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Development and Preliminary Validation of a Self-Report Scale on Generative AI Literacy in Learning Among High School Students

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ABSTRACT

The use of generative AI (GenAI) in learning creates a need for assessment instruments that are appropriate to learners' developmental characteristics, learning purposes, and educational contexts. Existing scales, however, have largely been developed for higher education or non-Vietnamese contexts, whereas high school students differ in learning autonomy, academic integrity experience, and technology-use conditions. This study develops and preliminarily validates a self-report scale assessing high school students' GenAI literacy in learning. The scale was developed from existing AI/GenAI literacy frameworks, Bloom's Revised Taxonomy, and Vietnam's digital competence framework for learners. Survey data from 1,003 students at eight high schools in Ho Chi Minh City were analyzed using Cronbach's alpha and Exploratory Factor Analysis. The findings provide initial evidence of reliability and a multidimensional structure consisting of 23 observed items across five dimensions: Knowledge & Understanding GenAI, Use & Apply GenAI, Evaluate GenAI, Create GenAI, and GenAI Ethics. The psychometric evaluation yielded a KMO value of 0.896, a significant Bartlett's test ($p < 0.05$), and a total variance explained of 59.07%, while internal consistency was confirmed with Cronbach's alpha coefficients ranging from 0.691 to 0.851 across the factors. The study proposes a contextually grounded instrument that may help schools identify students' self-perceived GenAI literacy. Beyond its methodological contributions, this scale serves as a pivotal diagnostic tool for educational stakeholders to tailor AI integration strategies and for policymakers to refine digital literacy standards within the general education sector, while emphasizing the need for further validation through confirmatory factor analysis, convergent and discriminant validity testing, and measurement invariance before broader use.

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1. Introduction

The wave of artificial intelligence (AI) technologies in general, and generative artificial intelligence (GenAI) in particular, has ushered in a new era for teaching and learning across all educational levels. Notably, within the context of K–12 education, several countries have emerged as leaders in integrating AI into formal curricula, including the United States through the AI4K12 initiative, China through AI4Future, as well as other countries such as Canada, Singapore, Germany, South Korea, and Japan [1], [2]. However, unlike many previous AI systems that primarily focused on analyzing information and producing outputs, GenAI is capable of providing personalized information and feedback while generating diverse forms of new content, including text, images, and audio [3]. Combined with its accessibility and ease of use, GenAI has demonstrated substantial potential and is increasingly becoming a powerful learning support tool, enabling learners not only to receive information but also to interact and co-construct knowledge with AI systems [4]. Furthermore, research has suggested that GenAI represents more than merely an additional educational tool; it is transforming the ways in which individuals engage in teaching and learning processes [5]. In this context, GenAI literacy is understood as the ability to interact effectively and responsibly with GenAI technologies at the fundamental, technical, and specialized levels, requiring learners to understand the core ethical and social principles of its use [3]. Therefore, in line with UNESCO's global perspective, the rapid spread of GenAI since late 2022 has created an urgent need to ensure all students possess a core set of knowledge, skills, and values, positioning GenAI literacy as a crucial foundation for responsible and innovative citizenship in the AI era [6]. In other words, empirical evidence regarding this competency is also needed to evaluate the effectiveness of GenAI integration in education promptly.

Despite this growing importance, the assessment of learners' AI competencies in general and GenAI competencies in particular remains underexplored [1]. More specifically, the emergence of GenAI necessitates dedicated measurement instruments because this competency emphasizes the effective use of content-generation tools in formal learning environments rather than merely understanding traditional analytical AI concepts [7]. Notably, GenAI literacy is strongly influenced by specific social and cultural values that shape learners' self-beliefs and perceptions of practical relevance [8]. However, existing assessment instruments are often fragmented and lack integration between psychological dimensions and educational policy frameworks [9]. Moreover, most available scales have been developed for adult learners and therefore may not align with the developmental characteristics of K–12 students [10]. This situation reflects a shortage of valid assessment instruments tailored to different educational levels, thereby hindering educational goals. Furthermore, contextual biases in existing research, particularly in Southeast Asian countries, have limited the examination of the reliability of multicultural assessment instruments [11]. Therefore, exploring and developing appropriate approaches for assessing learners' GenAI literacy, grounded in an understanding of the specific social implications within the Vietnamese context, is both urgent and necessary in contemporary education.

