy. The insights gained from this study can guide the development of customized educational approaches that utilized emerging technologies to enhance learning outcomes and foster a deeper understanding of complex subjects such as biology. Finally, this study is anticipated to bring a favourable transformation in the educational system, empowering teachers and students with the tools necessary for success in the digital era. Hence, the objective of this study is:

- To determine the usability of ChatGPT as a learning tool among pre-service biology teachers in Malaysia, focusing on aspects such as usefulness, ease of use, ease of learning, and satisfaction.
- To evaluate the perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia, including aspects such as perceived usefulness, perceived ease of use, attitudes towards usage, and behavioural intention to use.
- To determine the relationship between the usability of ChatGPT as a learning tool and perceptions for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia.

The research hypothesis of this study includes:

- H_{A1}: There is a significant relationship between the usability of ChatGPT as a learning tool and perceptions for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia.

Methodology

In this study, a cross-sectional survey research methodology with a quantitative approach was employed. The research design utilized correlation analysis to determine the relationships between the variables. The choice of a cross-sectional survey design was driven by its efficiency and cost-effectiveness in collecting data at a particular moment in time (Wang & Cheng, 2020). Additionally, the quantitative approach enables a methodical analysis of numerical data and enables the generalization of results to a broader population and validation of hypotheses (Rana, Gutierrez, & Oldroyd, 2021). Data collection utilized an online admission questionnaire distributed to pre-service biology teachers at UPM Serdang. Prior to the study, the study's protocol received authorization from the UPM Ethics Council for Research Involving Human Subjects (JKEUPM) (No. JKEUPM-2021-844), ensuring adherence to ethical guidelines.

Population of Study

The population of the study comprised all 76 pre-service biology teachers enrolled in the Bachelor of Science with Education (Hons) program at the Faculty of Science, UPM Serdang. Due to the small population size and specific study objectives, a census approach was chosen, surveying the entire population instead of a sample (Oribhabor & Anyanwu, 2019). Thus, every pre-service biology teacher from the first to fourth cohorts in the program will be invited to participate.

Attrition Consideration

While every effort will be made to maximize response rates, it is acknowledged that attrition may occur, and not all individuals in the population may respond to the survey. Factors such as non-response, incomplete responses, or dropout may contribute to attrition in the study (Bougie & Sekaran, 2019). The pre-service teachers were contacted through multiple channels such as WhatsApp and Telegram with the assistance of lecturers to increase response rate.

Instrument

The instrument used in this study was an online questionnaire comprising three main sections: (1) Demographic information, (2) ChatGPT usability as a learning tool among pre-service biology teachers in Malaysia, and (3) Perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia. In the first section, respondents were required to disclose demographic characteristics including cohort, gender and teaching practicum experience. The second section consisted of 20 items adapted from Lund (2001), which are suitable for evaluating the usability of a technical system, as mentioned by Shaikh et al. (2023). These items addressed factors such as usefulness, ease of use, ease of learning and satisfaction. For the last section, 11 items were adapted from Ghani et al. (2019) and several items were formulated by the researchers following a review of the literature. These items will examine factors such as perceived usefulness, perceived ease of use, attitude, and behavioural intention to use (Davis et al., 1989). Respondents indicated their level of agreement or disagreement with each item using a five-point Likert scale as illustrated in Table 1 (Jamieson, 2004).

Table 1
Likert scale

Likert scale	Level of agreement
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

Validity and Reliability

Content validity of the questionnaire was established through the Scale-level Content Validity Index/Average (S-CVI/Ave) (Yusoff, 2019). Two experts from UPM and Institut Aminuddin Baki evaluated the items for relevance using a 4-point scale as shown in Table 2. The S-CVI/Ave was calculated to be 0.93, which is considered acceptable (Davis, 1992). In the context of population surveys, although the incorporation of a pilot study is frequently omitted, the evaluation of reliability remains essential (Srinivasan & Lohith, 2017). After surveying the entire population, Cronbach's Alpha coefficient was used to evaluate the internal consistency reliability of the questionnaire (Bougie & Sekaran, 2019). The obtained alpha value of 0.92 indicated very good internal consistency (Taber, 2017). This is especially critical when using Likert-type scales, as researchers are required to compute and report the alpha value to verify internal consistency reliability (Gay et al., 2012).

