GenAI as a Learning Assistant, an Empirical Study in Higher Education

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Abstract: This empirical study investigates the use of Generative Artificial Intelligence (GenAI) as a learning assistant in higher education and explores the impact of AI literacy on its frequency of use. Based on theoretical models of cognitive and metacognitive learning strategies, the study analyzes how students use GenAI to support these learning processes. Several usage scenarios were developed to explore how GenAI can be used as a learning assistant for cognitive and metacognitive learning strategies. The results show that GenAI is predominantly used to support cognitive learning strategies, such as explaining complex concepts and summarizing texts, while its use to support metacognitive learning strategies, such as self-regulation and learning planning, is less frequent. The study is based on an online survey of 266 students from the University of St.Gallen. Using the AI literacy model of Ng, four dimensions of AI competence (affective, behavioral, cognitive, and ethical) are measured, with the behavioral dimension identified as a significant predictor of GenAI usage for learning activities. Developing targeted programs to promote practical AI literacy is considered necessary to facilitate the integration of GenAI into learning processes and realize its potential more fully.

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1 INTRODUCTION

There are many different ways in which AI can be used in education. Several studies are exploring the opportunities and risks of new AI technologies for educational organizations (Adiguzel et al., 2023; Michel-Villarreal et al., 2023; Zhang & Aslan, 2021).

The use of AI tools in universities is currently the subject of heated debate. Some view this type of technological support as a form of cheating, mainly when students use AI to assist with tasks like writing papers or generating content. Others, however, believe that collaborating with AI tools represents the future of contemporary education, where such technologies can enhance learning outcomes and foster new ways of acquiring and applying knowledge (Schneider, 2023).

A previous study by Spirgi et al. (2024) shows that students use generative AI (GenAI) for writing academic texts, but its potential for supporting other learning processes remains partly underexplored. AI technologies have and will have a significant impact on the way we learn (Chen et al., 2020). These changes are particularly important for students, who need to build up a lot of knowledge in order to complete their studies successfully.

This study focused on how university students use GenAI for learning. In its role as a learning assistant (LA), GenAI thus becomes an integral part of students' learning strategy.

Research in this area is essential because GenAI offers students many opportunities for individualized learning and can, therefore, increase their learning success (Alshami et al., 2023; Michel-Villarreal et al., 2023). Early studies have already shown that students use AI to learn (von Garrel et al., 2023).

2 AI IN ACADEMIC LEARNING

2.1 AI as a Learning Assistant

As highlighted in the introduction, GenAI tools can be utilized to support individualized learning for

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students. The AI tool becomes a learning assistant when GenAI becomes an integral part of a student's learning strategy. There are two types of learning strategies that AI can be used for.

Learning strategies can be defined as internal programs for controlling learning processes. Learning strategies guide intentional learning (Schnotz, 2011). A distinction can be made between cognitive and metacognitive learning strategies (Wild & Schiefele, 1994).

Cognitive learning strategies refer to the direct processes used to acquire, process, and understand knowledge (Nückles, 2021). These strategies enable learners to take in, organize, and remember information actively. They focus on the "what" of learning - the specific content and how to process it.

Metacognitive learning strategies are strategies that relate to "thinking about thinking." They involve planning, monitoring, reflecting, and adapting one's learning process (Hasselhorn & Andju, 2021). These strategies help learners to manage and optimize their cognitive processes. It is about knowing how to learn and being able to self-regulate learning.

GenAI can function as a learning assistant for both cognitive and metacognitive strategies. For instance, it can provide explanations for complex concepts that were not sufficiently covered in class, helping students actively acquire and understand knowledge (cognitive). Additionally, GenAI can assist in creating a structured learning plan, enabling students to plan, monitor, and adapt their learning process effectively (metacognitive). For more details, see Table 3

2.2 AI Literacy

With the advent of large language models like ChatGTP, AI became accessible to everyone (Seufert & Spirgi, 2024). Technological advancements have led to increased and more complex requirements for the digital competencies of both students and employees (Seufert & Guggemos, 2021). To navigate the opportunities and challenges presented by AI, individuals must acquire a foundational knowledge of AI and the skills to utilize and assess AI systems effectively (Hornberger et al., 2023). These abilities are commonly known as AI literacy (Long & Magerko, 2020). AI literacy has been recognized as an essential digital literacy across various disciplines and aspects of everyday life (Kandlhofer et al., 2016; Long & Magerko, 2020; Ng et al., 2021a; Ng et al., 2021b). The concept of "AI literacy" is understood and defined in multiple ways. In their study, Ng et al. (2024) define AI literacy as a comprehensive concept based on four dimensions: affective dimension, behavioral dimension, cognitive dimension, and ethical dimension.

