




ISSN: 2617-6548

URL: [www.ijirss.com](http://www.ijirss.com)



## Exploring college students' opinions on generative AI and flipped classroom

 Hanchu Liu<sup>1</sup>,  Sirirat Petsangsri<sup>2\*</sup>,  Kanyarat Sriwisathiyakun<sup>3</sup>

<sup>1,2,3</sup>*School of Industrial Education and Technology King Mongkut's Institute of Technology Ladkrabang, Thailand.*

Corresponding author: Sirirat Petsangsri (Email: [sirirat.pe@kmitl.ac.th](mailto:sirirat.pe@kmitl.ac.th))

### Abstract

This study aimed to explore college students' and professors' opinions, experiences, and requirements regarding the integration of Generative AI (GenAI) into flipped classroom (FC) models, as understanding stakeholders' perceptions in these combined learning environments has become critical, given the rising adoption of both technologies in higher education. A mixed-methods research design was employed, with quantitative data collected through stratified random sampling from 400 college students and five professors in Hangzhou, China, during September 2024, complemented by qualitative insights gathered through in-depth interviews to provide a comprehensive understanding of participant perspectives. Quantitative analysis revealed moderate satisfaction with GenAI tools among participants ( $M=3.36$ ) and higher proficiency levels in flipped classroom activities ( $M=4.37$ ), with students particularly valuing GenAI's capacity to enhance learning efficiency ( $M=5.00$ ) and expressing a strong desire for improved pre-class preparation materials ( $M=4.49$ ). Qualitative thematic analysis identified key themes, including personalized AI support and interactive technology usage as positive aspects, alongside significant challenges such as anxiety toward GenAI adoption and time management difficulties, with statistically significant differences ( $p<.01$ ) observed between current conditions and desired educational outcomes. The integration of GenAI into flipped classroom environments presents both opportunities and challenges for higher education stakeholders, with students recognizing the potential for enhanced learning efficiency and personalized support while expressing concerns about technology anxiety and time management barriers that require attention. The findings provide actionable insights for instructional designers and educators, suggesting that targeted educational strategies should focus on addressing technology anxiety, improving time management support, and enhancing pre-class preparation materials to guide the effective and ethically sound integration of GenAI into student-centered learning environments and support more successful flipped classroom implementations in higher education settings.

**Keywords:** College students, Flipped classroom (FC), Generative artificial intelligence (GenAI), Opinions.

**DOI:** 10.53894/ijirss.v8i6.9817

**Funding:** This study received no specific financial support.

**History:** Received: 8 July 2025 / Revised: 12 August 2025 / Accepted: 14 August 2025 / Published: 12 September 2025

**Copyright:** © 2025 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

**Competing Interests:** The authors declare that they have no competing interests.

**Authors' Contributions:** All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

**Transparency:** The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

**Publisher:** Innovative Research Publishing

## **1. Introduction**

Today's college students face new challenges as education rapidly evolves with technology. Many universities are seeking better ways to improve student learning and overall educational experiences [1]. Two important approaches gaining popularity are generative AI tools and the flipped classroom teaching model. One of the popular methods in the spotlight is the flipped classroom approach, aimed at ensuring in-class learning is interactive and engaging [2, 3]. In the flipped classroom, students should learn the fundamentals of the course pre-class, typically through online learning platforms. The in-class time, in turn, is dedicated to in-depth learning activities such as problem-solving, group work, and meaningful discussions [4, 5]. This approach, while adapting teaching techniques to online environments, promotes active learning, memory retention, and student engagement through flexible frameworks and technology-driven, student-centered approaches.

At the same time, the use of Generative AI tools in education is rapidly changing the way students and teachers experience learning. These tools offer personalized, real-time support, helping to improve both teaching and learning [6]. GenAI has strong potential to strengthen flipped classroom models by automating feedback, tailoring learning materials to student needs, and increasing engagement through flexible and adaptive learning experiences [7]. Research shows that integrating ChatGPT into flipped interactive learning (FIL) significantly enhances programming skills, interactivity, and personalized learning, outperforming conventional flipped learning [8]. Furthermore, generative AI can create more supportive and personalized learning environments that address both emotional well-being and academic achievement when implemented thoughtfully [9]. Still, there is a lack of detailed studies that carefully measure how effective this approach is. This gap highlights the need for further research.