Table 2
Rating scale in the content validation form to the experts

Rating scale	Degree of relevance
1	The item is not relevant to the measured domain
2	The item is somewhat relevant to the measured domain
3	The item is quite relevant to the measured domain
4	The item is highly relevant to the measured domain

Normality Test

In order to meet the prerequisites for conducting parametric analysis, a normality test was conducted by assessing the skewness and kurtosis values, which should fall between the range of -2.00 and 2.00 (George & Mallery, 2010). The test revealed that the data for both study variables were normally distributed, with skewness values ranging from -.387 to .110. Table 3 displays the outcomes of the normality test for the variables utilized in this research.

Table 3
Normality test

Variable	Skewness	Kurtosis
ChatGPT usability as a learning tool among pre-service biology teachers in Malaysia	-.387	-.470
Perceptions of pre-service biology teachers in Malaysia regarding the use of ChatGPT for understanding cell division	.110	-1.159

Data Collection Procedure and Statistical Analysis

The data collection procedure in this study follows the guidelines set by the Faculty of Educational Studies, UPM. Initially, the researcher obtained permission from the Faculty of Educational Studies and submitted an application to the JKEUPM to ensure adherence to ethical guidelines. Upon receiving approval from both the Faculty of Science and the Faculty of Educational Studies, the study commenced. The number of pre-service biology teachers enrolled in the Bachelor of Science with Education (Hons) program at UPM was obtained directly from the Faculty of Science. Following this, data collection began. A survey formatted as a Google Form questionnaire, was distributed to respondents through WhatsApp, and Telegram with the assistance of lecturers and representatives from the students' council.

The data collected was analyzed using the software SPSS (Statistical Package for the Social Sciences). Both descriptive and inferential statistical methods were utilized for analysis. Demographic characteristics of the respondents were examined using descriptive analysis that involved calculating frequency, percentage, mean, and standard deviation. The interpretation of the mean value was based on the guidelines provided by Alotaibi et al. (2017) as detailed in Table 4.

Table 4
Mean score interpretation

Mean score	Level
1.00 – 1.80	Very weak
1.81 – 2.60	Weak
2.61 – 3.40	Moderate
3.41 – 4.20	Strong
4.21 – 5.00	Very strong

The Pearson correlation was used to investigate the relationship between the usability of ChatGPT as a learning tool and perceptions for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia. This analysis helps the researcher to understand how pre-service teachers' views on ChatGPT's usability as a learning tool might influence their perceptions of its effectiveness for learning cell division. Based on the correlation result, the relationship between the variables can be categorized into five types of relationship based on Dancey and Reidy (2011) as shown in Table 5.

Table 5
r value interpretation

r value	Interpretation
0.0	Zero
0.10 - 0.39	Weak
0.40 - 0.69	Moderate
0.70 - 0.99	Strong
1.00	Perfect

Findings and Discussion

In this study, 63 out of 76 respondents (82.9%) who were pre-service biology teachers enrolled in the Bachelor of Science with Education (Hons) program at the Faculty of Science, UPM Serdang, participated. The respondents were distributed among the cohorts as follows:

12 (19.0%) from the first cohort, 18 (28.6%) from the second cohort, 22 (34.9%) from the third cohort, and 11 (17.5%) from the fourth cohort. The respondents consisted of 15 males (23.8%) and 48 females (76.2%). Regarding their experience as practical teachers in schools, 50 respondents (79.4%) had completed a practicum, while 13 (20.6%) had no prior teaching experience. The distribution details of the respondents' demographic are shown in Table 6.

