Digital Mentor by Generative AI to Support Creative Thinking in Character Design for Students

Vipusit Piankarnka [1] and Pinyaphat Tasatanattakool [2,*]

[1] Faculty of Mass Communication Technology, Rajamangala University of Technology Thanyaburi (RMUTT), Pathum Thani, Thailand
[2] Faculty of Science, Rajamangala University of Technology Suvarnabhumi, Ayutthaya, Thailand
Email: vipusit_p@rmutt.ac.th (V.P.); pinyaphat.t@rmutsb.ac.th (P.T.)
*Corresponding author

Manuscript received December 17, 2025; revised January 13, 2026; accepted February 18, 2026; published July 17, 2026

***Abstract*—This research aims to study the characteristics of, and to develop, a digital mentor prototype using generative AI to support the character design process for game design students. Functional requirements were analyzed, followed by the development of the prototype, and finally, the evaluation of the digital mentor's usage. This research is divided into 3 phases: 1) synthesizing the characteristics of a digital mentor, 2) prototyping a digital mentor using generative general Artificial Intelligence (AI), and 3) conducting a quasi-experimental study with a sample of 120 students enrolled in a game design course. The results were measured by assessing the students' creativity and comparing the differences between two groups using the independent t-test. The study found that the characteristics of a digital mentor should include 3 aspects: creativity and process acceleration, providing guidance and reinforcing learning, and interaction and credibility. Expert evaluation found the quality to be very high (mean = 4.19 ± 0.28). The highest score was for creativity and for accelerating the process (mean = 4.37 ± 0.20). Nine experts evaluated the prototype and found that it was of very high quality (total mean = 4.79 ± 0.28). Additionally, the experimental results indicated that the group of students using the digital mentor had significantly higher creativity assessment scores in terms of character design than did the control group ($p < 0.001$), especially in terms of presentation and appearance (mean = 4.42). The research results concluded that the digital mentor powered by generative AI is highly effective and efficient when it comes to enhancing the creativity and quality of character design work done by students in game design courses.**

***Keywords*—character design, digital mentor, game design, Generative Artificial Intelligence (AI), intelligence platform**

I. Introduction

Digital technology plays a crucial role in transforming the educational landscape, particularly in fields related to creativity and design, such as game design. Game design is a field that requires both technical skills and the ability to continuously generate new ideas. Character design is considered the heart of the game development process [1]. Since characters not only serve as a core element of the game but also drive the narrative and player experience, students new to game design often face several challenges when it comes to transforming abstract concepts into fully realized characters that are clear and consistent with the game's context [2]. The main problem encountered is the lack of personalized tools and guidance that can provide immediate feedback and help stimulate creative thinking at every stage of the design process [3]. Traditional teaching methods that rely on a single instructor to advise a large number of students may not be sufficient to provide thorough and timely individualized attention, resulting in a wide range of quality in the work produced. Therefore, given the rapid advancements in technology, it is imperative to apply modern technology as a learning support tool that can adapt and respond to the individual needs of each student [4]. Generative Artificial Intelligence (AI), which can create new content such as images, text, or ideas, opens new opportunities for developing powerful learning support tools. This technology can serve as a digital mentor or creative assistant, capable of synthesizing vast amounts of data to generate new options and suggest diverse design approaches to students [5]. Nawaz prioritized the use of technology to assist special-needs education, while Zhu et al. conducted a comprehensive investigation into the influence of generative AI on student learning achievements [4, 5].

The information above shows that there is no research on digital mentors in the field of character design education. This research therefore focuses on designing and developing a digital mentor using generative AI to serve as a creative assistant and provide guidance in the character design process for students enrolled in game design courses [6]. The development of an intelligent platform integrates AI's ability to analyze students' concepts and provide in-depth feedback on artistic and narrative coherence [7–10].

The primary objectives of this research study's in-game application are to (1) investigate the characteristics and functional requirements of a digital mentor utilizing generative AI as a creative assistant for character design in the context of game design students, (2) develop a digital mentor prototype with the support of generative AI for the character design process for students in design courses, and (3) analyze the results of using a digital mentor with the support of generative AI to promote creative thinking and provide design guidance for game design students compared to traditional teaching methods. The research questions of this study are:

- What are the characteristics of a digital mentor which can assist in the creative process and provide guidance for game design students through an intelligent platform?
- What does a digital mentor prototype using Generative AI look like, designed to assist in the creative process and provide guidance for game design students through an intelligent platform?
- How does using a digital mentor with Generative AI to assist in the creative process and provide guidance in the character design process for students in game design courses through an intelligent platform work?

Hypothesis:

H_1: Students who use a digital mentor score significantly

higher in creativity than those who learn through traditional teaching methods.

II. Literature Review

The literature review for this research focuses on exploring and synthesizing existing knowledge related to three main issues: generative AI technologies, the context of application, character and game design, and educational methods, digital mentoring, and their impact on learning. The following is the structure and main topics used for the research's literature review.

A. Game Character Design

In the entertainment media development industry, game design and character design are crucial elements that need to be closely integrated [11, 12]. Game design goes beyond just being fun and creating challenges based on rules; it also encompasses delivering an impressive User Experience (UX), fostering innovation, and ensuring the overall appeal of the product. Character design is more than just artistic visuals; it's a cornerstone in building emotional connections and engagement between players and the virtual world. Successful characters must have a clear, unique identity [13]. By providing striking physical characteristics, compelling backstories, and complex emotional dimensions, these elements collectively bring vibrancy and realism to the game's universe. They also serve as powerful tools for effectively and deeply communicating the game's core ideas, values, or themes. In a broader context, both game design and character development must consider constantly changing external factors, including the specific target audience they aim to reach, and the diverse cultures of players worldwide [14]. In addition, with the changing trends of the current era, considering these factors ensures that the games and characters created will truly be accessible, impressive and widely popular. High-quality design must not only meet current needs [15] but must also be sufficiently creative and innovative to set the direction or influence the future trends of the entire gaming industry. The fusion of intriguing game mechanics with characters who have strong stories and personalities is therefore a key to success and sustainability in the world of gaming [16].

B. Generative AI

The development of a technology-driven digital mentor, powered by generative AI, will aim to have the primary objective of revolutionizing the process of designing game characters for students. The project aims to enable them to create works that deeply and rationally integrate the completeness of artistic dimensions and gameplay functionality. In this context, generative AI is not used to replace human creativity but is assigned the role of an intelligent creative assistant, serving as a catalyst and systematic advisor throughout the design process [17]. The first significant role is accelerating the process of generating and exploring AI concepts. AI can quickly transform complex text prompts which combine game mechanics and artistic ideas, into various visual prototypes. This will allow students to explore dozens of design possibilities in a short amount of time [18]. AI will act as a crucial bridge between character and game design, analyzing the artistic elements chosen by students, such as the overall silhouette, color palette, or clothing characteristics, to assess their consistency with the character's role and mechanics in the game. If the AI detects conflicts such as a character designed for stealth but with a bright appearance or elements that could cause noise, it will provide specific recommendations for immediate functional improvements. Additionally, it will help ensure that the character's appearance can quickly communicate its main role to other players. This is a critical factor in multiplayer games. This process effectively promotes practical learning and iterative experimentation. The AI's ability to quickly generate results and evaluate them allows students to revise and develop their ideas multiple times within a limited time span, simulating the real-world work environment in the highly agile gaming industry [19]. Therefore, using generative AI will empower new designers, enabling them to make strategic decisions and solve complex design problems with precision, rather than spending time on repetitive artwork. Ultimately, this digital mentoring tool will lead to the creation of well-rounded game characters [20]. Every detail of the exterior appearance is logically linked to, and supports, practical use according to the rules of the game, making the student's design work truly an integral part of the game system, not just beautiful art separate from the context of play [21].

C. Digital Mentor

Digital mentors and smart platforms have become central to educational reform in the 21st century, particularly in fields such as game design that require creative skills and high-tech application [22]. The role of these technologies is to shift from traditional, one-way knowledge transfer-focused learning to personalized, hands-on learning environments. Digital mentors, often powered by AI and generative AI, are not just tools, but highly specialized personal assistants [22]. These mentors can provide nuanced and timely guidance throughout the creative process, from brainstorming and initial concept generation to final portfolio evaluation. In the context of game character design, digital mentors will bridge artistic knowledge with gameplay functionality requirements. For example, if a student is designing a character for stealth mechanics, the mentor will be able to analyze the sketches created and provide logical feedback. This integrated mentorship will help students see the big picture of the entire game design, not just the creation of beautiful artwork. Meanwhile, the smart platform serves as the infrastructure supporting the functionality of the digital mentors [23]. These platforms continuously collect and analyze student learning behavior data to understand individual strengths, weaknesses, and learning patterns. With this information, the platforms can precisely tailor course content, learning sequence, and the complexity of design assignments to match each student's progress [24]. Additionally, the smart platform facilitates rapid experimentation and iteration, particularly in design fields that require constant prototyping. Students can test multiple concepts within a limited time span, simulating a real-world industry work environment [25]. The integration of digital mentors providing personalized guidance with smart platforms focused on data management and learning process improvement, will significantly empower learners. They not

only acquire necessary skills but also develop strategic thinking, engage in complex problem-solving, and collaborate with new technologies, all of which are crucial for becoming professional game developers in the future [26].