Affective dimension: This dimension refers to learners' emotional responses and attitudes towards AI. It includes intrinsic motivation, self-efficacy, career interest, and confidence when interacting with AI. The goal is to foster positive emotions and attitudes to support learning and engagement with AI.

Behavioral dimension: This dimension focuses on learners' actual behaviors when interacting with AI, including behavioral intention, engagement, and collaboration. The aim is to measure behaviors that indicate active participation and the application of AI skills in learning contexts.

Cognitive dimension: This captures learners' knowledge and higher-order thinking skills, ranging from understanding AI principles to applying and evaluating AI solutions.

Ethical dimension: This dimension addresses the moral understanding and responsible use of AI technologies. It focuses on ethical issues such as privacy, social responsibility, transparency, and digital security. The goal is to ensure students use AI responsibly and reflectively in all stages of their learning and development.

3 THE PRESENT STUDY

This study aims to assess the prevalence of using GenAI tools as learning assistants. Additionally, this study aims to examine how AI literacy influences the usage of these tools in educational settings. To explore the role of GenAI in learning strategies, we pose three research questions:

1. How often do students use GenAI as a learning assistant for cognitive and metacognitive learning strategies?
2. Are there any gender differences in using AI as a learning assistant?
3. How does AI literacy affect the frequency of using GenAI as a learning assistant?

Ng et al. (2024) concept of AI literacy serves as the foundation for addressing research question 3 (see Chapter 2.2). By exploring the role of GenAI in educational processes, this study deepens our understanding of how AI can support learning. It advances the field by offering a comprehensive perspective on the integration of AI into the learning process, with a particular focus on both cognitive and metacognitive learning strategies.

4 METHODS

4.1 Online Survey and Sample

A digital survey was selected for the study to thoroughly investigate students' experiences with AI. The survey was conducted online using the "Qualtrics" platform between September and October 2024. All the questions were single-choice. A total of 266 students from the local university completed the survey. The average age of the respondents is 19.7 (SD = 1.1) years. The students taking part in the survey are studying either economics or law. Table 1 shows the composition of the sample.

Table 1: Sample.

Characteristic	Absolute	Percentage
Female Students	107	40.2 %
Male Students	157	59.0 %
Diverse Students	2	0.8 %
First Semester Students	253	95.1 %
Bachelor Students	8	3.0 %
Master Students	5	1.9 %

4.2 Development of Instrument

The questionnaire consisted of two sections. The first section assessed the frequency of using GenAI as a learning assistant. The authors of this article developed four items covering scenarios in which GenAI is used to support cognitive learning strategies. The areas addressed include acquiring knowledge, summarizing content, applying knowledge, and explicitly explaining concepts. Additionally, four items were developed to address scenarios where GenAI supports metacognitive learning strategies. These included planning the learning process, self-monitoring, self-reflection, and adapting learning strategies. The fully elaborated items are presented in Table 3. Participants were asked to indicate the frequency of their usage on a 5-point Likert scale. The scale included the following response options: "Never" = no use, "Rarely" = once per semester, "Sometimes" = once per month, "Frequently" = multiple times per month, and "Usually" = once or more per week.

In the second part of the survey, Ng et al. (2024) validated instrument was used to assess participants' AI literacy. This instrument measured four dimensions of AI literacy: the affective dimension, the behavioral dimension, the cognitive dimension, and the ethical dimension. Participants were presented with 5 to 6 items for each of these dimensions. Respondents were asked to indicate the extent to which they agreed with each statement using a 5-point Likert scale with the following response options: "strongly disagree," "disagree," "neutral," "agree," and "strongly agree." An example item was: "To what extent do you agree with the following statement: Artificial intelligence is relevant to my everyday life (e.g., personal, work)."