Within the Vietnamese context, this gap is particularly noteworthy as secondary school students are rapidly gaining access to tools such as ChatGPT, Gemini, and other AI assistants, while assessment criteria specifically designed to evaluate GenAI literacy among this age group remain limited [12]. Therefore, the present study draws upon existing theoretical frameworks and measurement instruments related to AI and GenAI competencies to develop and conduct a preliminary validation of a self-report scale measuring high school students' GenAI literacy in learning. Self-reported scales were chosen because this method is dominant in the field, and it has demonstrated empirical effectiveness in providing multidimensional data and ensuring optimal feasibility for large-scale population surveys [13]. The study was conducted in Ho Chi Minh City, where students generally have favorable access to technology, demonstrate advanced adaptability and where recent studies have documented the use of AI in educational settings [12], [14]. This study is expected to provide one of the foundational references for assessing students' GenAI literacy in learning and to serve as a reliable resource for educators seeking to apply and further develop such assessment tools in the future.

2. Theoretical Background

Originating from the broader field of AI literacy, recent studies conceptualize AI literacy as a set of competencies that enable individuals to understand and use artificial intelligence systems, apply AI knowledge across different contexts, evaluate and anticipate AI-related outcomes, design AI-based applications, and make ethical considerations in their use [15], [16]. Accordingly, an AI-literate individual is not only expected to possess foundational conceptual understanding and operational skills but also to engage in higher-order cognitive processes such as critical evaluation, prediction, and responsible design of AI systems.

Building on this foundation, recent studies have extended the concept of AI literacy to GenAI, in which GenAI literacy is understood as a continuous developmental process of competencies that enable learners to understand, use, critically evaluate, create, and interact responsibly with GenAI technologies to support learning processes and accomplish academic tasks [17]. In addition, prior research [3] further expands this construct by incorporating understanding of technological principles, critical evaluation skills, and a sense of responsibility when interacting with GenAI tools across different levels of use. Notably, this approach is closely aligned with Bloom's Revised Taxonomy, which describes a developmental progression from foundational understanding to higher-order cognitive skills, including application, analysis, evaluation, and creation in the context of GenAI use [3]. Bloom's framework has therefore been widely recognized as a systematic theoretical foundation for structuring the developmental levels of GenAI literacy [15].

Based on this theoretical foundation, the authors adapt the concept of GenAI literacy to better fit the learning context of high school students, emphasizing GenAI as a tool for learning support, knowledge acquisition, and the development of critical thinking skills. Specifically, in this study, *GenAI literacy in learning is conceptualized as a learner's multifaceted capability to comprehend, apply, critically assess, and ethically engage with generative tools to optimize their academic activities and cognitive development (adapted from [17])*. Accordingly, GenAI literacy includes the ability to understand core concepts and operational mechanisms of GenAI, as well as to use GenAI tools for learning support, information seeking, and problem-solving in various educational contexts [3]. It also encompasses the ability to critically evaluate AI-generated content and to recognize and apply ethical principles when using such technologies [17], [18]. Based on the theoretical foundations established by [15] and [16], the authors further propose mapping the components of GenAI literacy to the corresponding cognitive levels of Bloom's Revised Taxonomy.

These components were subsequently adapted and standardized in content to reflect the characteristics of GenAI systems and the learning context of Vietnamese high school students. Specifically, the components continue to fully reflect and correspond to the digital competency requirements established by the Ministry of Education and Training in the Digital Competency Framework for Learners, including Understanding AI, Ethical and Responsible Use of AI, and Evaluation of AI Tools [19]. The integration of international theoretical frameworks and domestic policy standards provides the basis for the authors to extend the framework to the context of GenAI, reflecting the new competency requirements that arise when learners interact with generative technologies. Accordingly, the study conceptualizes the meanings of the four components of GenAI literacy in learning as presented in Table 1.