D. Intelligence Platform for Education

Smart learning platforms are advanced digital systems designed to revolutionize education by integrating various cutting-edge technologies, particularly AI, machine learning, and learning analytics. The combination gives these platforms capabilities superior to traditional Learning Management Systems (LMS) [27] making them able to precisely and deeply adapt to the individual needs of each learner [28]. The main part of the system involves constantly gathering and examining data about how users learn, such as how long they study, the types of questions they get wrong, and how they engage with activities on the platform [29]. In addition to assessing the level of interest and feelings of the learners, this insightful information is used to create a personalized learning path that is best suited for each student [30]. This content adjustment ensures that learning challenges are at an appropriate and optimal level, meaning that they are challenging enough to engage learners without discouraging or demotivating them. The result is a significant increase in student motivation and academic achievement [31]. In addition to its role in student development, the intelligent platform also serves as a crucial assistant in reducing the workload of teachers [32]. This is achieved by automating time-consuming tasks such as checking exercises, providing detailed assessments, and identifying individual student strengths and weaknesses [33]. This is achieved by automating time-consuming tasks such as checking exercises, providing detailed assessments, and identifying individual student strengths and weaknesses [30]. To create an exciting and immersive learning environment, digital education is highly flexible, easily accessible from anywhere, and comprehensively meets society's need for lifelong learning [34, 35]. These platforms are therefore considered indispensable tools for driving and raising the quality of education to keep pace with the ever-changing modern world [36, 37].

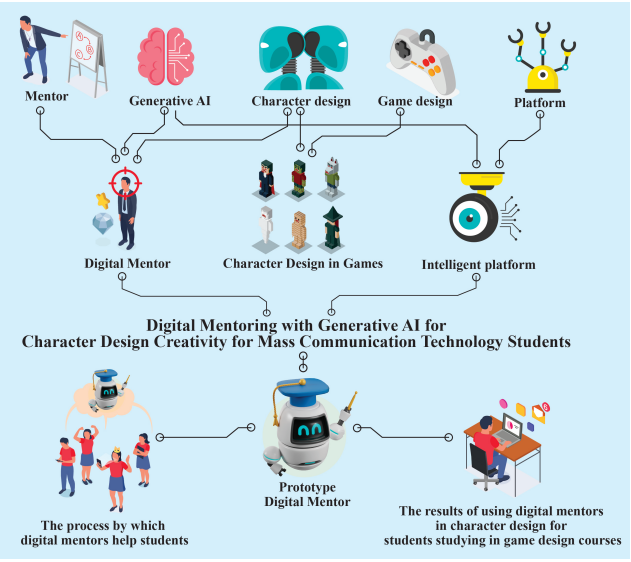


Fig. 1. A research framework for digital mentor by generative AI to Support creative thinking in character design for students.

A research framework is established for a generative AI digital mentor to support creative character design among students, as shown in Fig. 1.

III. Materials and Methods

This research is divided into three phases as follows:

Phase 1: Synthesis of digital mentor characteristics as a creative assistant and guide in the character design process for game design students via smart platforms, by searching for information from the Scopus database. This involved extracting data to create a synthesis table and to categorize information related to the roles, functions, and characteristics of generative AI used as a creative assistant in the character design process for game design students via smart platforms. The outcome was evaluated by 9 experts in generative AI, communication, and character design. A digital mentor feature model was then developed to serve as a creative assistant and to provide guidance in the character design process for students through a smart platform. Based on the research's conceptual framework, a set of essential features and functions of the digital mentor was identified, grounded in academic knowledge.

Phase 2: Prototyping a digital mentor with generative ai to serve as a creative assistant and guide in the character design process for game design students on a smart platform, by synthesizing elements and processes, retrieving information from the SCOPUS Database, and extracting and using the obtained data to create a synthesis table of elements and processes. Additionally, the process of using generative AI to create a digital mentor was evaluated by the 9 experts in generative AI, communication, and character design in terms of its function as a creative assistant and its ability to provide guidance in the character design process. Subsequently, a structural model was created to illustrate the process of prototyping digital mentors using generative AI and this was evaluated by the 9 experts. Thereafter, a digital mentor prototype was created using the Adobe Firefly application, employing the text-to-image generation method. The resulting output was a JPG image file. Data used for providing guidance in the character design process for students in game design courses was generated using applications such as ChatGPT and Gemini. This communication data was then used to create audio clips using the Botnoi application, employing the text-to-speech generation method. The result was an MP4 audio file. The JPG image file and the MP4 audio file were used to create animation using the D-ID application. The ZWIZ.AI chatbot application was used, resulting in a digital mentor prototype that has been validated by experts and is ready for actual use on the platform (ZWIZ.AI).

Phase 3: This research was a quasi-experimental study conducted on a sample of 120 students enrolled in game design courses at the Faculty of Mass Communication Technology, Rajamangala University of Technology Thanyaburi. The researcher used a purposive sampling method, where students enrolled in section 1 were selected for the intervention group and students enrolled in section 2 were selected for the control group, with their consent obtained before participating in the research. The students were divided into two groups: Group 1 consisting of 60 students used digital mentoring with generative AI as a

creative assistant which provided guidance in the character design process utilizing a smart platform. Group 2 with a total of 60 students used traditional teaching methods in the game design course. Their performance was measured by assessing the students' creativity in character design using the "Creativity Assessment Form for Character Design in Game Design," which was evaluated by the instructor. The differences between the two groups were compared using the independent t-test. This study analyzed the data using STATA ver. 18.

IV. Results

In terms of the characteristics of a digital mentor as a creative assistant and guide in the character design process for game design students via a smart platform based on the data synthesis mentioned above were as shown in Table 1.

Table 1. Synthesizing the characteristics of a digital mentor

In terms of synthesizing the characteristics of a digital mentor the table summarizes the characteristics of the proposed digital mentor		[38–40]	[41, 42]	[43, 44]	[45, 46]	[47, 48]	[49–51]	[52, 53]	[53–55]	Researcher
1. In terms of creativity and accelerating the process.	Quick start idea generation	√	√		√	√	√		√	√
	Exploring a variety of styles	√		√	√		√		√	√
	Expanding the concept	√			√	√		√		√
2. In terms of providing guidance and enhancing learning.	Providing constructive feedback.	√	√		√	√	√		√	√
	Skill Guidance	√		√	√		√	√	√	√
	Presentation of theoretical knowledge	√	√		√	√	√		√	√
3. In terms of interaction and trust.	Flexibility to repeat	√		√	√		√	√	√	√
	Source identification and ethics	√	√		√	√		√		√
	personalization	√		√		√	√		√	√

Table 1 presents the results of synthesizing the characteristics of digital mentors for character design in game design courses through smart platforms. From these we can conclude that the necessary characteristics consist of 3 main aspects that must work together in balance: creativity and accelerating the process, which is the core of creating results and speeding up prototyping; providing guidance; and enhancing learning. This elevates the system to a true mentor and develops students' academic skills, as well as their interaction and credibility, all of which are factors that drive continuous system acceptance and use. The combination of these three aspects will help fully promote the character design process and student learning outcomes.

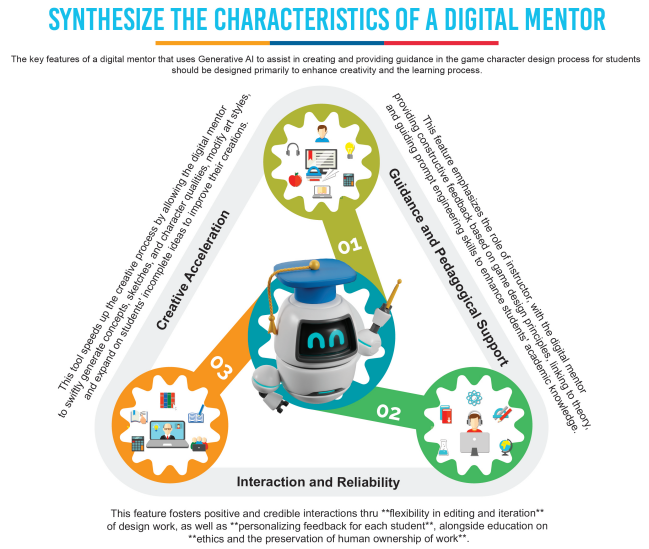


Fig. 2. A digital mentor character model to serve as a creative assistant and provide guidance in the character design process for game design students with the use of a smart platform.

According to Table 2, the results of the evaluation of the characteristics of digital mentors as creative assistants and advisors for character design showed that the overall characteristics were deemed to be at a very high level, with an overall mean of 4.19 (standard deviation ±0.28). When considering each aspect individually, the highest evaluation was with regard to creativity and process acceleration, with a mean of 4.37 (±0.20), followed by guidance and learning reinforcement, with a mean of 4.33 (±0.29). These two aspects demonstrate that the experts valued the system's role in generating results and supporting learning highly. In terms of interaction and reliability characteristics, these were also highly rated, but with the lowest average of 3.85 (±0.34). This may indicate areas that need attention in further developing the system's interactivity and trustworthiness.