4.3 Statistical Testing

Statistical testing is performed initially using multiple regression analysis. Multiple regression analysis evaluates whether a dependent variable could be predicted based on independent variables (Seber & Lee, 2012). The significant difference is set at $\alpha = 0.05$. Assumptions of the regression, including linearity, normality of residuals, homoscedasticity, multicollinearity, and independence of errors, were tested to ensure the validity of the model. Regression analysis was performed using R.

The scales were created by calculating the mean of their corresponding items. A total of 5 different scales were created for this paper (see Table 2). The Learning Assistant scale represents the use of AI as a learning assistant. The other scales represent one dimension of AI literacy.

The difference between two means is calculated using an independent two-sample t-test.

5 RESULTS

5.1 Internal Consistency

The internal consistency of the scales was evaluated using Cronbach's alpha, a measure that indicates how closely related the items within an index are.

Table 2: Frequency of use index.

Scale	Items	Cronbach's Alpha
Learning Assistant	12	$\alpha = 0.87$
Affective dimension	6	$\alpha = 0.80$
Behavioral dimension	5	$\alpha = 0.73$
Cognitive Dimension	5	$\alpha = 0.77$
Ethical dimension	6	$\alpha = 0.74$

All indexes showed values above 0.7, reflecting an acceptable to a good level of internal consistency (Cronbach, 1951).

Table 3: AI as Personal Learning Assistant: *"I use gen AI…"*.

	Type of use of ChatGPT	M (SD)	Never	Rarely	Sometimes	Frequently	Usually
cogitive	- to get explanations for complex concepts that were not sufficiently covered in class	2.9 (1.4)	22 %	17 %	24 %	20 %	18 %
	- to get concise summaries of longer texts or articles	2.9 (1.3)	21 %	17 %	25 %	24 %	14 %
	- to obtain examples of how to apply theoretical knowledge in practical situations.	2.2 (1.2)	39 %	24 %	19 %	12 %	6 %
	- to get simplified explanations of difficult terms or theories.	3.0 (1.4)	22 %	14 %	23 %	21 %	20 %
metacognitive	- to create a structured learning plan.	1.5 (0.9)	71 %	17 %	6 %	5 %	1 %
	- to check my understanding of the learning material by testing myself or completing exercises	1.7 (1.1)	65 %	14 %	11 %	5 %	5 %
	- to receive feedback on my learning progress and to identify areas for improvement.	1.5 (1.0)	72 %	14 %	7 %	4 %	3 %
	- to find alternative learning methods when I have difficulty understanding the material	1.8 (1.1)	60 %	15 %	14 %	7 %	3 %

5.2 Current Frequency of Using GenAI as a Learning Assistant

Table 3 presents data on the usage frequency of GenAI as a personal learning assistant across two primary categories: cognitive and metacognitive learning strategies. In the cognitive domain, the average frequency of AI use is higher compared to metacognitive strategies. The difference is statistically significant. Overall, GenAI is used infrequently for learning, as indicated by the generally low mean scores across both cognitive and metacognitive tasks.

The standard deviation of the means is similar for all items. The distributions are shown in the table. The percentages indicate the frequency of answer choices.

The item with the highest average (mean) value is "to get simplified explanations of difficult terms or theories", with a mean of 3.0 (SD = 1.4). This indicates that GenAI supports this cognitive task the most frequently among the participants in the study.

The item with the lowest average (mean) value is "to create a structured learning plan" in the metacognitive category, with a mean of 1.5 (SD = 0.9). This suggests that using GenAI for this specific metacognitive task is the least frequent.

5.3 Gender Differences

The following figure shows the gender differences in frequency of use. For the sake of simplicity, the gender category "Diverse" was not included in the diagram.

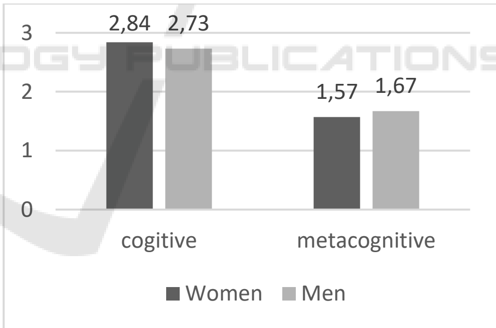

Figure 1: Gender differences.

