

The 4I Model of Benefits and its Integration with the Technology Acceptance Model (TAM): Teenagers' Perspectives on Using ChatGPT for Homework

Zinaida Adelhardt and Thomas Eberle

Friedrich-Alexander University Erlangen-Nürnberg, Germany

zinaida.adelhardt@fau.de

office@thomaseberle.de

Abstract: The introduction of ChatGPT has provided students with a tool similar to a fairy-tale djinn, giving the ability to simplify homework and projects with just a few keystrokes. This study examines teenagers' perspectives on using ChatGPT for homework, exploring both the perceived benefits and concerns. Based on content analysis of responses from 141 teenagers aged 14 to 16 from grammar schools across various federal regions in Germany, we introduce the *4I Model of Benefits*, identifying four key advantages: Information, Inspiration, Improvement, and Immediacy. Integrated within the Technology Acceptance Model (TAM) framework, this model clarifies factors influencing teenagers' acceptance of AI text generators in education. Findings indicate that, while most teenagers recognize the distinct benefits of using ChatGPT, concerns about learning efficacy and over-reliance underscore the need for balanced educational integration. By enriching the TAM framework, the 4I Model identifies the specific benefits of ChatGPT that drive its acceptance and provides valuable insights for educators, policymakers, and developers.

Keywords: ChatGPT in education, 4I model of AI benefits, Educational benefits of AI text generators, Homework support through AI, Technology acceptance model (TAM) Extension, User studies

1. Introduction

The rapid growth of artificial intelligence (AI) has significantly impacted the educational landscape, offering students access to innovative easy-to-use tools having the potential to reshape and revolutionize learning experiences (Bem Machado et al. 2024; DuBoulay et al. 2023; Holmes et al. 2019). Among these tools are generative pre-trained transformers (GPTs) like OpenAI's ChatGPT, which stand out as particularly impactful in educational settings, surpassing other similar generative transformers such as Bing Chat, Bard, and Ernie (Rudolph et al. 2024). Like a fairy-tale djinn, ChatGPT grants students the ability to generate human-like responses, reasonable explanations, and even complete essays with just a few keystrokes – the powerful ability of new technology that raises both enthusiasm and concern among educators, students, and researchers.

In this article, we introduce the **4I Model of Benefits**—Information, Inspiration, Improvement, and Immediacy—developed from a qualitative analysis of 141 essays written by teenagers reflecting on their use of ChatGPT. The model identifies key advantages students perceive in using ChatGPT for their schoolwork. Furthermore, we situate these findings within the framework of the Technology Acceptance Model (TAM) (Davis 1989), a widely used framework that explain how users come to adopt and engage with new technologies. By combining the 4I Model with TAM, we aim to provide deeper insights into the factors that influence teenagers' acceptance of AI-based textual generators, highlighting the perceived benefits of ChatGPT among students.

1.1 ChatGPT in Education

The academic discourse surrounding ChatGPT's integration into education has emphasized its transformative potential in reshaping how students learn and how educators teach (Bem Machado et al. 2024; Farrokhnia et al. 2024; Grassini 2023; Tlili et al. 2023; Meyer et al. 2023). Most studies have focused on university settings, exploring its applications in specific subject areas, such as legal education (Choi et al. 2023), medical education (Kung et al. 2023; Wen and Wang 2023), media education (Pavlik 2023), and programming (Rahman and Watanobe 2023). ChatGPT's relatively high performance on the US Medical Licensing Exam (Kung et al. 2023) and its ability to handle law school exams at an average student level (Choi et al. 2023) highlight its potential to assist in higher education contexts.

1.2 ChatGPT and its Benefits for Students

OpenAI's ChatGPT has gained considerable attention for its potential to assist students with a wide array of academic tasks (Grassini 2023; Mahapatra 2024; Meyer et al. 2023; Sok and Heng 2023). Trust et al. (2023) outlined several key benefits of ChatGPT for students, starting with *personalized learning support*, which includes individualized tutoring, research assistance, activity directions, and explanations of complex topics in simpler language. It can generate summaries, outlines, writing tips, sentence starters, and make translations

(Trust et al. 2023). Moreover, ChatGPT *supports creative thinking* by suggesting ways to improve sentence structure and aiding brainstorming processes. It also provides *assessment support*, such as quizzes and practice tests, and assist *reading and writing comprehension*. Existing studies affirm these benefits, demonstrating ChatGPT's ability to improve academic writing skills (Mahapatra 2024), offer personalized tutoring, and assist with various research tasks (Grassini 2023).