Table 2. Expert assessment of digital mentor characteristics for game design students

Evaluation	Mean ± S.D.
1. In terms of creativity and accelerating the process.	4.37 ± 0.20
2. In terms of providing guidance and enhancing learning.	4.33 ± 0.29
3. In terms of interaction and trust.	3.85 ± 0.34
Total	4.19 ± 0.28

In this research we are prototyping a digital mentor with generative AI to serve as a creative assistant and guide in the character design process for game design students on a smart platform. In prototyping the digital mentor, generative AI technology is applied. This process started with the synthesis of relevant components and processes through searching and extracting data from the SCOPUS database to create a synthesis table, followed by an evaluation of the process of using generative AI technology to create the digital mentor, and finally, the development of a structural model to illustrate the process of prototyping the digital mentor with generative AI systematically. These processes are as shown in Table 3 and Table 4.

The results with regard to synthesizing the elements of a digital mentor for game character design reveal 3 main components: a knowledge base (comprising theories,

personalities, motivations, and game knowledge), interactive creative tools (including sketching/modeling tools, an automated feedback system, and a diversity creation tool), and a user-friendly interface (emphasizing clear navigation and learning outcome display). All these components work together to provide a comprehensive learning experience and assist students in designing characters effectively, as shown in Table 3.

Table 3. Synthesis of digital mentor components with generative ai as a creative assistant and advisor in the character design process for game design students via a smart platform

The main components of a digital mentor to serve as a creative assistant and provide guidance in the character design process for game design students via a smart platform		[38–40]	[41, 42]	[43, 44]	[45, 46]	[47, 48]	[49–51]	[52, 53]	[53–55]	Researcher
1. Character Design Knowledge Base	Basic theory	√	√	√		√	√		√	√
	Personality elements	√		√	√		√	√	√	√
	Reference and inspiration	√	√	√		√	√		√	√
	Game knowledge	√	√		√	√	√		√	√
2. Interactive creative tools	Drafting and modeling tools	√	√	√		√	√	√		√
	Automatic feedback system		√		√	√		√	√	√
	Diversification tools	√	√		√	√	√			√
3. User-friendly interface	Clear navigation	√	√	√		√	√		√	√
	Displaying learning results	√		√	√		√	√	√	√

A digital mentor that uses generative AI to help game design students through the use of a smart platform can be broken down into three main parts that work together to encourage creativity and give good advice. The first part is the knowledge base for character design. This is a complete academic library that has both basic theories (in terms of shapes, colors, proportions) and more detailed personality traits (in terms of background information, motivations), as well as reference libraries and game knowledge. The second part consists of interactive creative tools. The practical part includes sketching/modeling tools, an automated feedback system for initial evaluation (for example, checking shadow clarity and color consistency), and a diversity tool to encourage people to contemplate a range of ideas. The last part is the easy-to-use interface, which connects students and AI and makes it easy for the students to locate their way around and see how they're doing. As shown in Fig. 2, the digital mentor can be a full creative assistant because it combines knowledge, prototyping, and practical advice.

Table 4. Digital mentoring process using Generative AI to assist in the creative design and provide guidance for game design students through a smart platform

Synthesizes the digital mentoring process using Generative AI to assist in the creative design and provide guidance for game design students through a smart platform		[38–40]	[41, 42]	[43, 44]	[45, 46]	[47, 48]	[49–51]	[52, 53]	[53–55]	Researcher
1. Conceptualization and Structuring	Question setting	√		√	√	√	√		√	√
	Finding inspiration	√	√		√	√		√		√
	Structural advice	√	√	√	√		√	√	√	√
2. Creating and analyzing sketches.	Automatic sketch analysis	√	√	√		√	√		√	√
	Clarity of shadows		√		√		√	√		√
	Using proportions	√		√		√	√		√	√
	Color and material recommendations	√	√		√	√	√	√	√	√
3. Summarizing results and preparing documentation.	Final quality inspection	√	√	√		√	√		√	√
	Document creation		√		√	√	√		√	√
4. Providing in-depth, iterative feedback.	Conformity check	√	√	√		√	√	√		√
	Encouragement to improve	√	√		√	√		√	√	√
	Context simulation	√	√	√		√	√	√	√	√

The results of synthesizing the digital mentor design process for character design in game design courses show that there are 4 main interconnected steps, starting with 1) concept and structure definition to set the framework and direction of the work. This is followed by 2) sketch creation and analysis. This is the core where the mentor analyzes and provides technical guidance, such as with regard to proportions and color. The next is 3), summarizing and documenting, to verify the final quality and automatically generate design documentation. Finally, there is 4) involving iterative in-depth feedback that encourages students to continuously improve their design work by simulating real-world usage contexts. The most important step is 2) creating and analyzing sketches—as this is when the system uses Generative AI to analyze the artwork and provides direct technical recommendations. This drives the quality of the creative output, making the character design process complete and efficient. Therefore, a structural model was created to illustrate the process of building a digital mentor prototype using Generative AI to assist and advise game design students in terms of character design through the use of a smart platform, as shown in Fig. 3.

This article provides a description of the digital mentor prototyping process, which uses generative AI as a creative assistant and guide in the character design process for game design students on an intelligent platform.

Input: The input data consisted primarily of student input in two forms: conceptual data and visual data. Initially, students inputed personality, role, and game theme information to guide the AI in determining the artwork's

direction. As the sketching stage began, the input data became more specific in terms of commands, such as selecting the shape language and shape prompts for creating the sketch. During the refinement stage, the input data included completed drawings or textual editing commands such as "make the clothes look more torn" for the AI to analyze and modify according to the instructions.

Process: The researcher chose to use the process of creating a digital mentor prototype with generative AI to serve as a creative assistant and provide guidance in the character design process for students in the game design course through a smart platform. The main process of developing the digital mentor involved the collaboration of multiple AI technologies to systematically create and analyze character design work. The first part was generative processing, which was performed by GDE (Generative Digital Environment) to directly generate new content, such as creating mood boards, reference images, and 5–10 character silhouette sketches, based on the design principles entered in the knowledge base. The second part was refinement processing. This is the process of adding detail and providing specialized advice. This module uses the AI Color Palette Generator to suggest color palettes suitable for personality and generative details to quickly create reference images of the parts the student wants. The final part is Vision AI Analysis. This plays a role in the review and iteration stage. This phase involves analyzing the drawings submitted by students to evaluate the correctness of technical elements such as proportions, arrangement, and focus clarity. These diverse processes will ensure that students receive comprehensive support from concept creation to technical improvement.

Output: The results obtained from the digital mentor are divided into two main categories to support a continuous and high-quality design cycle. Output during the process includes the results that students use to develop and iterate on their designs in a timely manner. The first category consists of character silhouette sketches with strengths and weaknesses analyses, recommended color palettes with ready-to-use color codes, and a critique report with a visual guide. This is an edited example image used to concretely guide improvements. These results help students overcome mental blocks and develop self-critical skills simultaneously. The final output is a complete and industry-standard product. The system uses an Automated Document Generator to collect all design information generated throughout the process, including selected silhouettes, proportions, color codes, personality, and reference images, to create a complete Character Sheet that is automatically delivered to the game development student. The result is considered the final, high-quality, and standardized product.

Feedback: Feedback is a core function in the digital mentoring system that drives learning and improves students' work. It is divided into three parts for comprehensive coverage. The first is offering a critical critique. This is performed by the NLP mentor, which provides detailed, text-based constructive criticism. For example, criticism regarding the use of unbalanced proportions or a lack of character agility. This criticism is based on design principles found in the Expert Knowledge Base. The second is visual guidance. This utilizes GDE to generate example images modified from the student's editing commands. This helps students visualize concrete editing guidelines before drawing. The final part is Automated Evaluation, performed by the Feedback Module. This is used to analyze the differences and clarity of communication in each AI-generated shadow option. This helps students make informed decisions when choosing their initial concept. This diverse feedback allows students to immediately improve their work and align it with correct design principles.

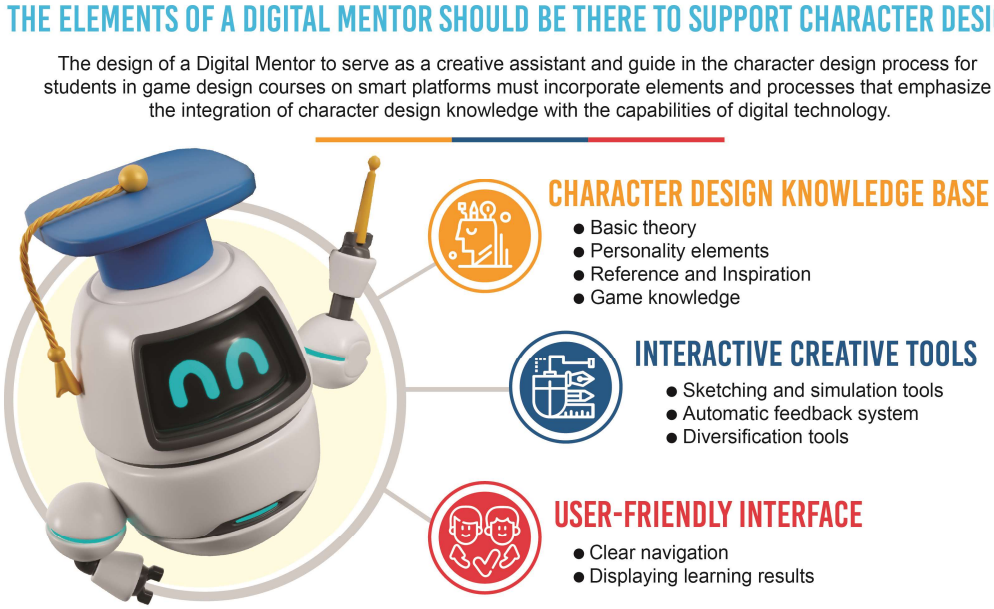


Fig. 3. The main components of a digital mentor: to serve as a creative assistant and provide guidance in the character design process for game design students through a smart platform.