For both cognitive and metacognitive learning strategies using GenAI, the differences in mean scores between women and men were not statistically significant. This indicates that there is insufficient statistical evidence to support the existence of systematic differences between genders on these scales.

5.4 Frequency of Use and AI Literacy

The regression analysis shows that the model provides a somewhat limited but sufficient explanation of the variance in the dependent variable, Learning Assistant. The overall model is statistically significant.

Among the predictors, behavioral dimension emerged as a significant positive predictor of GenAI usage as a learning assistant, suggesting that individuals with stronger behavioral dimension strategies are more likely to engage with the Learning Assistant. While not significant, the Affective dimension showed a trend toward a positive association. Neither the cognitive dimension nor ethical dimension were significant predictors in the model, indicating that these dimensions of AI Literacy do not substantially influence the use of the Learning Assistant in this context.

These results highlight the importance of behavioral strategies in this learning environment, while other AI Literacy dimensions seem to have less influence on the use of GenAI as a Learning Assistant.

Table 4: Regression.

	Dependent variable: Learning Assistant		
	Estimate	P-Value	
Intercept	0.0080	(0.9838)	
Affective dimension	0.1967	(0.0512)	
Behavioral dimension	0.3479	(0.0005)	***
Cognitive Dimension	0.1296	(0.1439)	
Ethical dimension	-0.0402	(0.6460)	
Residual Std. Error: 0.7904 (df = 261)			
R^2: 0.1938			
Adjusted R^2: 0.1814			
F Statistic: 15.68 (df = 4; 261)			***

6 DISCUSSION

6.1 Low Frequency of Use of AI as a Learning Assistant

The results indicate that students currently underutilize GenAI tools as comprehensive learning assistants. Their most frequent application is simplifying and clarifying course materials, particularly by providing explanations of complex concepts not adequately covered in class or summarizing lengthy texts and articles. This result is consistent with the usage frequencies collected by von Garrel et al. (2023). This suggests that AI tools are primarily embedded within cognitive learning strategies, focusing on acquiring and processing knowledge. These tasks are usually concrete and less demanding, which makes the use of GenAI more intuitive and can lead to greater acceptance among students.

In contrast, students significantly less frequently use AI tools to support metacognitive learning strategies. Activities such as creating structured learning plans, assessing one's understanding, or obtaining feedback on learning progress are rarely supported by AI tools. This limited usage suggests that students may either be unaware of the capabilities of AI tools in these areas or may be reluctant to trust AI in more personal and reflective processes.

One possible explanation for the higher prevalence of cognitive applications over metacognitive ones is that cognitive tasks are more concrete and less complex. Asking for explanations or summaries is a tangible activity that can be easily integrated into existing study routines. In contrast, metacognitive strategies, which involve planning, monitoring, and evaluating one's learning, require a higher level of self-awareness and self-regulation. It is possible that students are either unfamiliar with the relevant functions of AI tools or hesitate to use them for tasks that require more intensive personnel.

Previous studies have consistently observed that men tend to use AI tools more intensively than women, particularly in contexts where AI is employed as a writing assistant (Seufert et al., 2024; Spirgi et al., 2024). However, this gender disparity is no longer evident when AI is utilized as a learning assistant. One possible explanation for this shift could be that the functions associated with AI in educational settings, such as obtaining explanations or simplifying complex materials, may appeal equally to both genders.

6.2 AI Literacy Influences AI Learning

A particularly noteworthy finding from the regression analysis is the statistically significant impact of the behavioral dimension on the use of GenAI as a learning assistant. With a coefficient of 0.3479 and a highly significant p-value of 0.0005, this dimension shows a clear positive correlation with the frequency of GenAI usage (see table 4). This suggests that students' actual behaviors when interacting with AI, such as active usage, engagement, and interaction with AI tools, play a critical role in determining how frequently GenAI is integrated into learning processes.

There are several potential reasons for the strong influence of the behavioral dimension. First, this indicates that learners who take a proactive approach toward using AI are more likely to incorporate these technologies into their daily learning routines. The behavior of actively engaging with AI might reflect a higher degree of confidence in their ability to use AI tools effectively. Engagement with AI can also be seen as a marker of greater technological competence, which could lower the perceived barriers to the frequent use of AI tools like GenAI.