1.3 Concerns about ChatGPT

Despite its many benefits, the use of ChatGPT in education has sparked significant concerns, particularly around *academic integrity* (Kasneji et al. 2023; Trust et al. 2023; Tlili et al. 2023; Sok and Heng 2023). The ease with which it generates human-like text has led to fears regarding the preservation of academic honesty and its potential misuse in educational settings (Cotton et al. 2023; Sullivan et al. 2023).

Additionally, ChatGPT has been found to provide *inaccurate information*, fabricate content, create false citations, and generate unreliable reference lists, all of which compromise its credibility (Azaria et al. 2024; Bhattacharyya et al. 2023). Research also highlights risks of reproducing specific negative perceptions (Abramski et al. 2023) and political biases (Rozado 2023).

Over-reliance on AI poses another critical challenge, with concerns that tools like ChatGPT may erode students' higher-order cognitive skills and reduce independent problem-solving abilities (Farrokhnia et al. 2024). Uncritical engagement with AI-generated content also raises issues for educators and policymakers, alongside concerns about copyright, data protection, legal responsibility, and cybersecurity in education (Sallam 2023).

These concerns are driving ongoing discussions about the responsible use of ChatGPT and debates on whether it should be allowed in educational contexts (Yu 2023; Ogugua et al. 2023). While several Australian states have restricted the use of ChatGPT in schools to maintain educational standards (Bernardone 2023), some US schools are experimenting with generative AI tools as a potential substitute for teachers (Young 2023). However, even if schools ban ChatGPT on school devices, controlling how students complete their homework remains challenging. Current detection tools for identifying AI-generated content have proven to be ineffective (Pegoraro et al. 2023). This underscores the need for more research on the ethical integration of ChatGPT in education (Cotton et al. 2023; Miao et al. 2021; Hagendorff 2020; Nguyen et al. 2023). However, in order to develop reliable ethical policies and guidelines, it is essential to further investigate how students use these tools and what drives their appeal.

1.4 Theoretical Framework and Research Objectives

The use of ChatGPT in education has predominantly been studied within the context of higher education, with a significant focus on university students from various disciplines (Bašić et al. 2023; Chan and Tsi 2023; Al-Abdullatif and Alsubaie 2024; Ravšelj et al. 2024), leaving a critical gap in understanding how younger, more vulnerable students in secondary schools engage with these tools.

Research on secondary school students' use of ChatGPT is limited, despite teenagers being key users of the technology. OpenAI's Terms of Use require users to be at least 13 years old (OpenAI.com 2024), and with growing access among teens, it is crucial to understand their views on its benefits and risks. Unlike university students, secondary school students face different cognitive and developmental challenges, highlighting the need for tailored policies and guidelines for them. More research is needed on how younger students use ChatGPT, its appeal, and the ethical implications in secondary education.

To address this gap, our study investigates how secondary school students use ChatGPT, with a focus on the benefits they perceive in relation to their schoolwork. We aim to explore the key factors that make ChatGPT appealing to teenagers, particularly in how they believe it enhances their learning experience. The central research question guiding this study is: "What benefits do teenagers perceive in using AI text generators like ChatGPT for their schoolwork?"

To analyze the factors influencing teenagers' acceptance of ChatGPT, we apply the **Technology Acceptance Model (TAM)**, originally developed by Davis (1989). TAM posits that two main factors influence users' acceptance of new technologies:

- **Perceived Usefulness (PU):** The belief that using the technology will improve one's performance.
- **Perceived Ease of Use (PEOU):** The belief that using the technology will be effort-free.

These factors are influenced by external variables and shape users' attitudes toward the technology, which in turn influence their behavioural intentions and ultimately determine actual usage. While TAM has been

extended in various ways, including TAM 2 (Venkatesh and Davis 2000) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003), we choose to use the original TAM framework for its simplicity. However, we extend it by introducing an additional layer to capture the specific appeal of generative AI tools like ChatGPT. Bagozzi (2007) criticized TAM for potentially oversimplifying the complexity of technology adoption, particularly across different contexts and user groups, stating that "almost no research has deepened TAM in the sense of explaining PU and PEU, reconceptualizing existing variables, or introducing new ones to explain how these variables produce their effects" (p. 244). Our approach aims to address this gap by adapting TAM to the context of generative AI, specifically focusing on ChatGPT adoption.