The digital mentor process using generative AI to assist in the creative design and provide guidance for game design students through a smart platform, as shown in Fig. 4.

In terms of the result of creating a digital mentor prototype using Generative AI to assist in the creative process and provide guidance in the character design process for students in game design courses via a smart platform, the process is as follows.

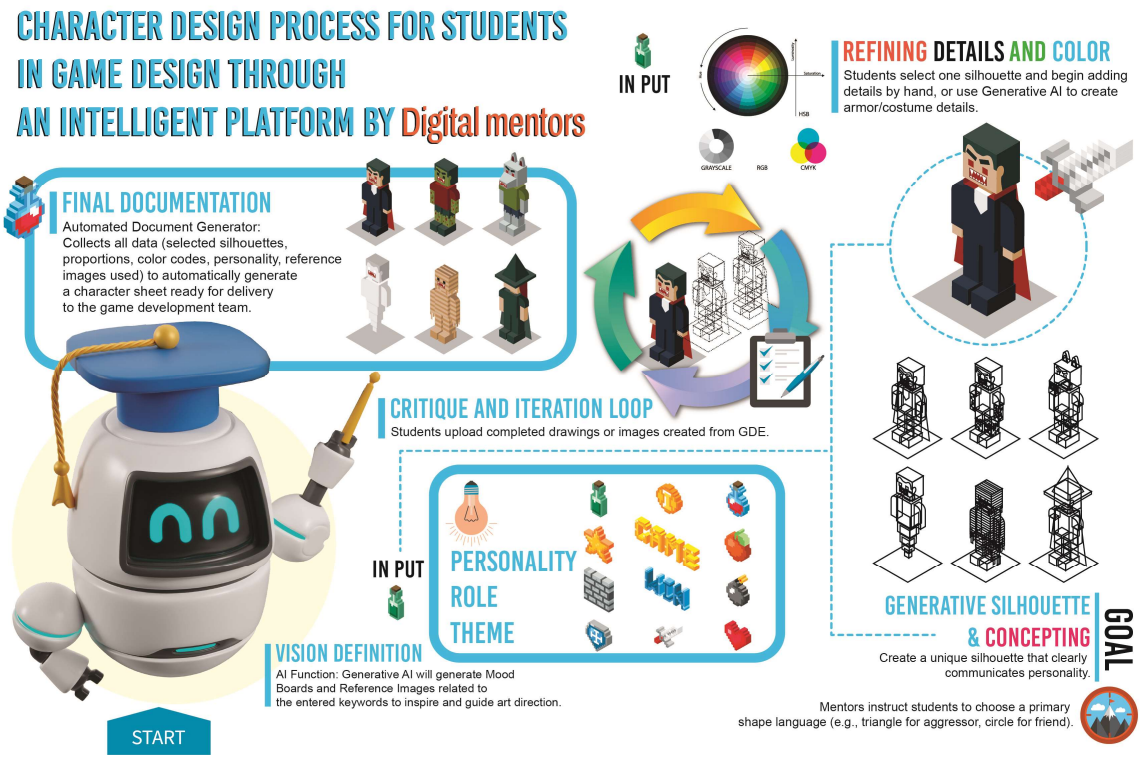


Fig. 4. The digital mentor process using generative AI to assist in the creative design and provide guidance for game design students through a smart platform.

The development of the digital mentor prototype in this second phase began with the creation of a digital mentor character using Adobe Firefly, employing the text-to-image generation method to prototype the digital mentor in JPG file format, as shown in Fig. 5 and Fig. 6. The digital mentor exhibits artistic diversity and aligns with the desired mentor characteristics. In terms of content and advice, large language models such as ChatGPT and Gemini were used to generate datasets for communication and provide in-depth guidance during the character design process. This guidance was designed to cover the dimensions of concept creation, prototyping, and critical analysis. With regard to audio and interaction, the communication data was used to create audio clips using the BOTNOI application with the text-to-speech generation method, resulting in MP4 audio files as shown in Fig. 7. Subsequently, the JPG image files and MP4 audio files were animated to create a digital avatar that embodies the personality of a mentor through the D-ID application, as shown in Fig. 8. The integration of all these elements was published and operated through a smart platform using the ZWIZ.AI Chatbot Application as shown in Fig. 9. This serves as the primary channel for students to access and interact with the digital mentor in real-time. This resulted in a digital mentor prototype that can function as a creative assistant and provide practical guidance for the character design process for students in game design courses, making it complete and ready for real-world testing.

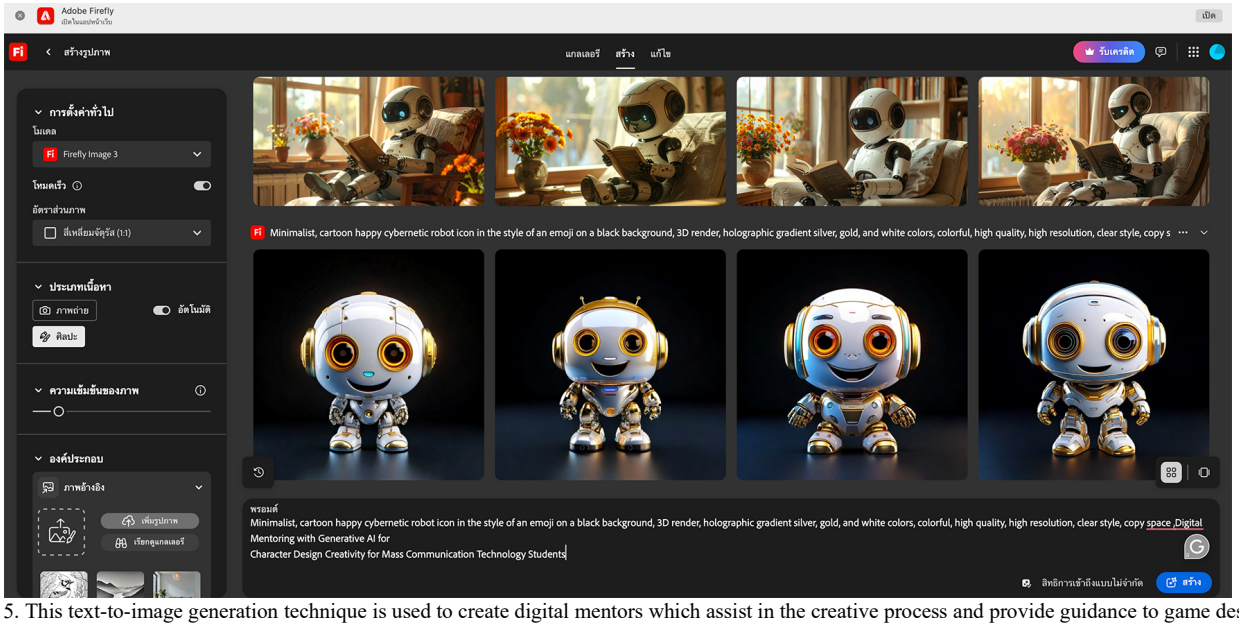


Fig. 5. This text-to-image generation technique is used to create digital mentors which assist in the creative process and provide guidance to game design students through the Adobe Firefly smart platform.



Fig. 6. Use of Adobe Firefly to create a digital mentor prototype using the text-to-image generation method.

The evaluation results show the creation of a digital mentor prototype using generative AI to assist in the creative process and to provide guidance in the character design process for students in game design courses via a smart platform.

The evaluation of the digital mentor prototyping system was conducted by 9 experts. The outcome showed a very high rating, with an overall mean of 4.79 ± 0.28. This demonstrates the acceptance and success of the prototype. Considering each aspect, it was found that the students' results and skills received the highest mean score of 4.84 ± 0.30, particularly in the development of design skills and work efficiency, which had mean scores of 4.89 and 4.83, respectively. The next highest mean score was for user attitudes and satisfaction (4.81 ± 0.27), reflecting overall satisfaction. Meanwhile, the quality and efficiency of the digital mentor had an mean score of 4.72 ± 0.26, with usefulness for creativity being the highest-scoring item in this category (4.85). As shown in Table 5, the overall evaluation results confirm that this prototype digital mentor is effective and acceptable in terms of promoting students' design processes and skills.