Table 1. *Conceptualization of the components of GenAI literacy in learning.*

Bloom's Revised Taxonomy	Component	Content
Remember & Understand Ability to recall core concepts and explain the mechanisms of GenAI in learning contexts	**[KU]** Knowledge & Understanding GenAI	*This component refers to the ability to recognize and understand the foundational principles of GenAI technology as well as its role in learning.* Specifically, learners need to master concepts related to operational mechanisms, training data, and the content-generation capabilities of GenAI. At the same time, this competency includes a clear understanding of the functions, limitations, and impacts of GenAI on learning and society, providing a cognitive foundation for using technology responsibly and effectively in digital learning environments.
Apply Establish relationships among ideas; generalize GenAI-related issues to accomplish academic tasks	**[UA]** Use & Apply GenAI	*This component reflects the ability to effectively utilize and apply GenAI tools to support learning processes and accomplish academic tasks.* Learners can use GenAI to generate content, retrieve knowledge, and enhance learning performance in various contexts. This competency also reflects proficiency in direct interaction with the system, particularly the ability to construct appropriate prompts and confidence in utilizing the technology to achieve desired academic goals.
Evaluate & Create Justify decisions through reasoning and design; develop new and original academic products	**[EC]** Evaluate & Create GenAI	*This component reflects higher-order thinking abilities, combining analysis, judgment, and creativity in the use of GenAI for academic and technical tasks.* First, learners need to be able to evaluate the reliability and authenticity of content generated by GenAI systems through cross-checking information and identifying inaccuracies produced by generative systems. At the same time, this competency is also reflected in the ability to use GenAI as a creative support tool

		to develop ideas, solutions, or applications for solving problems in learning and everyday life. Therefore, this component reflects the combination of students' analytical, judgmental, and creative abilities when utilizing GenAI for learning tasks.
Analyse Analyze and explain behavioral decisions as well as ethical consequences in the context of GenAI applications	**[ET]** GenAI Ethics	*This component refers to the ability to recognize and practice ethical principles when using GenAI technology.* Specifically, students need to adhere to values related to privacy, data security, transparency, and respect for copyright. This competency also includes identifying risks associated with bias and misinformation in order to make responsible decisions regarding technology use, ensure the originality of learning products, and promote meaningful educational values.

3. Materials and Methods

Guided by established international frameworks for scale development in educational and psychological measurement [20] and informed by recent studies on competency scale development within the Vietnamese educational context [21], [22], the present study structured the scale development process into two main phases: (1) theoretical scale development and (2) preliminary scale validation. This design follows established guidelines for instrument development, pilot testing, and psychometric evaluation of survey-based measures, ensuring initial evidence of reliability and factor structure within the context of Vietnamese high school students. Rather than proposing a new theoretical model, the study focuses on the adaptation and operationalization of existing dimensions of GenAI literacy into measurable indicators in students' learning contexts. The preliminary validation focuses on students' self-reported (perceived) GenAI literacy, reflecting how they perceive their level of GenAI literacy in learning contexts. Before data collection, the research proposal was reviewed and approved by the Academic Council of the University of Science, Vietnam National University Ho Chi Minh City, to ensure compliance with ethical standards in educational research and the protection of participant data.

3.1. Theoretical Scale Development

A comprehensive review of the literature was conducted on the Google Scholar database to identify and synthesize existing instruments related to AI and GenAI competencies worldwide, using several key keywords such as "AI/GenAI competency scale", "AI/GenAI literacy scale", "students", and "K-12". This process identified 10 relevant studies that serve as the theoretical foundation for synthesizing competency aspects and behavioral indicators in this study. Building on this foundation, a measurement framework was developed to assess high school students' GenAI literacy in learning contexts. In addition, Vietnamese educational standards regarding understanding AI principles, ethical use of AI, and critical evaluation of AI tools [19] are consistent with international competency frameworks [9], [10], [15], particularly in relation to knowledge, application, and ethics dimensions that are appropriate for school-level learners. Accordingly, the behavioral indicators (observed variables/items) were synthesized and adapted from existing AI and GenAI literacy scales in education and contextualized to students' learning environments.