This study introduces an extension of TAM through the development of the **4I Model of Benefits**—Information, Inspiration, Improvement, and Immediacy. By integrating this model within the TAM framework, we aim to offer a more nuanced understanding of the factors influencing ChatGPT's acceptance among secondary school students. While prior research has explored the use of generative AI tools like ChatGPT in education, few studies have focused specifically on teenagers' perceptions. This study presents the 4I Model, derived inductively from qualitative data, as a novel approach to understanding the perceived benefits of text generators like ChatGPT among school students.

In doing so, we seek to contribute to ongoing discussions about AI generators in education by providing evidence-based recommendations for ethical integration. By understanding what drives ChatGPT's appeal for younger students, we aim to inform the development of policies and guidelines that promote responsible, effective use of AI generative tools in schools, ensuring it supports rather than hinders educational outcomes.

2. Methodology

This study employs a qualitative approach to examine teenagers' perceptions of the benefits associated with AI text generators. A total of 141 teenagers, aged 14 to 16 (mean age 14.97, standard deviation 0.77, 58.7% female), participated in the research. The participants, students from German grammar schools (Gymnasien) and applicants to an adventure education program, represented a geographically diverse sample, coming from fourteen of Germany's sixteen federal regions.

Participants were asked to write short essays in response to the question: "What advantages do you see in using ChatGPT as a resource for homework or projects?" Given the involvement of participants under the age of eighteen, we implemented several safeguarding measures. Written informed consent was obtained from both participants and their parents/guardians. To ensure clarity, we conducted two pre-data collection Zoom meetings to explain the research aims and methods. All responses were anonymized to protect participants' identities, stored securely, and accessible only to the research team. Participation was voluntary, with the option to withdraw at any time. The survey question was carefully designed to be age-appropriate and understandable for teenagers.

Data collection occurred via the online survey platform SoSci Survey at the end of February 2024. Participants were given ten days to complete the survey at their convenience, allowing them reasonable time to provide thoughtful and well-considered responses. The length of responses to the open-ended question varied from one to fifty-six words.

A content analysis was performed on the collected data, categorizing the responses into themes based on perceived benefits. Preliminary thematic analysis revealed four key categories of benefits - Information, Inspiration, Improvement, and Immediacy - which led to the development of the 4I Model. Unlike other existing mnemonic-based frameworks, the 4I model was derived directly from participants' feedback, specifically reflecting their views on the benefits of ChatGPT. Additionally, responses highlighting a lack of perceived benefits or focusing on drawbacks were also identified and quantified as part of the analysis.

3. Results

The analysis of the teenagers' essays revealed that all participants were already familiar with ChatGPT and held well-defined opinions about its usefulness for academic work. Notably, 83% of teenagers identified specific benefits that they perceived in using ChatGPT, while 17% reported that they saw no advantages in this tool.

3.1 Perceived Benefits of ChatGPT

The analysis of teenagers' essays highlighting benefits revealed a consistent set of recurring themes - **Information, Inspiration, Improvement, and Immediacy** - that capture the perceived advantages of using ChatGPT for academic tasks. All benefits mentioned by students can be aligned with one of these categories.

The distribution of responses across these themes suggests a varied range of uses for AI text generators, emphasizing both practical and creative aspects. Below are the benefits that teenagers associate with using ChatGPT (the total percentage exceeds 83% because many students mentioned multiple benefits in their responses):

3.1.1 Information

A significant portion of respondents (27%) highlighted the value of ChatGPT in providing quick access to vast amounts of information. Teenagers appreciated how ChatGPT could condense research time by offering readily available summaries and explanations from diverse sources. For many students, this was particularly useful when they needed to grasp complex topics or needed a starting point for further investigation. The ability to retrieve relevant content instantly is described as helpful in understanding subjects and in creating a more holistic view of the subject matter. One student noted an additional advantage in using ChatGPT over general internet search engines: it provides information without the distraction of unnecessary advertisements.

Examples: "You can gather a lot of different information from different sources quickly and get an overall picture" (P.22); "Questions can be answered appropriately, by an AI pulling information from the internet and adapting it to the question" (P.57); "You can search more specifically and find content faster. Plus, you don't get unnecessary info/ads" (P.116).

3.1.2 Inspiration

For many teenagers, ChatGPT functions as a creative spark (16%). The tool's ability to present ideas in novel ways or suggest alternative approaches made it valuable for students seeking inspiration. It was often described as a way to break through creative blocks, particularly when beginning an assignment or project. By offering fresh perspectives, ChatGPT served as a catalyst for generating new ideas, enhancing students' ability to explore different solutions or angles on a task.