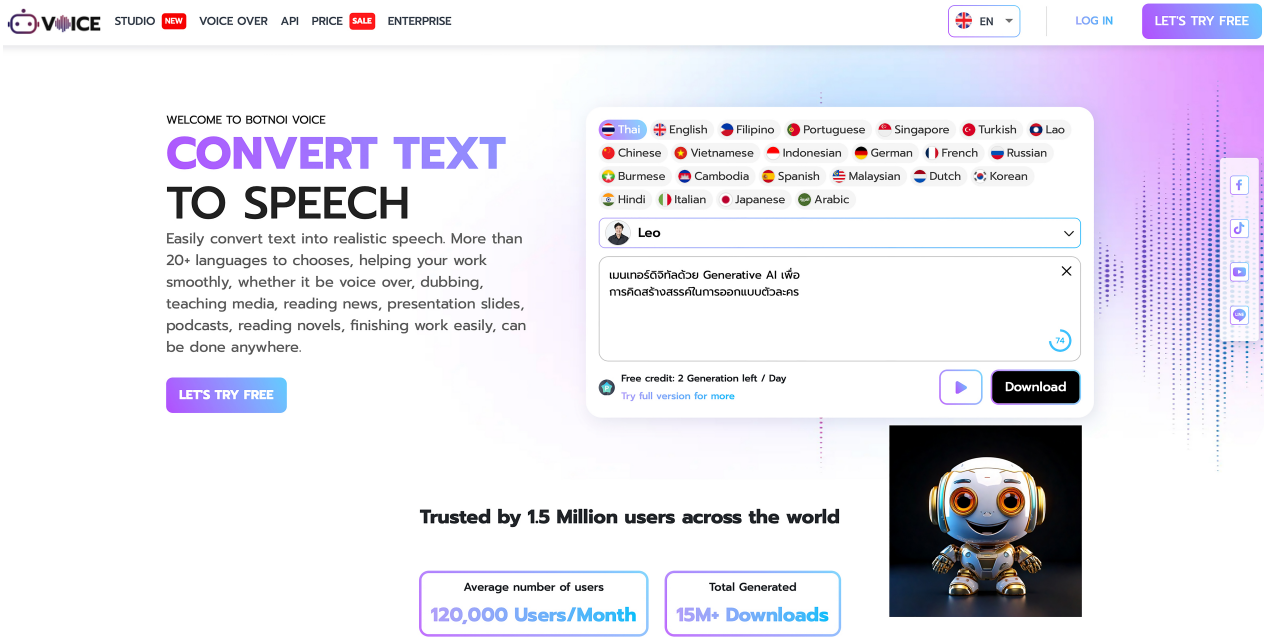


Fig. 7. The BOTNOI application uses a text-to-speech method to generate an MP4 audio file for creating voice instructions.

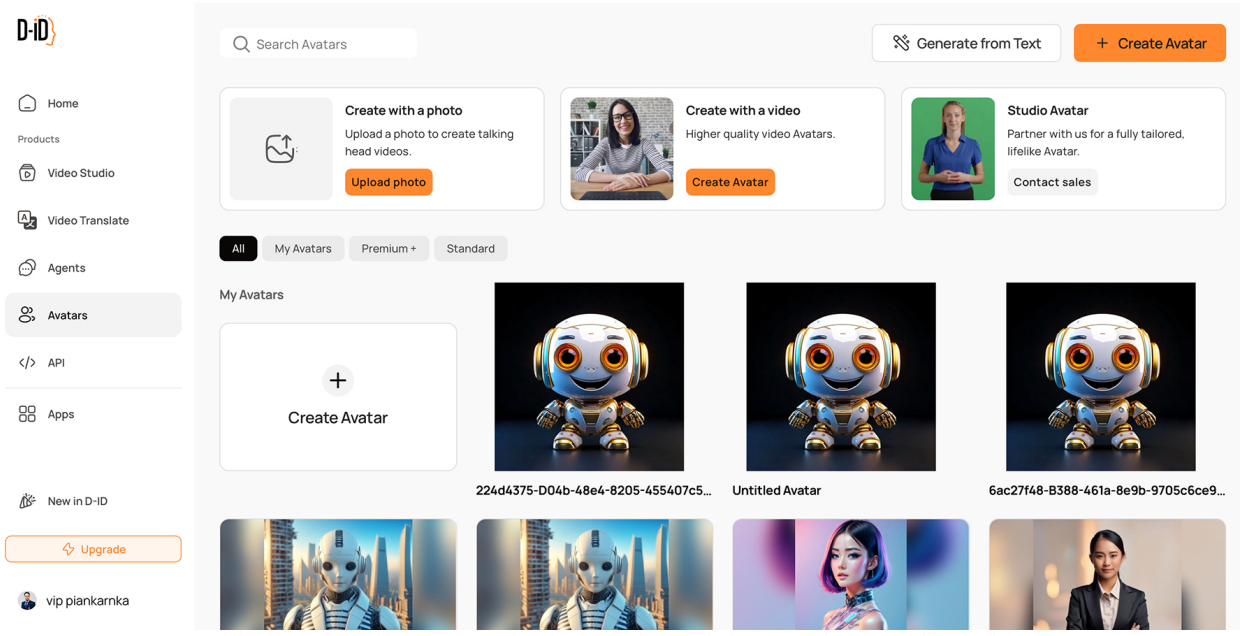


Fig. 8. Use of the D-ID application to create animations to make a digital avatar with a personality similar to a mentor.

The results of using a digital mentor with Generative AI to assist in the creative process and provide guidance in the

character design process for students in a game design course via a smart platform.

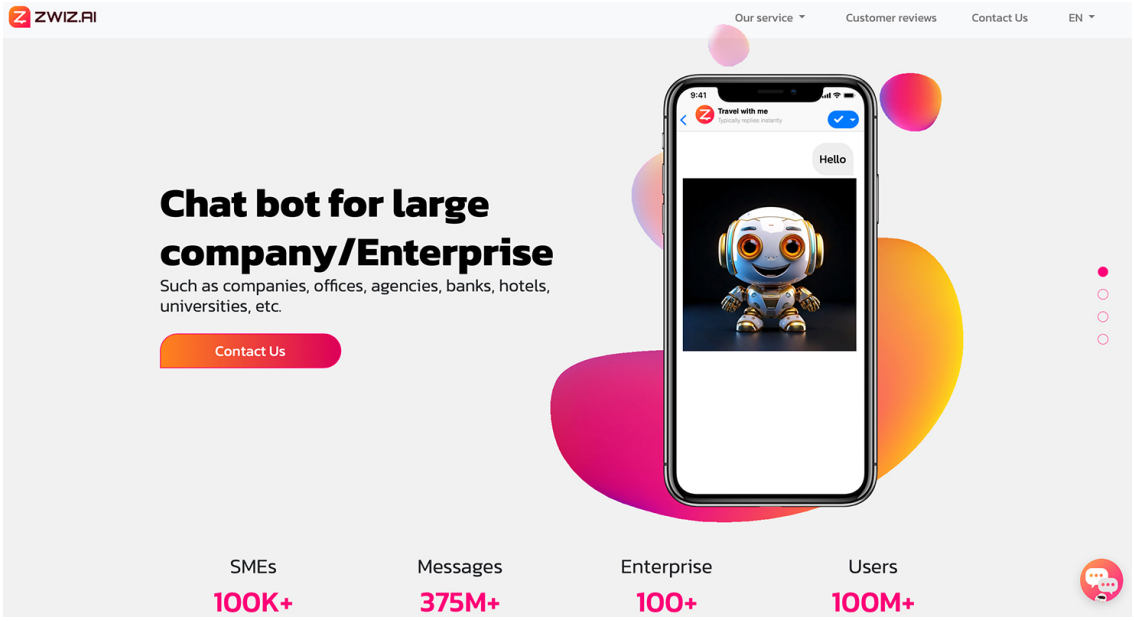


Fig. 9. The ZWIZ.AI intelligent chatbot application serves as the primary channel for students to access and interact with their digital mentors in real time.

Table 5. The evaluation results of the digital mentor prototype created using Generative AI to assist in the creative process and provide guidance in the character design process for students in game design courses via a smart platform (n = 9)

Evaluation		Mean±S.D.
1. Regarding the quality and efficiency of digital mentors (Generative AI)	1.1 The accuracy and relevance of the advice/content.	4.67 ± 0.24
	1.2 Creativity's usefulness	4.85 ± 0.34
	1.3 Usability and user experience (UX)	4.63 ± 0.20
	Total	4.72 ± 0.26
2. Regarding student outcomes and skills	2.1 Quality of character design work	4.81 ± 0.33
	2.2 Developing design skills	4.89 ± 0.24
	2.3 Work efficiency (time and efficiency)	4.83 ± 0.35
	Total	4.84 ± 0.30
3. User attitudes and satisfaction	3.1 Overall satisfaction	4.89 ± 0.22
	3.2 Attitudes toward Generative AI	4.67 ± 0.25
	3.3 Development needs	4.89 ± 0.33
	Total	4.81 ± 0.27
Total (1+2+3)		4.79 ± 0.28

The results of comparing creativity in character design from a comparative study between students using digital mentoring with generative AI (Group 1) and those using traditional teaching methods (Group 2), with 60 students in each group, showed that Group 1 had 56.67% male students, 43.33% female students, and an average age of 20.27 ± 0.94 years. Group 2 had 50.00% male students, 50.00% female students, and an average age of 20.23 ± 0.96 years, as shown in Table 6. Students in Group 1had significantly higher creativity scores in terms of character design across all aspects compared to the traditional teaching group, especially with regard to presentation and appearance, where Group 1 had the highest mean score (4.42 ± 0.25) and the greatest difference from Group 2. Additionally, in terms of concept and creativity, as well as the game design aspects, differences were also significantly higher (p < 0.001), as shown in Table 7.