Additionally, the accessibility and user-friendly nature of GenAI tools, such as ChatGPT, may significantly reinforce this behavior. These tools are designed for ease of use, allowing learners who are willing to experiment with them to quickly recognize their benefits in various learning contexts. This ease of use influences the frequency of technology use (Davis, 1985). As learners actively engage with these technologies and experience positive outcomes—such as improved learning efficiency or enhanced understanding—this can create a positive feedback loop, motivating further usage.

Social factors also likely play a role. Observing peers' successful use of AI tools in collaborative learning environments can encourage others to follow suit. According to social learning theory, individuals are more likely to adopt behaviors that they see modeled successfully by others (Bandura, 1977), further reinforcing the behavioral dimension's influence on AI adoption.

In summary, the significant influence of the behavioral dimension on the use of GenAI as a learning assistant can be explained by several factors: the willingness to adopt new technologies, the accessibility and feedback from AI tools, and the social and institutional context. This dimension highlights that actual behavior and active engagement with AI are crucial in fully realizing the potential benefits of AI in educational settings.

7 CONCLUSIONS

7.1 Theoretical Implications

The findings of this study not only highlight the underutilization of GenAI tools as learning assistants but also contribute to the theoretical understanding of their role in educational contexts. Specifically, we have developed the concept of GenAI as a learning assistant by distinguishing its application between cognitive and metacognitive learning strategies. Cognitive strategies involve processes related to knowledge acquisition and organization, while metacognitive strategies focus on self-regulation, reflection, and strategic planning. Additionally, this study integrates Ng's AI literacy framework, linking it to the concept of GenAI as a learning assistant.

While students frequently use AI to support cognitive learning strategies—such as simplifying complex concepts or summarizing materials—there is a notable gap in the use of GenAI for more complex, metacognitive learning processes, such as self-regulation, reflection, and strategic planning. This indicates that the full range of GenAI's capabilities remains largely untapped in educational settings. A key takeaway from the regression analysis is the significant influence of the behavioral dimension on GenAI usage. The proactive use of AI, including active engagement and experimentation with AI tools, is more important than merely possessing cognitive knowledge about AI. This suggests that "doing"—actively using and experimenting with AI tools—is more critical than "knowing" in terms of effectively integrating AI into both cognitive and metacognitive learning processes.

7.2 Practical Implications

These findings emphasize the need to foster hands-on engagement with AI technologies in educational environments, as behavioral engagement is a crucial driver of AI adoption and frequent usage. There is a need to equip students with solid competencies in AI literacy, particularly in practical and behavioral aspects. As AI continues to evolve and become more integrated into various sectors, the ability to use AI tools effectively will become increasingly critical, not only for academic success but also for future career readiness (Baidoo-Anu & Owusu Ansah, 2023; Laupichler et al., 2022). To address this gap, targeted training programs should be developed to encourage students to explore the full spectrum of AI tools and their applications in learning. These programs should prioritize active engagement and provide opportunities for students to experiment with AI rather than focusing solely on theoretical knowledge. By doing so, educational institutions can empower students to leverage AI as a comprehensive learning assistant, ultimately enhancing both their learning outcomes and their preparedness for a technology-driven future. University lecturers play a key role in this process, as they can provide students with easy access to AI tools by integrating them into their courses. In this way, the behavioral dimension of AI literacy can be directly addressed in the classroom.

7.3 Further Research

While this study highlights important findings regarding the underutilization of GenAI tools and the significance of behavioral engagement, several areas for future research remain. One key focus could be exploring the specific barriers that prevent students from fully utilizing GenAI for metacognitive learning strategies, such as self-regulation and reflection. Identifying whether these barriers stem from a lack of awareness, trust issues, or insufficient AI literacy could help inform the development of targeted interventions.

7.4 Limitations

This study is subject to several limitations. First, the sample primarily consisted of first-semester students, which may limit the generalizability of the findings to more experienced students. Additionally, the study was conducted exclusively with students from the local university, further restricting its scope. Lastly, all participants were enrolled in economics-related programs, meaning the results may not be fully applicable to students from other academic disciplines.

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