Examples: "It's a good source of ideas. Before you despair over a task because you have no idea what to write, it's better to get different ideas. That often makes the work easier" (P.73); "AI can provide ideas that you or your group wouldn't have thought of so quickly" (P.47); "New perspectives and ideas or suggestions to broaden your horizons" (P.42).

3.1.3 Improvement

Another frequently cited benefit was ChatGPT's role in enhancing the quality of work (19%). Teenagers mentioned its usefulness in refining text formulations, checking grammar and spelling errors, and clarifying difficult concepts. In this way, ChatGPT was not merely seen as a source of information but as a tool for enhancing the accuracy and quality of their work. Some respondents appreciated how the tool could improve their output by providing concrete examples or guiding them towards clearer, more professional expressions. One teenager even compared it to a substitute teacher, when the real one didn't have time.

Examples: "It can be quite useful because it can also improve your own skills" (P.40); "It's a good way to formulate your thoughts clearly and explain your own opinion in a way that's understandable for others, especially if you struggle with that" (P.5); "It's like a substitute for a teacher when they don't have time for you" (P.76).

3.1.4 Immediacy (time and effort saving)

The immediacy with which ChatGPT delivers results was a prominent theme, with many students valuing the time and effort it saves (28%). Teenagers highlighted that ChatGPT allowed them to complete tasks more quickly and efficiently, reducing the burden of long research or writing processes. This benefit was particularly important for students facing time constraints or multiple assignments, as they felt that ChatGPT could help them manage their workload more effectively, giving them more free time for other activities.

Examples: "I think ChatGPT is a very interesting tool. With ChatGPT, I was able to inform myself much faster and more precisely about topics (e.g., for a presentation) <...> I think ChatGPT has the advantage of speeding up and easing many tasks." (P.119); "You can finish tasks faster and have more time for things you enjoy" (P.127); "One advantage is efficiency – you can complete tasks faster. Also, some school tasks are not really productive/useless, and you could use your time for better things" (P.94).

3.2 Perceived Drawbacks and Concerns

Approximately 17% of teenagers reported perceiving no benefits from using ChatGPT for their homework or school projects. Several essays presented a combination of perceived advantages and concerns, illustrating a nuanced view of the tool's potential in education. The teenagers expressed the following drawbacks and concerns:

3.2.1 Lack of learning

This theme emerged as the most prominent concern in the teenagers' essays. Many responses highlighted that reliance on ChatGPT could hinder their personal learning. These students voiced worries about over-dependence on AI, fearing it may compromise their critical thinking skills and independent engagement with the material. Several teenagers articulated their fears that frequent use of ChatGPT could diminish their ability to process information and learn autonomously.

Examples: "I see little advantage because there is no learning process if ChatGPT does everything for you" (P.2); "It's also okay to let ChatGPT do the homework sometimes, but the use should be limited and not become a habit. Overall, ChatGPT can take away a lot of stress <...> but you shouldn't let an AI do everything. It can be useful, but it can also lead to losing important skills, and you won't be well-prepared for school tasks, etc." (P.125); "For homework, I find it very concerning because it can quickly lead to poorer performance in school since you don't repeat the content through doing homework"(P.138).

3.2.2 Concerns about quality and accuracy

Other notable concerns centred around the quality and accuracy of the information provided by ChatGPT. A few teenagers pointed out that the AI sometimes generated incorrect information or responses that were too general to be useful for specific tasks. These concerns suggest that ChatGPT may not necessarily enhance the quality of students' work and could even contribute to poorer academic performance.

Examples: "I think it can lead to mistakes and that you don't learn anything from it" (P.37); "If you're doing a project where research is allowed, you could use it for summarized and concise content, but you must verify it" (P.9).

3.2.3 Academic honesty

Ethical concerns regarding academic honesty and the potential misuse of ChatGPT to avoid learning or to cheat were also mentioned. This tension highlights the conflict between the convenience offered by the tool and the risk of undermining the educational process.

Examples: "you're not using your own knowledge" (P.43).