The scale items were then translated from English into Vietnamese and adapted for high school students. The translation was conducted independently by the authors, followed by a review by another author who performed back-translation and compared it with the original instruments to ensure semantic equivalence. Any discrepancies in wording or interpretation were discussed until consensus was reached. The final instrument consists of 25 observed variables, in which the KU, UA, and EC components each include 6 items, and the ET component includes 7 items. These items reflect cognitive processes aligned with Bloom's Revised Taxonomy and are operationalized through authentic learning scenarios relevant to high school students. All items were measured using a 10-point Likert scale ranging from 1 ("strongly disagree") to 10 ("strongly agree"), allowing for a more fine-grained assessment of students' perceived competencies and behaviors in relation to GenAI use in learning contexts.

In addition, a pilot study involving interviews with 10 high school students was conducted. These students were selected using a purposeful, convenience sampling method, ensuring even representation from grades 10, 11, and 12 to test linguistic and cognitive appropriateness across different age groups. The interview questions focused on examining the comprehensibility of the items, the clarity of the terminology used, and the appropriateness of the hypothetical situations embedded within each observed variable. The pilot results indicated that most students were able to understand both the content and the intended meaning of the items. Nevertheless, several revisions were made following the pilot phase, primarily involving the replacement of highly academic terminology and expressions with language more closely aligned with students' everyday learning experiences. This stage was intended as a preliminary screening of linguistic clarity and suitability for the target population; therefore, the results should not be regarded as a substitute for independent expert review or formal content validity assessment.

3.2. Preliminary Scale Validation

In this study, convenience sampling was employed to collect data from students who have used GenAI for learning purposes in Ho Chi Minh City. Specifically, the research team contacted the principals of eight high schools (including seven public schools and one private school) and provided detailed information regarding the objectives and procedures of the study to obtain permission for access to potential participants. In addition, the participating schools informed parents about the study and obtained parental consent through the schools' communication systems. Data collection was conducted using a combination of online questionnaires administered through Google Forms and paper-based surveys. The survey was designed to be anonymous and did not collect personally identifiable information such as names, email addresses, or telephone numbers. Students were fully informed of the study's purpose, participated voluntarily, and were assured that participation or non-participation would not affect their academic performance or educational rights. After collection, all data were coded and stored within the research team's secure data management system and were used exclusively for academic analysis and scientific reporting purposes.

Table 2. *Criteria for scale assessment.*

Analysis	Criterion	Indicator	Threshold	Reference
Cronbach's Alpha Analysis	Internal consistency reliability	Cronbach's alpha	≥ 0.60	[23]
	Correlation with other items within the construct	Corrected item–total correlation	≥ 0.30	[24]
Exploratory Factor Analysis (EFA)	Suitability for factor analysis	Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy	≥ 0.50 and ≤ 1.00	[23]
		Bartlett's test of sphericity (p-value)	< 0.05	[25]
	Factor retention criteria	Eigenvalue	> 1	[23]
		Scree plot	Visual inspection (elbow point)	[23]
	Convergent validity	Factor loading	≥ 0.50	[23]
	Discriminant validity	Difference between the highest factor loading and other loadings for each item	≥ 0.30	[26]
	Extracted variance	Total variance explained	≥ 50%	[27]

The results yielded a sample of 1,003 students, which adequately met the sample size requirements for exploratory factor analysis (EFA) [23]. The characteristics of the sample were as follows: regarding gender, females accounted for 59.92%, and males accounted for 40.08%; regarding grade level, Grade 10 students accounted for 18.44%, Grade 11 students accounted for 47.16%, and Grade 12 students accounted for 34.40%. The proposed scale was examined through Cronbach's Alpha analysis and exploratory factor analysis using the Principal Component Analysis extraction method combined with Varimax rotation to evaluate reliability according to the specific criteria presented in Table 2. The data analysis process was supported by IBM SPSS Statistics Version 28 software.