Table 6
Respondents' demographic

Demographic factor	**Frequency (N=63)**	**Percentage (%)**
Aspect 1: Cohort		
First	12	19.0
Second	18	28.6
Third	22	34.9
Fourth	11	17.5
Aspect 2: Gender		
Male	15	23.8
Female	48	76.2
Aspect 3: Teaching practicum Experience		
Experienced	50	79.4
None	13	20.6

The demographic characteristics of the participants offer crucial background for understanding the results of this research. With a strong participation rate of 82.9% (N=63), the study offers relevant insights, even though 17.1% (N=13) of the population did not respond. Among the four cohorts surveyed, the third cohort had the highest participation rate at 34.9% (n=22), while the fourth cohort had the lowest at 17.5% (n=11). The lower response from the fourth cohort is likely due to their involvement in the teaching practicum, where 31.25% (n=5) were actively participating at the study's time. This highlights a typical challenge in survey-based research, where some individuals are less available due to other commitments (Bougie & Sekaran, 2019).

The respondents were predominantly female, making up 76.2% (n=48) of the population, compared to 23.8% (n=15) male. This gender skew mirrors broader trends in the teaching profession, which is often dominated by females (MOE, 2024). This imbalance is important as it may influence how technology, like ChatGPT, is adopted and used, with previous research suggesting gender can affect technology perceptions and usage patterns (Aruleba et al., 2023; Bouzar et al., 2024). Most respondents, 79.4% (n=50), had participated in a teaching practicum, while 20.6% (n=13) had not. This variation is significant because it can influence how pre-service teachers perceive and utilize educational technologies. Ahmad (2024) notes that the teaching practicum at UPM provides pre-service teachers with hands-on experience in lesson planning, implementing diverse teaching methods, and applying educational theories in classrooms. Building on this, those with practicum experience are generally better equipped to integrate tools like ChatGPT into their teaching practices, as they have already developed essential skills in practical settings. In contrast, those without practicum experience might find it more challenging to adapt to and effectively use these technologies in their teaching.

ChatGPT usability as a learning tool among pre-service biology teachers in Malaysia

The study determined the usability of ChatGPT among pre-service biology teachers in Malaysia, focusing on aspects such as perceived usefulness, ease of use, ease of learning, and satisfaction. The descriptive analysis reveals a strong usability of ChatGPT as a learning tool among pre-service biology teachers in Malaysia, with a mean score of M=4.18 (SD=0.46). When examining constructs, ease of learning emerges with the highest mean score of M=4.29 (SD=0.61), while ease of use exhibits the lowest mean of M=4.07 (SD=0.47). At the item level, UU4 (ChatGPT saves my time when I use it) records the highest mean value at M=4.54 (SD=0.64), whereas UU5 (ChatGPT does not meet my needs) demonstrates the lowest mean at M=3.60 (SD=0.61). The interpretation of mean score is detailed in Table 4. Refer to Table 7 for detailed mean scores and standard deviations for each construct.

Table 7
Mean score and standard deviation for constructs in ChatGPT usability among pre-service biology teachers in Malaysia

Construct	Mean score	Standard deviation	Level
Usefulness	4.24	0.52	Very strong
Ease of use	4.07	0.47	Strong
Ease of learning	4.29	0.61	Very strong
Satisfaction	4.16	0.58	Strong
Overall average	4.18	0.46	Strong

ChatGPT's strong usability as a learning tool for pre-service biology teachers in Malaysia is supported by previous studies (Cooper, 2023; Dai et al., 2023; Montenegro-Rueda et al., 2023). This study found that ease of learning had the highest mean score, indicating quick proficiency among pre-service teachers in using ChatGPT to obtain direct responses to queries (Chinonso et al., 2023). However, the lower mean score for ease of use indicates room for improvement, particularly noted in handling complex biological queries and low performance compared to ChatGPT Plus (Dao & Le, 2023; Williams & Fadda, 2023). However, this result differs with Shaikh et al. (2023) who found that ease of use had the highest mean score for learning English, suggesting subject-specific challenges. This implies that while ChatGPT is effective for simpler subjects, enhancements may be needed for complex subjects like biology.