Table 6. General information of the research participants (n = 120)

Information	Group 1 (n = 60)	Group 2 (n = 60)
Male	34 (56.67)	30 (50.00)
Female	26 (43.33)	30 (50.00)
Age	20.27 ± 0.94	20.23 ± 0.96

Table 7. The results of comparing the creativity in character design of game design students using digital mentors with Generative AI as a creative assistant and advisor in the character design process for game design students through a smart platform in the game design course versus using traditional teaching methods

Evaluation	Mean ± S.D.		t	p-value
	Group 1 (n = 60)	Group 2 (n = 60)		
1. In terms of ideas and creativity.	4.00 ± 0.37	3.54 ± 0.48	5.87	p < 0.001
2. In terms of design for gaming.	4.07 ± 0.28	3.63 ± 0.55	5.42	p < 0.001
3. In terms of presentation and appearance.	4.42 ± 0.25	3.60 ± 0.67	8.89	0.00

V. Discussion

The study results indicate the characteristics of a digital mentor as a creative assistant and advisor in the character design process for game design students via a smart platform. These are generally deemed to be very high, with an overall mean ± SD of 4.19 ± 0.28 ± 0.28. When considering each aspect individually, the creative and process acceleration aspect received the highest evaluation with a mean ± SD of 4.37 ± 0.20, followed by the guidance and learning enhancement aspect, which had a mean ± SD of 4.33 ± 0.29. Both aspects indicate that the experts highly valued the system's role in terms of generating results and supporting

learning. The interaction and reliability aspects were also highly evaluated but had the lowest mean ± SD of 3.85 ± 0.34. This may indicate areas that need attention when it comes to developing the system's interactive capabilities and trustworthiness. Lee et al. found that good mentoring should include identifying needs, matching mentors to learners, building quality relationships, using appropriate learning approaches, and evaluating results to ensure change [56]. This research created and evaluated a digital mentor prototype, applying generative AI technology to support game character design for students via a smart platform. The digital mentor's components and processes (synthesis) were designed using 3 main elements: 1) a character design knowledge base (covering basic theories, personality traits, and game knowledge), 2) interactive creative tools (including an automated feedback system and diversity creation tools), and 3) a user-friendly interface. The digital mentor's workflow consists of 4 steps. Namely: 1) Concept and Structure Definition, 2) Sketch Creation and Analysis (the most important step), 3) Conclusion and Documentation, and 4) Iterative In-depth Feedback. The main mechanism is generative processing, which creates content, adds details, and analyzes drawings. Based on the evaluation of the prototype by 9 experts, the digital mentor was found to be of very high quality, with an overall mean of 4.79 ± 0.28. The highest-scoring aspect was the students' results and skills (4.84 ± 0.30), which reflects the effectiveness of the digital mentor in developing students' design skills and work efficiency (4.89). Next was the aspect of user attitude and satisfaction (4.81 ± 0.27). This evaluation result confirms that the digital mentor prototype created is effective and acceptable in terms of promoting the character design process. With regard to the results of using the digital mentor with generative AI, the quasi-experimental study summarizes the use of the digital mentor with generative AI in terms of game character design, comparing it to a student group using traditional teaching methods (60 students per group). Statistical analysis using the independent t-test clearly shows that the group of students using the digital mentor (Group 1) had higher creativity in character design than the group learning traditionally (Group 2), with statistically significant differences in all aspects of the evaluation, especially in presentation and appearance, where Group 1 had the highest mean (4.42 ± 0.25) and the greatest difference from Group 2. Additionally, aspects of concept and creativity and game design also had significantly higher means ($p < 0.001$). The results confirm that digital mentors using generative AI are highly effective in terms of promoting creativity and the quality of character design work in game design courses. Factors related to the students' use of digital mentors in character design in this course are divided into 3 main areas that promote creativity: design knowledge, where the mentor acts as a supplement for students with limited knowledge by providing immediate technical feedback, enabling them to produce higher-quality work than would be the case with their existing skills; design motivation, where the mentor acts as an accelerator by reducing repetitive tasks and allowing the students to quickly create exciting results. This increases the sense of accomplishment and encourages students to be more creative; and finally, design experimentation, which makes the design iteration process much faster and more economical, resulting in each experimental effort having a greater chance of leading to the discovery of original ideas as shown in Fig. 10. This is consistent with the study by Marshall *et al*. [54], which found that using digital mentoring can increase motivation to learn. Factors related to the use of a digital mentor in character design for game design students, as shown in Fig. 11.

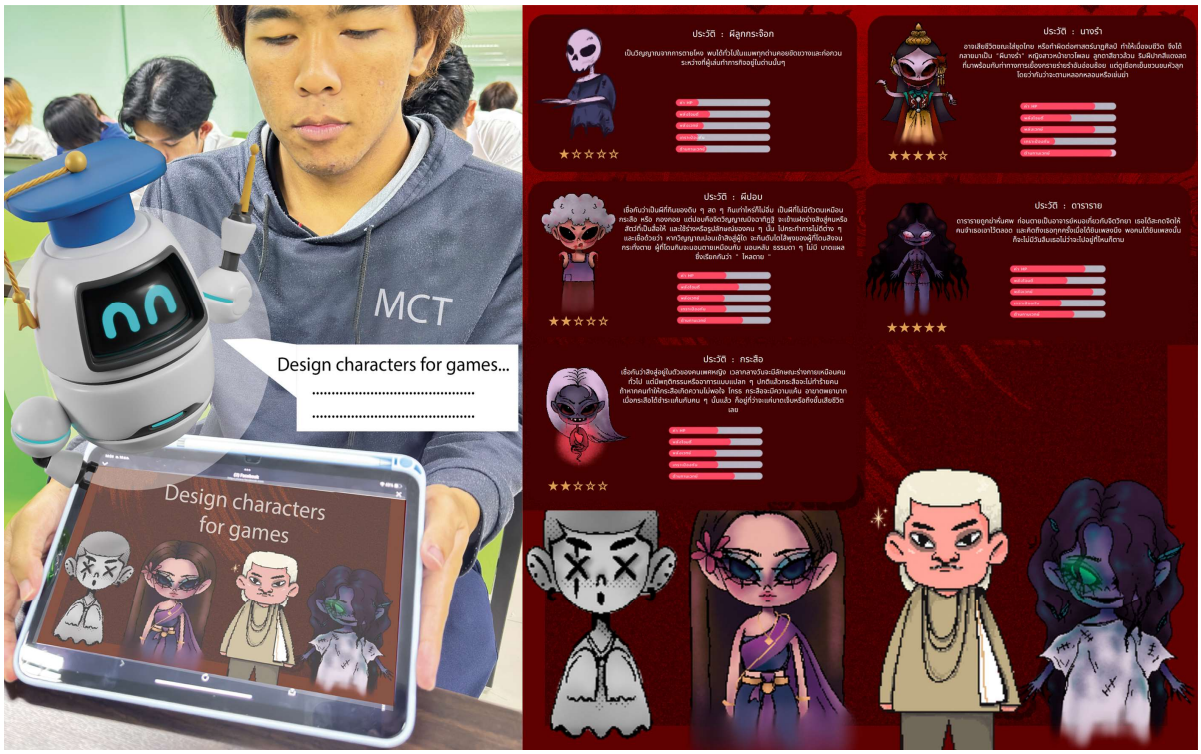


Fig. 10. Using digital mentors to assist in the creative process and provide guidance in the character design process for students in game design courses via a smart platform.

The results of this study help expand the scope of digital mentoring theory by presenting three main dimensions: fostering creativity, providing guidance, and establishing credible interactions. This aligns with the concept of Marshall *et al*. [54] who stated that digital mentoring requires motivation and easy access for effective outcomes. In practice, the digital mentor system proved capable of solving learning problems within the classroom and reducing the burden on instructors through real-time feedback, which is consistent with the findings of Kasneci *et al*. [57] regarding the use of large language models in education to help manage personalized learning content. Additionally, the statistical finding that the experimental group had significantly higher creativity scores than the control group at $p < 0.001$, particularly in terms of the appearance of the work (mean = 4.42), further confirms and expands upon the research of Li and Liu [11], who found that AI algorithms can significantly improve the visual quality of game character design, thereby enhancing the quality of the results.