4. Results and Discussion

4.1. Results of preliminary scale validation

The analysis results showed that the KMO coefficient was 0.903 and Bartlett's test had $p < 0.05$, satisfying the conditions for conducting exploratory factor analysis of the scale. The results of the exploratory factor analysis identified five competency components (see Table 3). Two observed variables, *KU5 – "Recognize the advantages and disadvantages of using GenAI for learning"* and *KU6 – "Present the impacts (positive/negative) that GenAI may bring in the future"*, had very low factor loadings (both below the threshold of 0.5) and were therefore removed from the scale. After re-examining the meanings of these two observed variables, the authors found that removing them did not narrow the meaning of the Knowledge & Understanding GenAI (KU) component because their meanings were general in nature and shared similarities with the meaning of *ET3 – "Present the impacts that the use of GenAI may have on society"* in the GenAI Ethics (ET) component.

Table 3. *Exploratory factor analysis results of the scale*.*

Behavioral Indicator	Factor				
	1 (ET)	*2 (UA)*	*3 (EV)*	*4 (KU)*	*5 (CR)*
ET2	0.757				
ET3	0.744				
ET1	0.710				
ET4	0.688				
ET6	0.676				
ET5	0.622				
ET7	0.505				
KU6					
UA3		0.754			
UA2		0.745			
UA4		0.719			
UA1		0.681			
UA5		0.637			
UA6		0.521			
EC3			0.721		
EC1			0.683		
EC2			0.663		
EC4			0.612		
KU3				0.711	
KU4				0.691	
KU2				0.605	
KU1				0.572	

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KU5	
EC6	0.883
EC5	0.861

**Table 3 reports the initial EFA results based on all 25 original items. The column order in Table 3 (ET, UA, EV, KU, and CR) reflects the empirical factor-extraction order, whereas Tables 4 and 5 present the five factors in the conceptual order (KU, UA, EV, CR, and ET).*

One notable result was that the Evaluate & Create GenAI (EC) component did not remain consistent with the original theoretical structure but was separated into two distinct factors. After examining the meanings of the observed variables, these two factors were named Evaluate GenAI (EV) and Create GenAI (CR). This result suggests that, in the context of high school students, the activity of evaluating GenAI-generated content/tools and the activity of creating or designing solutions with GenAI may operate as two related but distinct aspects.

After removing the two variables KU5 and KU6, exploratory factor analysis was continued with the remaining variables. The results showed that the KMO coefficient was 0.896 and Bartlett's test had $p < 0.05$, satisfying the conditions for conducting exploratory factor analysis of the scale. The factor analysis results showed that the scale structure contained only four components instead of the original five. In particular, Use & Apply GenAI (UA) and Evaluate GenAI (EV) were merged into a new factor, while the remaining components remained unchanged (Model 1). To further examine the possibility of maintaining the original structure, the research team continued to perform exploratory factor analysis with the number of factors fixed at five. The results showed that the variables were extracted exactly as in the original model (Model 2). Regardless of which model was applied, the related indices still satisfied the necessary conditions for preliminary scale validation (see Table 4).

Table 4. *Comparison of two models for assessing GenAI literacy in learning*.*

Component	Cronbach's Alpha	Item–total Correlation Coefficient	Correlation Coefficient Total Variance Explained	Factor Loading
		Model 1		
Component 1. KU	0.691	0.409-0.541	**54.728**	0.586-0.705
Component 2. UA & EV	0.866	0.509-0.641		0.518-0.742
Component 3. CR	0.851	0.740		0.845-0.863
Component 4. ET	0.834	0.463-0.655		0.533-0.752
		Model 2		
Component 1. KU	0.691	0.409-0.541	**59.071**	0.611-0.702
Component 2. UA	0.830	0.514-0.683		0.534-0.769
Component 3. EV	0.765	0.526-0.584		0.613-0.740
Component 4. CR	0.851	0.740		0.868-0.884
Component 5. ET	0.834	0.463-0.655		0.507-0.762