Despite these challenges, ChatGPT's ability to save time is significant, as evidenced by the highest mean score for the item “ChatGPT saves my time when I use it”, highlighting the tool’s efficiency in educational settings (Ganguly et al., 2019). This time-saving capability can be particularly beneficial for pre-service teachers during their teaching practicum. Additionally, the item “ChatGPT does not meet my needs” received the lowest mean score after recoding, indicating general satisfaction among pre-service biology teachers for their learning needs (Nguyen et al., 2023).

Perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia

This section evaluated pre-service biology teachers' perceptions of using ChatGPT to understand cell division, focusing on perceived usefulness, perceived ease of use, attitudes towards usage, and behavioural intention to use. Within the descriptive analysis, pre-service

biology teachers in Malaysia demonstrate strong perceptions regarding the use of ChatGPT for understanding cell division, reflected in a mean score of M=4.15 (SD=0.53). Notably, the constructs of perceived usefulness and perceived ease of use attain the highest mean scores of M=4.23 (SD=0.54) and M=4.23 (SD=0.63) respectively, while behavioural intention to use records the lowest mean score of M=3.97 (SD=0.65). Upon closer examination of individual items, PPU2 (ChatGPT will be useful to help me understand the interconnected topics of cell division) emerges with the highest mean score at M=4.30 (SD=0.75), while PBIU2 (I intend to increase the usage of ChatGPT in my pre-service teacher training) obtains the lowest mean score at M=3.83 (SD=0.75). Table 4 provides the interpretation of mean scores, while Table 8 offers a detailed breakdown of mean scores and standard deviations for each construct.

Table 8
Mean score and standard deviation for constructs in perceptions of using ChatGPT to understand cell division among pre-service biology teachers in Malaysia

Construct	Mean score	Standard deviation	Level
Perceived usefulness	4.23	0.54	Very strong
Perceived ease of use	4.23	0.63	Very strong
Attitudes towards usage	4.12	0.60	Strong
Behavioural intention to use	3.97	0.65	Strong
Overall average	4.15	0.53	Strong

The findings indicate that pre-service biology teachers in Malaysia strongly perceive ChatGPT as a valuable tool for understanding cell division. Perceived usefulness and perceived ease of use received the highest mean scores, suggesting that pre-service teachers find ChatGPT beneficial and user-friendly for understanding cell division concepts across cognitive levels (Dao & Le, 2023; Mat et al., 2023). This finding aligns with the assertion of Pratiwi and Suprihatin (2020) that products demonstrating enhanced usability prioritize ease of use and accessibility for the user. Additionally, the item "ChatGPT will be useful to help me understand the interconnected topics of cell division" received the highest mean score, emphasizing its importance in biology education as comprehension in cell division directly influences other topics within biology (Basri and Abdullah, 2020).

However, the construct of behavioural intention to use recorded the lowest mean score, indicating some hesitation among pre-service teachers in fully committing to use ChatGPT in their training programs. This hesitation may stem from concerns about the tool's effectiveness, particularly for handling complex biological queries compared to other AI models (Dao & Le, 2023). Additionally, there are reservations regarding ChatGPT's impact on skill enhancement and critical thinking capacities (Singh et al., 2023). Despite recognizing the benefits of ChatGPT, pre-service teachers appear cautious about increasing their usage, as evidenced by the lower mean score for the item “I intend to increase the usage of ChatGPT in my pre-service teacher training”. This hesitation underscores the need for further exploration into addressing specific concerns related to ChatGPT's application in understanding complex biological concepts.