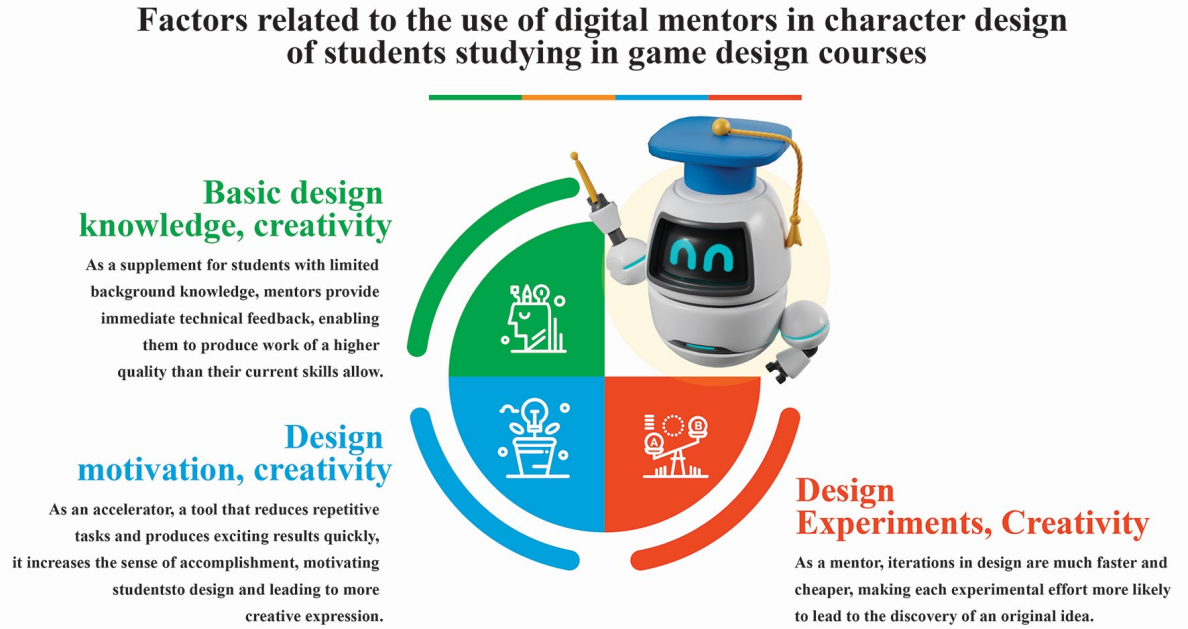


Fig. 11. Factors associated with the use of digital mentors in character design by students studying game design.

From the study results, it was found that the negative impacts or incomplete aspects of using AI in research include: 1) interaction and reliability issues, which aligns with the study by Kasneci *et al*. and Zawacki-Richter *et al*. [57, 58] Specifically, it states that AI systems, particularly generative AI, still have limitations in content accuracy, data generation errors (hallucinations), and cannot completely replace deep human interaction in the research process, which affects the reliability of research results and academic decision-making. 2) natural interaction and trust issues, and 3) ethics and ownership concerns. Additionally, students and instructors may view the impact of AI systems negatively. For example, students may see the indiscriminate collection and analysis of their data through AI systems as a violation of privacy [59].

VI. Conclusion

This research developed and evaluated the effectiveness of a digital mentor using generative AI in promoting creativity and providing guidance in the character design process for game design students. It began by synthesizing the necessary features and workflows. The former consisted of three main components: a knowledge base, interactive creative tools, and a user-friendly interface. The latter included four main working steps with the creation and analysis of sketches being the most important. The expert evaluation results confirmed that the overall system features were at a very high level, particularly in terms of creativity and accelerating the process, as well as in providing guidance and enhancing learning, which received the highest scores. When the prototype built by integrating various generative AI technologies was evaluated, it also received a very high score, with the highest efficiency being in terms of the most important of which are student outcomes and skills. The outcomes of the quasi-experimental study unequivocally demonstrate that the cohort of students utilizing digital mentors achieved markedly superior creative design assessment scores compared to the cohort engaged in conventional learning, particularly regarding presentation and aesthetics ($p < 0.001$). The conclusion validates that the utilization of generative AI-driven digital mentors, characterized by their robust framework and functionalities, is exceptionally effective as a creative aid and in enhancing the quality of character design work within the realm of higher education. For future research, essential factors in improving the performance of generative AI may encompass the development of more natural interaction capabilities, and the establishment of trust in AI recommendations.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

V.P. conducted the research, designed the digital mentor framework, and wrote the paper. P.T. was responsible for collecting and analyzing the data. All authors have read and agreed to the published version of the manuscript.

ACKNOWLEDGMENTS

The author would like to express sincere gratitude to the Creative Media Technology program at Rajamangala University of Technology Thanyaburi for their invaluable support, knowledge, and advice, which contributed significantly to the successful completion of this work.

REFERENCES

[1] A. Sunik, *Benefits of Personality Disorder Traits in Game*, 2025.
[2] C. A. Barney, "Application of pattern language for game design in pedagogy and design practice," *Information (Switzerland)*, vol. 12, no. 10, 2021. doi: 10.3390/info12100393
[3] I. O. Adeleye, "The impact of artificial intelligence on design: Enhancing creativity and efficiency," *Journal of Engineering and Applied Sciences*, vol. 3, no. 1, pp. 1–14, 2024. doi: 10.70560/vvsfej12
[4] A. Nawaz, "Emerging approaches of technology for teaching people with special needs," in *Proc. the 2010 International Conference on Educational and Information Technology (ICEIT 2010)*, vol. 1, 2010, pp. 133–139.
[5] Y. Zhu, Q. Liu, and L. Zhao, "Exploring the impact of generative artificial intelligence on students' learning outcomes: A meta-analysis," *Educ. Inf. Technol. (Dordr)*, vol. 30, no. 11, pp. 16211–16239, 2025. doi: 10.1007/s10639-025-13420-z
[6] T. Jia-Jun, "Sketchar: Supporting character design and illustration prototyping using generative AI," in *Proc. ACM Hum. Comput. Interact*., 2024, pp. 1–28.
[7] F. Mo *et al*., "Generative AI, human creativity, and art," *Nature Communications*, vol. 14, no. 1, pp. 1–37, 2023. doi: 10.1038/s41467-023-40131-4
[8] J. Hutson and P. Cotroneo, "Generative AI tools in art education: Exploring prompt engineering and iterative processes for enhanced creativity," *Metaverse*, 2023. doi: 10.54517/m.v4i1.2164.Original
[9] X. Wei, L. Wang, L. K. Lee, and R. Liu, "The effects of generative AI on collaborative problem-solving and team creativity performance in digital story creation: An experimental study," *International Journal of Educational Technology in Higher Education*, vol. 22, no. 1, 2025. doi: 10.1186/s41239-025-00526-0
[10] J. Rafner, R. E. Beaty, J. C. Kaufman, T. Lubart, and J. Sherson, "Creativity in the age of generative AI," *Nat. Hum. Behav.*, vol. 7, no. 11, pp. 1836–1838, 2023. doi: 10.1038/s41562-023-01751-1
[11] J. Li and Q. Liu, *Application of Generative Artificial Intelligence AIGC Technology Under Neural Network Algorithm in Game Character Art Design*, Springer US, 2024. doi: 10.1007/s13132-024-02152-z
[12] V. Piankarnka, P. Nilsook, and P. Wannapiroon, "A micro-learning approach with artificial intelligence for improving skills in designing the movement of in-game characters and using mixed reality," *International Journal of Information and Education Technology*, vol. 15, no. 4, pp. 847–857, 2025. doi: 10.18178/ijiet.2025.15.4.2291
[13] J. Cohen, "Defining identification: A theoretical look at the identification of audiences with media characters," *Advances in Foundational Mass Communication Theories*, vol. 4, no. 3, pp. 253–272, 2018. doi: 10.4324/9781315164441-14
[14] A. P. Sungkono, "Wayang Kulit shadow puppetry as an influence on Indonesian video game character design," *Art and Society*, vol. 4, no. 2, pp. 1–7, 2025. doi: 10.56397/as.2025.02.01
[15] N. Ji and X. Ji, "Animation and game design effectiveness analysis for skill development," *Neutrosophic Sets and Systems*, vol. 26, pp. 1–1, 2019.
[16] K. A. Apriana, A. K. Tyas, R. A. Mutiarani, and I. Wayan, "Design strategy 2D animation infographic to raise awareness of Indonesian games," *Jurnal Ekspresi: Desain Komunikasi Visual dan Seni*, vol. 2, no. 1, pp. 1–8, 2025.
[17] J. Leong, D. Ledo, T. Driscoll, T. Grossman, G. Fitzmaurice, and F. Anderson, "Paratrouper: Exploratory creation of character cast visuals using generative AI," in *Proc. Conference on Human Factors in Computing Systems*, 2025. doi: 10.1145/3706598.3714242
[18] M. Zheng, "AI generative technology-driven comic IP image character design of agricultural and side products in Jilin province helps rural revitalization research," *Journal of Combinatorial Mathematics and Combinatorial Computing*, vol. 127b, no. August 2024, pp. 3163–3183, 2025. doi: 10.61091/jcmcc127b-177
[19] M. M. Abootorabi *et al.*, "Generative AI for character animation: A comprehensive survey of techniques, applications, and future directions," arXiv preprint arXiv:2504.19056, pp. 1–106, 2025. http://arxiv.org/abs/2504.19056
[20] S. A. Alharthi, "Generative AI in game design: Enhancing creativity or constraining innovation?" *J. Intell.*, vol. 13, no. 6, 2025. doi: 10.3390/jintelligence13060060
[21] A. Korsah, *The Impact of Generative Artificial Intelligence in Game Development: A Scoping Review*, 2025.
[22] S. Hajar, M. Hussain, and R. Tasnim, *Mentoring Digital Competency Development*, pp. 171–176, 2024.
[23] E. Soltovets, O. Chigisheva, and A. Dmitrova, "The role of mentoring in digital literacy development of doctoral students at British universities," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 16, no. 4, 2020. doi: 10.29333/ejmste/117782
[24] H. K. Smith, *Mentorship in the Digital Age: Leveraging Technology for Women's Leadership Growth*, 2025.
[25] D. E. Werderich, M. Manderino, and G. Godinez, "Leveraging digital mentor texts to write like a digital writer," *Journal of Adolescent and Adult Literacy*, vol. 60, no. 5, pp. 537–546, 2017. doi: 10.1002/jaal.584
[26] C. H. Wang and C. L. Wu, *Synergizing Mentorship and Mindfulness with Innovation and Digital Transformation: A Strategic Framework for the Restaurant Industry*, vol. 16, no. 2. 2025. doi: 10.1007/s13132-024-02213-3
[27] Y. Zhang, G. Qin, L. Cheng, K. Marimuthu, and B. S. Kumar, "Interactive smart educational system using ai for students in the higher education platform," *Journal of Multiple-Valued Logic and Soft Computing*, vol. 36, no. 1, pp. 83–98, 2021.
[28] I. Shakhina, O. Podzygun, A. Petrova, and G. Gordiichuk, "Smart education in the transformation digital society," *Modern Information Technologies and Innovation Methodologies of Education in Professional Training Methodology Theory Experience Problems*, vol. 67, no. 1, pp. 51–64, 2023. doi: 10.31652/2412-1142-2023-67-51-64
[29] A. Dehbi, A. Bakhouyi, A. M. Khaddar, and M. Talea, "Education and smart technologies: towards a new pedagogical paradigm," *International Journal of Evaluation and Research in Education*, vol. 14, no. 1, pp. 297–309, 2025. doi: 10.11591/ijere.v14i1.30470
[30] L. Zhou, W. Meng, S. Wu, and X. Cheng, "Development of digital education in the age of digital transformation: Citing China's practice in smart education as a case study," *Science Insights Education Frontiers*, vol. 14, no. 2, pp. 2077–2092, 2023. doi: 10.15354/sief.23.or095
[31] R. Huang *et al.*, "Global understanding of smart education in the context of digital transformation," *Open Praxis*, vol. 16, no. 4, pp. 663–676, 2024. doi: 10.55982/openpraxis.16.4.761
[32] Y. Li, W. Y. Leong, and H. Zhang, "Innovative teaching practice in vocational education using smart technology: A case study of cement production course," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 21, no. 12, 2025. doi: 10.29333/ejmste/17491
[33] H. Singh and S. J. Miah, "Smart education literature: A theoretical analysis," *Educ. Inf. Technol. (Dordr)*, vol. 25, no. 4, pp. 3299–3328, 2020. doi: 10.1007/s10639-020-10116-4
[34] Z. T. Zhu, M. H. Yu, and P. Riezebos, "A research framework of smart education," *Smart Learning Environments*, vol. 3, no. 1, 2016. doi: 10.1186/s40561-016-0026-2
[35] J. Yang, G. Shi, W. Zhu, and Y. Sun, "Intelligent technologies in smart education: a comprehensive review of transformative pillars and their impact on teaching and learning methods," *Humanit. Soc. Sci. Commun.*, vol. 12, no. 1, pp. 1–15, 2025. doi: 10.1057/s41599-025-05444-0
[36] M. A. Dima, "The impact of digital transformation: From traditional education to smart education," *Smart Cities and Regional Development (SCRD) Preprints*, vol. 1, no. 1, 2024,
[37] E. J. Chukwuemeka, "Smart education: Opportunities, challenges and future of traditional education," *International Journal of Smart Technology and Learning*, vol. 4, no. 3, pp. 191–202, 2025. doi: 10.1504/ijsmarttl.2025.146286
[38] E. A. C. Bittner, M. Mirbabaie, and S. Morana, "Digital facilitation assistance for collaborative, creative design processes," in *Proc. the Annual Hawaii International Conference on System Sciences*, vol. 2020-Janua, 2021, pp. 370–379. doi: 10.24251/hicss.2021.044
[39] M. Selfa-Sastre, M. Pifarré, A. Cujba, L. Cutillas, and E. Falguera, "The role of digital technologies to promote collaborative creativity in language education," *Front Psychol*, vol. 13, no. February, 2022. doi: 10.3389/fpsyg.2022.828981
[40] Y. Indrianti, M. Hamsal, A. Furinto, and R. Kartono, "It takes two to tango: Roles of digital strategy and human creativity in creating transformational technopreneurship," *E3S Web of Conferences*, vol. 388, 2023. doi: 10.1051/e3sconf/202338804045
[41] D. C. Yaw, "E-mentoring in virtual education," *Online Submission (eric)*, no. 2005, pp. 1–7, 2007.
[42] N. C. Phillips and V. K. Lund, "Leveling up: Connected mentor learning in a digital media production after-school space," *Journal of*