4. Discussion

4.1 The 4I Model of Benefits

The findings indicate that most teenagers (83%) recognize practical and creative benefits of using ChatGPT for academic tasks. Analysis identified four key themes - Information, Inspiration, Improvement, and Immediacy - leading to the development of the 4I Model of Benefits (Figure 1). This model categorizes the perceived benefits of ChatGPT into four primary domains, offering an organized way to understand teenagers' views on its academic utility. It highlights that ChatGPT's attractiveness encompasses these areas: the extensive information it offers, its capacity to inspire creativity, its role in improving the quality of work, and the efficiency it brings in terms of time and effort saved.

Information <i>A tool for providing quick access to information</i> Provides quick access to vast resources and data, aiding in understanding and research efficiency	Inspiration <i>A tool for creative ideas and new perspectives</i> Sparks creativity by offering fresh ideas and different approaches to tasks
Improvement <i>A tool for enhancing the quality of work</i> Helps improve the quality of work through better text formulations, corrections, and clarifications of complex concepts	Immediacy <i>A tool saving time and effort</i> <i>Reduces time and effort, allowing students to complete tasks more efficiently</i>

Figure 1: The 4I Model of Benefits

Four types of benefits:

Information: Many teenagers highlighted that ChatGPT provides quick access to vast amounts of information, which helps them understand topics better and saves research time.

Inspiration: Students indicated that ChatGPT serves as a creative catalyst, offering ideas and perspectives that enhance their work. This observation is consistent with findings from previous studies, such as those by Sok and Heng (2023), which emphasize the tool's capacity to stimulate creativity in academic settings.

Improvement: ChatGPT is regarded by teenagers as a valuable tool for enhancing work quality, especially in areas such as text formulation, error checking, and concept clarification. Our findings align with existing research, which underscores its potential to improve writing quality and clarity. Studies indicate for instance that ChatGPT can assist in generating coherent text, identifying grammatical errors, and clarifying complex concepts in academic contexts (Grassini 2023; Bašić et al. 2023; Bem Machado et al. 2024; Mahapatra 2024).

Immediacy: Many teenagers appreciated ChatGPT for its speed and efficiency, highlighting how it reduces the effort required to complete assignments.

These insights align with existing research on AI benefits in education (Trust et al. 2023; Grassini 2023; Kasneci et al. 2023). For instance, Trust et al. (2023) identified benefits in personalized learning and creative support that align closely with the "Improvement" and "Inspiration" themes. Similarly, Sok and Heng (2023) found ChatGPT also advantageous for assessment creation, personal tutoring, and brainstorming. This aligns well with our findings, though teenagers did not directly mention assessment-related benefits, which may be more relevant for advanced or older students.

4.2 Integration with the Technology Acceptance Model (TAM)

The TAM model suggests that "perceived usefulness" and "perceived ease of use" are key factors driving technology acceptance, both shaped by external variables (Davis 1989). Figure 2 illustrates an extended TAM framework that integrates the key benefits of ChatGPT as perceived by teenagers:

- **Information, Inspiration, and Improvement** aspects directly contribute to the perceived usefulness of ChatGPT. These benefits support students in performing academic tasks more effectively and improving the quality of their work.
- **Immediacy** aligns with perceived ease of use, as ChatGPT's time-saving features reduce the effort required to complete assignments, thus increasing its appeal to students.

Together, these benefits of the 4I Model positively influence teenagers' overall attitudes toward ChatGPT, promoting its adoption for academic purposes despite potential concerns.

Our findings suggest that teenagers perceive multiple benefits to using ChatGPT for academic tasks, which are effectively captured within the 4I Model. This model adds to the existing literature by offering a structured way to categorize and understand the different types of benefits. By linking these perceived benefits to the established TAM framework, we contribute to ongoing discussions about the integration of AI in education.

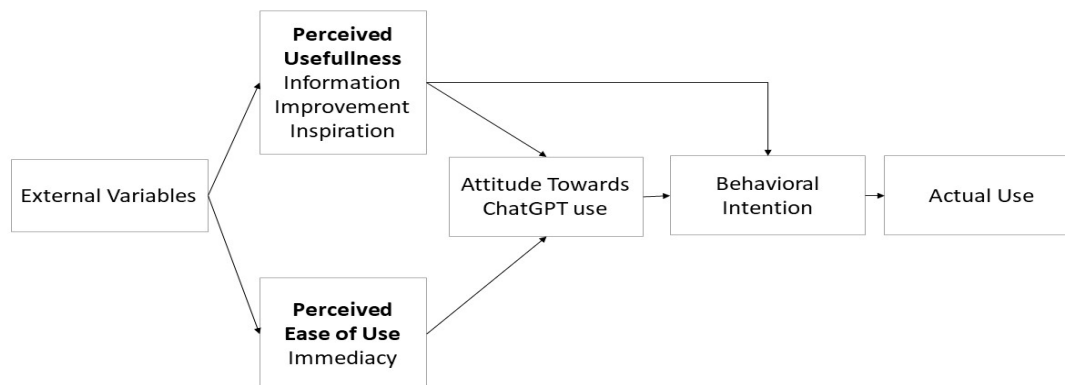


Figure 2: Integration of the 4I Model of Benefits with Technology Acceptance Model