Relationship between each usability constructs of ChatGPT as a learning tool and perceptions for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia

The Pearson correlation analysis was conducted to examine the relationships between each usability constructs of ChatGPT as a learning tool and the perception for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia. The findings suggest moderate and positive relationships between each usability construct and the perception, as outlined in Table 5. Specifically, satisfaction demonstrates the strongest correlation with perception (r=0.66), followed by ease of use (r=0.60), usefulness (r=0.48), and ease of learning (r=0.43). The results are presented in Table 9.

Table 9
Pearson correlations between each usability constructs of ChatGPT as a learning tool and perception for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia

Construct	R value	Significant (p)	Interpretation
Usefulness	0.48	<0.01	Moderate
Ease of use	0.60	<0.01	Moderate
Ease of learning	0.43	<0.01	Moderate
Satisfaction	0.66	<0.01	Moderate

*Correlation is significant at the 0.01 level (2-tailed)

Notably, this finding revealed the strongest correlation between user satisfaction with ChatGPT and their perception for learning cell division. This differs slightly from Mulia et al. (2023), who identified user dissatisfaction due to potential information limitations up to 2021. The difference in satisfaction could be attributed to the specific learning task. As the current study focused on cell division, teachers might have valued ChatGPT's ability to explain core concepts more than its limitations in broader knowledge areas. This aligns with research highlighting the challenges pre-service biology teachers face in mastering biological concepts beyond memorization (Etobro & Fabinu, 2017; Fatmawati & Fauzi, 2019).

Conversely, the ease of learning with ChatGPT demonstrated a slightly weaker positive relationship with pre-service teachers' perception for using ChatGPT to understand cell division compared to other usability constructs. This finding suggests that while ease of learning plays a role, it might not be the most crucial factor shaping pre-service teachers' perceptions. In this context, ChatGPT's proficiency in providing clear explanations of core cell division principles might have a more significant impact on their perception of effectiveness, even if learning to use the tool initially requires slightly more effort. These findings align with Xu et al (2024), who noted that undergraduate students primarily focus on foundational knowledge and skill development.

Relationship between ChatGPT usability as a learning tool and perceptions for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia

The relationship between the usability of ChatGPT as a learning tool and perceptions for using ChatGPT to understand cell division among pre-service biology teachers in Malaysia was examined using Pearson correlation analysis. The analysis revealed a significant positive and moderate correlation (r=0.64, p<0.01, n=63), as indicated in Table 5. The coefficient of

determination (r^2=0.41) suggests that 41.0% of the variance in perceptions regarding the use of ChatGPT for understanding cell division can be attributed to the variability in the usability of ChatGPT as a learning tool among pre-service biology teachers in Malaysia. The correlation values between the variables were shown in Table 10.

Table 10
Pearson correlation between usability of ChatGPT as a learning tool among pre-service biology teachers in Malaysia and perceptions for using ChatGPT to enhance understanding of cell division

Variable 1	Variable 2	R value	Significant (p)	Interpretation
ChatGPT usability as a learning tool among pre-service biology teachers in Malaysia	Perceptions of pre-service biology teachers in Malaysia regarding the use of ChatGPT for understanding cell division	0.64	<0.01	Moderate

*Correlation is significant at the 0.01 level (2-tailed)

The results revealed a positive and moderate correlation, indicating that pre-service teachers who perceive ChatGPT as usable are also more likely to view it as a valuable tool for understanding cell division concepts. Furthermore, approximately 41.0% of the variance in teachers' perceptions regarding using ChatGPT for cell division can be attributed to the perceived usability of ChatGPT as a learning tool. These findings support 21st-century learning that caters to e-learners and promotes self-directed learning facilitated by technology (Ganguly et al., 2019). This focus on active learning environments resonates with the principles (Lazonder, 2023; Loyens, 2023). These factors likely contribute to the observed positive correlation between perceived usability of ChatGPT and pre-service teachers' perceptions of using it in understanding cell division.