**Table 4 presents the EFA results after removing KU5 and KU6; therefore, factor loadings may differ slightly from those in Table 3, which reports the initial results based on all 25 items.*

When comparing the two models after refinement, the authors propose selecting model 2 because both the total variance explained and the factor loadings were superior, even outperforming those of model 1 as well as the initial results. This choice is also consistent with current theoretical foundations, which continue to support Use & Apply GenAI (UA) and Evaluate GenAI (EV) as belonging to two separate factors because they represent different levels of thinking [19]. Specifically, the Evaluate GenAI (EV) component reflects a higher level of cognitive competency, requiring learners to be able to provide arguments to justify a viewpoint or decision regarding the use of AI-generated content [16]. Therefore, combining these two components into the same factor may reduce the discriminant validity of the scale at the conceptual level. In addition, for the Create GenAI (CR) factor, although it includes only two observed variables, it is still retained as a component scale because it is an indispensable factor within the theoretical framework of students' GenAI literacy [16]. Furthermore, the loadings of these two variables reached high values (0.868–0.884) on a large sample size (more than 1,000 students), supporting that the scale still ensures stability and reliability even in cases where a factor contains a limited number of observed variables [28].

4.2. Official scale and discussion

Based on scale model 2, the study has preliminarily proposed a scale for assessing GenAI literacy in learning among high school students, as presented in Table 5. In terms of structure, the exploratory factor analysis results showed that the scale was formed with five components, consistent with the multidimensional tendency of many AI scales, such as AISE scale [29] and the scale developed by [7]. However, one notable finding is the clear separation between the two components, Evaluate GenAI (EV) and Create GenAI (CR), implying that they operate as cognitively independent constructs in the learning context. Although this differs from the structure of the AILS scale [30], it is consistent with the MAILS scale [15], in which AI creativity is considered a distinct skill that is related to, but not an inherent component of, AI evaluation or AI use competency. Therefore, this finding contributes to clarifying the cognitive structure of GenAI literacy in the learning context of school students.

In addition, regarding the ethical aspect, while some scales, such as GAAIS [31] reflect concerns at the societal level regarding the possibility that organizations may use AI unethically, this study shifts the focus toward students' individual learning responsibility. This is reflected through indicators related to ensuring that learning products continue to demonstrate students' own originality and intellectual contribution rather than being entirely dependent on GenAI. Furthermore, the fact that the ethical component accounts for the highest explanatory weight confirms its central position in the GenAI literacy structure. This separation demonstrates that the boundary between using assistive tools and maintaining academic integrity is a core competency component, independent of typical technical operations. Regarding the target population, the scale is designed to focus on the self-assessment of high school students. This is consistent with the AI knowledge competency framework proposed by [11], which requires general education curricula to focus on developing a foundational understanding of AI, AI applications, and awareness of the ethical and social impacts of this technology. Furthermore, this scale also adopts an approach that measures belief in personal competency, consistent with the AISE scale, in which AI self-efficacy is understood as self-assessment of personal skills related to the use of AI [29]. These findings reveal a multi-layered cognitive development process in students, progressing from knowledge acquisition and application skills to higher-level thinking states under the regulation of ethics. The research results confirm the cognitive maturity of students when they are able to differentiate between technical operations and value judgments in the process of using GenAI.

However, the current study still faces several limitations. First, the data were collected using convenience sampling from several schools in Ho Chi Minh City and only included students who had used GenAI in learning; therefore, the sample does not ensure representativeness of the diversity of school types, local contexts, and characteristics of high school students in general. In addition, the scale has currently only undergone preliminary quantitative validation and has not yet achieved stability regarding the number of factors in the scale. These limitations also suggest that future studies should conduct confirmatory factor analysis (CFA) to confirm the factor structure, while also evaluating convergent validity, discriminant validity, test–retest reliability, and measurement invariance across groups in order to improve the validity and generalizability of the scale. Furthermore, this self-report scale is also subject to certain biases because it focuses only on students' self-assessments. Therefore, future studies should also develop instruments for directly assessing students' competency-related behavioral indicators as a basis for comparison and for more comprehensive and objective evaluation.