4.3 Perceived Concerns and Implications

While 83% of teenagers in this study identified benefits to using ChatGPT for academic work, approximately 17% saw no clear advantages. The most common concern among these students was that ChatGPT might inhibit their learning. Besides potential *lack of learning*, additional concerns included issues of *inaccuracy* and *academic integrity*. These perceptions align with the broader academic discourse, which highlights both opportunities and challenges posed by generative AI in education (Kasneci et al. 2023; Trust et al. 2023; Tlili et al. 2023; Sok and Heng 2023).

While some teenagers worried that over-dependence on AI might compromise their critical thinking, one student compared ChatGPT to a “substitute teacher”. Similarly, Chan and Tsi (2023) found that although some students and teachers anticipate a larger role for AI in teaching, most believe critical thinking, creativity, and emotional insight remain uniquely human qualities that AI cannot replicate.

Beyond integrity, our findings also emphasize the importance of developing students' critical AI literacy. As AI tools like ChatGPT become more integrated into learning, students must develop the ability to question how such technologies generate information and assess the biases that may be embedded in their outputs. For example, awareness of the limitations in ChatGPT's training data - such as cultural biases or stereotypes - can help students approach AI-generated information with a critical perspective.

Overall, these insights suggest that while ChatGPT presents considerable benefits, its integration into education requires a balanced approach that proactively addresses concerns regarding potential lack of learning, academic integrity, and the need for AI literacy.

5. Limitations and Further Research

This study offers valuable insights into teenagers' perceptions of using ChatGPT for homework and school projects; however, several limitations should be acknowledged.

The sample of 141 teenagers, while geographically diverse, consists solely of German grammar school students, which may limit the generalizability of the findings to other educational systems or countries with different cultural attitudes toward AI.

This study relies on qualitative, self-reported data from written essays, which may introduce response biases, such as social desirability or the tendency to provide “correct” answers. Variations in response length and depth could also affect the thematic analysis, with some students offering more detailed insights than others.

The study's focus is limited to perceived benefits, viewed from a user-experience perspective, without direct assessment of ChatGPT's influence on learning outcomes, critical thinking, or academic integrity. It reflects reported advantages, but does not account for possible long-term effects that prolonged AI use might have on educational development.

This study uses the TAM framework to examine factors influencing ChatGPT's adoption. Future research could explore alternative models like the Value-Based Adoption Model (VAM) (Kim et al. 2007), which considers both functionality and hedonic benefits. VAM has been used to assess various technologies, including mobile internet (Kim et al. 2007) and paid learning apps (Wang et al. 2019). Al-Abdullatif and Alsubaie (2024) applied an extended VAM framework with AI literacy to evaluate ChatGPT's acceptance in higher education, suggesting a promising approach for studying AI adoption in education.

Future studies could benefit from longitudinal approaches to examine how teenagers' perceptions and usage patterns of ChatGPT evolve over time, particularly as AI technology continues to develop and integrate into educational systems. This approach could provide deeper insights into the long-term educational impact of AI generators like ChatGPT on teenagers' learning, critical thinking, and academic habits.

6. Conclusion

This study introduces the **4I Model of Benefits**, offering an original perspective on how teenagers perceive the benefits of ChatGPT in academic contexts. It identifies **four key benefits**: *Information, Inspiration, Improvement, and Immediacy*. By positioning this model within the TAM framework, we gain a deeper understanding of the external factors that drive the acceptance of AI text generators among students.

The 4I Model of Benefits contributes to the growing discourse on the role of AI in education and provides a useful tool for future research on integrating generative AI into educational settings. While our findings clearly outline the advantages of using ChatGPT, they also emphasize the need for balanced usage. Over-reliance on AI tools may hinder the development of essential learning skills and critical thinking. Future research should explore strategies for effectively integrating these technologies into educational practices, aiming to maximize their benefits while minimizing potential drawbacks.

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