Conclusion

This study has evaluated the usability and perception of using ChatGPT among pre-service biology teachers in Malaysia, focusing on its effectiveness as a learning tool for understanding cell division. The findings underscore the dual importance of usability and perceptions in integrating ChatGPT into biology education. ChatGPT demonstrates strong usability, particularly in its ability to provide direct responses to queries and save time, despite noted challenges with complex biological problems. Additionally, pre-service biology teachers in Malaysia hold strong perceptions regarding ChatGPT's utility for understanding cell division, viewing it as beneficial and easy to use, albeit with some reservations about extensive adoption. The significant positive and moderate correlation between ChatGPT's usability and pre-service teachers' perceptions of using ChatGPT in understanding cell division indicates that a favourable user experience enhances its perceived value in understanding biological concepts. These findings highlight ChatGPT's potential to enhance biology education by simplifying tasks, clarifying core biological concepts, and accommodating diverse learning needs. The integration of ChatGPT into educational settings shows opportunities for enriching student learning experiences in Malaysia.

Research Implications

Theoretical Implications

This study significantly advances educational technology research by examining the strong usability and perceptions of pre-service biology teachers regarding ChatGPT as a learning tool for understanding cell division. The study reveals a notable positive correlation between usability and perceptions, shedding light on how AI tools are adopted and used in learning, which contributes to the Technology Acceptance Model (TAM) framework. It expands the understanding of how pre-service teachers' perceptions of AI tools influence their decision to integrate them into education, specifically in biology. The findings contribute to TAM in several ways. First, it affirms the core TAM principles of perceived usefulness and ease of use. Pre-service teachers find ChatGPT beneficial and user-friendly, aligning with TAM's view that these factors drive technology adoption. Second, the study highlights a lower inclination among teachers to fully commit to using ChatGPT, despite recognizing its benefits. This suggests that factors like the accuracy of alternative tools and concerns about their impact on critical thinking play significant roles in technology adoption. This finding proposes the need for a more comprehensive TAM model that incorporates these considerations, especially in the context of AI-based educational tools. Furthermore, the study shows that contextual factors, such as the specific topics taught like cell division and the educational practices within Malaysian pre-service biology teacher training programs, influence how AI tools are embraced and used. This suggests that TAM could benefit from refinement to incorporate these specific contextual influences, providing a deeper understanding of technology acceptance in educational settings.

Practical Implications

The findings from this study have significant implications for educators and curriculum developers. The strong usability and perceptions demonstrated by pre-service biology teachers suggest that integrating AI-based tools like ChatGPT into teacher education programs can enhance digital literacy and pedagogical skills. In-service teacher training programs can be designed to familiarize pre-service teachers with ChatGPT and provide strategies for its effective integration into classroom instruction. Furthermore, investments in AI-based educational technologies, supported by research and infrastructure, can enhance the quality of education. By leveraging ChatGPT's personalized learning capabilities, teachers can promote active learning in the classroom, fostering student engagement and comprehension of interconnected topics within biology, such as cell division. This research contributes to both pre-service teachers and high school biology students, who can benefit from more engaging and effective learning experiences. The potential of ChatGPT to transform biology education in HEIs underscores the importance of continued exploration and implementation of AI-based learning tools.

Limitations and Recommendations

Certain limitations were observed in this study and should be taken into account when interpreting the findings. Firstly, the population of pre-service biology teachers recruited was small. While this population provided valuable data, it limits the generalizability of the findings to the broader population of pre-service biology teachers across the country. Future research should involve a larger and more diverse sample by recruiting respondents from multiple public and private universities offering biology teacher education programs. Secondly, the study relied solely on a quantitative survey for data collection. While this

method provided valuable insights into usability, it did not capture the nuanced experiences and in-depth perspectives of pre-service teachers regarding ChatGPT. Essentially, future research could benefit from utilizing a mixed-methods approach that integrates both quantitative and qualitative data collection methods. This combined approach would offer a more comprehensive understanding. Lastly, the study employed a correlational design, which allows for the identification of relationships between variables. However, it cannot establish causation. Future research could explore causal relationships through the use of experimental designs with control groups.

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