Table 5. *GenAI literacy scale in learning for high school students.*

Initial Code	Final Code	Behavioral Indicator: *English version* *[During the learning process], I can…*	Behavioral Indicator: *Vietnamese version* *[Trong quá trình học tập], Em có thể…*	Source
	Component 1. Knowledge & Understanding GenAI (KU)			
KU1	KU1	Understand important concepts related to GenAI (large language models, prompts, tokens, etc.).	Hiểu các khái niệm quan trọng liên quan đến GenAI (ngôn ngữ lớn, prompt, token…).	[15], [32]
KU2	KU2	Know how to use GenAI in learning.	Biết cách sử dụng GenAI trong học tập.	[7], [15]
KU3	KU3	Know some prominent applications of GenAI.	Biết được một số công dụng nổi bật của GenAI.	[7], [32]
KU4	KU4	Explain how GenAI generates answers or other products (images, videos, etc.).	Giải thích cách GenAI đưa ra câu trả lời hoặc sản phẩm khác (hình ảnh, video…).	[11], [32]
KU5	*	Recognize the advantages and disadvantages of using GenAI for learning.	Nhận biết được những ưu điểm và nhược điểm của việc sử dụng GenAI trong học tập.	[15]
KU6	*	Present the impacts (positive/negative) that GenAI may bring in the future.	Trình bày được những ảnh hưởng (tích cực/tiêu cực) mà GenAI mang lại trong tương lai.	[15], [32]
	Component 2. Use & Apply GenAI (UA)			
UA1	UA1	Use GenAI to support the completion of learning tasks related to text, images, presentations, etc.	Dùng GenAI để hỗ trợ giải quyết các nhiệm vụ học tập liên quan đến văn bản, hình ảnh hoặc bài thuyết trình…	[7]
UA2	UA2	Use GenAI to search for additional information beyond textbooks quickly and effectively.	Dùng GenAI để tìm kiếm thêm thông tin ngoài sách giáo khoa một cách nhanh chóng và hiệu quả.	[7], [10]
UA3	UA3	Use GenAI to find ideas that help me complete learning tasks.	Dùng GenAI để tìm ý tưởng giúp em hoàn thành các nhiệm vụ học tập.	[10], [15]
UA4	UA4	Use GenAI to learn knowledge that I did not know before.	Dùng GenAI để tìm hiểu những kiến thức mà em chưa biết trước đây.	[10]
UA5	UA5	Use GenAI to provide comments and suggestions that help improve my ideas.	Dùng GenAI để đưa ra những nhận xét, gợi ý giúp cải thiện ý tưởng của em.	[10]
UA6	UA6	Use GenAI to generate content that matches the requirements I provide.	Dùng GenAI để tạo ra những nội dung đúng với yêu cầu em đưa ra.	[7], [29], [30]
	Component 3. Evaluate GenAI (EV)			
EC1	EV1	Evaluate whether the learning resources suggested by GenAI (such as websites, videos, images, etc.) are suitable for my learning objectives.	Đánh giá xem các tài nguyên học tập mà GenAI gợi ý (như trang web, video, hình ảnh,…) có phù hợp với mục tiêu học tập của em hay không.	[10]
EC2	EV2	Evaluate different GenAI applications to select the most appropriate one for each learning task.	Đánh giá các ứng dụng GenAI khác nhau để chọn ra ứng dụng phù hợp nhất cho từng nhiệm vụ học tập.	[11], [30]
EC3	EV3	Evaluate whether one of my learning tasks is suitable to be solved using GenAI.	Đánh giá xem một nhiệm vụ học tập của em có phù hợp để giải quyết bằng GenAI hay không.	[11], [32]