Youth Development, vol. 16, no. 1, pp. 29–54, 2021. doi: 10.5195/JYD.2021.932
[43] S. Chang, "The roles of mentors in electronic learning environments," *AACE Journal*, vol. 12, pp. 331–342, 2004.
[44] H. K. Thampy, S. Ramani, J. McKimm, and V. D. Nadarajah, "Virtual speed mentoring in challenging times," *Clinical Teacher*, vol. 17, no. 4, pp. 430–432, 2020. doi: 10.1111/tct.13216
[45] C. Bonnett, B. M. Wildemuth, and D. H. Sonnenwald, "Interactivity between protégés and scientists in an electronic mentoring program," *Instr Sci*, vol. 34, no. 1, pp. 21–61, 2006. doi: 10.1007/s11251-005-4115-9
[46] R. Pollard and S. Kumar, "Mentoring graduate students online: Strategies and challenges," *International Review of Research in Open and Distributed Learning*, vol. 22, no. 2, pp. 267–284, 2021. doi: 10.19173/irrodl.v22i2.5093
[47] J. Riegelsberger, M. A. Sasse, and J. D. McCarthy, "The mechanics of trust: A framework for research and design," *International Journal of Human Computer Studies*, vol. 62, no. 3, pp. 381–422, 2005. doi: 10.1016/j.ijhcs.2005.01.001
[48] R. Investment, *The Nature of Relationships in e-Internships: A Matter of the Psychological Contract, Communication and Relational Investment*, vol. 34, no. 1, pp. 113–121, 2018.
[49] A. Hussein, S. Elsawah, and H. A. Abbass, "Towards trust-aware human-automation interaction: An overview of the potential of computational trust models," in *Proc. the Annual Hawaii International Conference on System Sciences*, 2020, pp. 1–10. doi: 10.24251/hicss.2020.047
[50] M. Ashoori, Z. Shen, C. Miao, and R. Gay, "Mentor agent: An intelligent virtual teacher for personalized learning environments," in *Proc. 7th Int. Conf. Intell. Virtual Agents (IVA '07)*, Paris, France, 2007, pp. 315–320. doi: 10.1007/978-3-540-74997-4_28
[51] S. Janghorbani, J. Buhmann, A. Modi, and M. Kapadia, "Domain authoring assistant for intelligent virtual agents," in *Proc. 18th Int. Conf. Auton. Agents Multiagent Syst. (AAMAS '19)*, Montreal, QC, Canada, 2019, pp. 104–112.
[52] W. Zysk, "Self-paced learning with 3D humanoid virtual tutors," in *Proc. Int. Soft Comput. Conf. (iSCSIC)*, 2013, pp. 1–4.
[53] S. Halafihi and J. Matthews, "Social BIM: Co-creation with shared situational awareness," *Univ. Bath*, Bath, U.K., Working Paper Series vol. 20, pp. 230–252, 2015.
[54] A. Marshall, M. Dezuanni, and A. Hourigan, "Defining digital mentoring to advance adult digital inclusion," *Community Dev. J.*, bsaf021, 2025. doi: 10.1093/cdj/bsaf021
[55] T. S. Andersen and H. Wellen, "Being a mentor in the digital era: An exploratory study of the benefits undergraduate student mentors derived from providing virtual mentoring to youth," *J. Community Psychol.*, vol. 51, no. 7, pp. 2635–2651, 2023. doi: 10.1002/jcop.23051
[56] K. M. Lee and Y. P. Özdemir, "Mentoring and digital learning to enhance the impact of social sciences," *Ital. J. Sociol. Educ.*, vol. 14, no. 3, pp. 103–130, 2022. doi: 10.14658/pupj-ijse-2022-3-6
[57] E. Kasneci *et al.*, "ChatGPT for good? On opportunities and challenges of large language models for education," *IEEE Trans. Learn. Technol.*, vol. 16, no. 4, pp. 1–15, 2023.
[58] O. Zawacki-Richter, V. I. Marín, M. Bond, and F. Gouverneur, "Systematic review of research on artificial intelligence applications in higher education—where are the educators?" *Int. J. Educ. Technol. High. Educ.*, vol. 16, no. 1, pp. 1–27, 2019.
[59] R. Luckin, "Towards artificial intelligence-based assessment systems," *Nat. Hum. Behav.*, vol. 1, no. 3, pp. 1–3, 2017.

Copyright © 2026 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (CC BY 4.0).