EC4	EV4	Evaluate and select the necessary data to train GenAI applications for solving the problem that I want to address.	Đánh giá và lựa chọn được những dữ liệu cần thiết để huấn luyện các ứng dụng GenAI nhằm giải quyết vấn đề mà em mong muốn.	[9], [33]
	Component 4. Create GenAI (CR)			
EC5	CR1	Design new GenAI applications.	Thiết kế ra các ứng dụng GenAI mới.	[10], [11], [15]
EC6	CR2	Select appropriate tools and programming languages (Python, C++, etc.) to program a new GenAI application.	Chọn các công cụ và ngôn ngữ lập trình phù hợp (Python, C++,…) để lập trình một ứng dụng GenAI mới.	[11], [15]
	Component 5. GenAI Ethics (ET)			
ET1	ET1	Consider and evaluate ethical principles before deciding whether to use data provided by GenAI.	Xem xét, đánh giá về các nguyên tắc đạo đức trước khi quyết định có nên sử dụng dữ liệu do GenAI cung cấp hay không.	[11], [15], [30]
ET2	ET2	Understand important ethical principles when using GenAI (respecting privacy, maintaining academic honesty, etc.).	Hiểu các nguyên tắc đạo đức quan trọng khi sử dụng GenAI (tôn trọng quyền riêng tư, trung thực trong học tập,…).	[9], [11]
ET3	ET3	Present the impacts (positive/negative) that the use of GenAI may have on society.	Trình bày những ảnh hưởng (tích cực/tiêu cực) mà việc sử dụng GenAI có thể gây ra cho xã hội.	[15], [32]
ET4	ET4	Ensure that my learning products maintain my own originality rather than being entirely dependent on GenAI.	Đảm bảo rằng các sản phẩm học tập của em vẫn đảm bảo tính độc đáo của cá nhân em chứ không hoàn toàn phụ thuộc vào GenAI.	[10]
ET5	ET5	Protect personal information or sensitive content when using GenAI.	Bảo vệ thông tin cá nhân hoặc nội dung nhạy cảm khi dùng GenAI.	[9], [10], [32]
ET6	ET6	Know how to use GenAI safely and responsibly in learning.	Biết cách sử dụng GenAI một cách an toàn và có trách nhiệm trong học tập.	[9]
ET7	ET7	Recognize that GenAI tools may sometimes generate inaccurate or biased results.	Nhận ra rằng các công cụ GenAI đôi khi có thể tạo ra kết quả chưa chính xác hoặc có sự thiên vị.	[10]

**The item was removed following EFA results.*

5. Conclusions

The study developed and conducted a preliminary validation of a self-report scale on GenAI literacy in learning among high school students. Based on data from 1,003 students in Ho Chi Minh City, the results of the Cronbach's alpha analysis and EFA provided initial evidence for a scale structure consisting of 23 observed variables belonging to five components: Knowledge & Understanding GenAI; Use & Apply GenAI; Evaluate GenAI; Create GenAI; and GenAI Ethics. The results also suggest a distinction between evaluation competency and creation competency in the context of students using GenAI for learning. The main contribution of the study lies in proposing a reference instrument that is suitable for the Vietnamese general education context and can support schools and researchers in identifying students' self-assessed levels of GenAI literacy. However, the scale is currently only at the preliminary validation stage, and there is not yet sufficient basis to confirm it as a fully standardized instrument. Future studies should expand the sample beyond Ho Chi Minh City, including students who have not used GenAI, while also conducting CFA and examining convergent validity, discriminant validity, test–retest reliability, and measurement invariance across groups. In addition, further instruments should be developed to directly assess behavioral indicators in order to compare them with self-report results, thereby providing a more comprehensive picture of GenAI literacy among high school students.

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Conflict of Interest

The authors declare no conflict of interest.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors used ChatGPT for English language editing and translation. We have reviewed the output and take full responsibility for the final content.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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