However, the integration of these advanced educational technologies presents new challenges for students, including adaptation difficulties, time management issues, increased learning responsibility, and potential technology-related anxiety [10, 11]. Students may also encounter concerns regarding privacy, ethical considerations, and the reliability of AI-generated information [12]. Additionally, not all students respond equally well to these innovative approaches, with some struggling with self-directed learning, preparation, and technology adoption [13].

Despite the growing adoption of generative AI and flipped classroom methodologies in higher education institutions globally, there exists a critical disconnect between implementation and student readiness. Current educational practices often proceed without a comprehensive understanding of student perspectives, needs, and challenges related to these innovative approaches. This misalignment risks implementing methods that may not fully benefit students, potentially resulting in diminished academic performance and reduced emotional well-being. The lack of student voice in the integration process undermines the effectiveness of these potentially transformative educational tools.

While existing literature demonstrates the individual benefits of generative AI tools and flipped classroom models, there is a notable absence of comprehensive research examining student opinions and experiences regarding their combined implementation. Current studies lack a detailed empirical investigation into how effectively students perceive and adapt to the integration of generative AI within flipped classroom environments. Specifically, there is insufficient understanding of students' specific needs, expectations, support requirements, and training preferences for successfully utilizing these innovative educational approaches. This research gap represents a critical barrier to successful educational innovation implementation.

### **1.1. Research Objectives**

This study aims to:

RO1:

Identify and analyze students' experiences regarding the use of generative AI in their studies.

RO2:

Identify and analyze students' opinions and experiences related to the flipped classroom model.

RO3:

Investigate professors' views on generative AI, flipped classrooms in higher education.

Research Questions

This study addresses the following research questions:

RQ1:

What are students' experiences regarding the use of generative AI in their studies?

RQ2:

What are students' opinions and experiences related to the flipped classroom model?

RQ3:

What are professors' views on generative AI, flipped classrooms in higher education?

To address these research questions and objectives, this study will follow a systematic approach. This structured approach will ensure a comprehensive investigation of student opinions while providing actionable insights for improving the integration of generative AI and flipped classroom methodologies in higher education settings.

## **2. Literature Review**

### **2.1. Generative AI**

Generative AI is a subset of artificial intelligence. Generative AI refers to technology capable of producing content such as text, images, audio, and video. This type of AI learns from data to create new, realistic outputs [14]. In education,

generative AI can personalize learning experiences by adjusting to students' individual needs and learning speeds [15]. It provides instant feedback and tailored support, helping students understand complex topics better [16]. Teachers can use generative AI tools to create interactive materials, making learning more engaging and enjoyable [17]. However, every coin has two sides. GenAI-generated content may sometimes be incorrect or biased, which can mislead students [18]. Privacy concerns are also significant, as generative AI systems collect and analyze large amounts of student data, raising questions about data security and ethical use [12]. Research shows that students often feel more motivated and confident when using generative AI-supported educational materials [18]. Thus, understanding how to implement generative AI effectively is very important for educators.

## *2.2. Flipped classroom*

By relocating the content delivery out of the classroom, the flipped approach leaves more time for hands-on and group activities in the classroom. This arrangement allows students to practice what they have learned and discuss it with others [19]. One study examined how university flipped classrooms succeed and identified the positives, negatives, and what it may mean for the future of teaching [20]. Previous research has established that the approach can keep students more interested, think more critically, and perform better in their classes [9]. Recent studies explore technology integration within flipped classrooms. Mobile learning platforms and interactive videos enhance the learning experience [21]. Future research should examine optimal content delivery methods and effective assessment strategies for flipped environments.

## *2.3. Students' opinion*

Recent research reveals evolving student perspectives on generative AI in higher education. Usage has surged dramatically, with student AI utilization increasing from 66% in 2024 to 92% in 2025, and 86% of students globally using AI regularly in their studies [22]. Students recognize AI's potential for personalized learning support, writing assistance, and research capabilities, while expressing concerns about accuracy, privacy, ethical issues, and impacts on personal development [23]. Key benefits identified include 24/7 accessibility and time-saving advantages, though students raise concerns about potential academic costs [24]. These findings indicate that students view generative AI as both beneficial and problematic, requiring careful integration in educational contexts.

Students generally hold positive opinions about the flipped classroom approach. Most students have a positive perception of the flipped classroom, noting the advantages of practical in-class activities, as well as increased engagement and motivation [25]. Students appreciate the time optimization and personalization opportunities that flipped classroom methodology provides [26]. Students tend to prefer in-person lectures to video lectures, but prefer interactive classroom activities over lectures [27]. Meta-analytical evidence suggests that flipped classroom approaches enhance student self-efficacy and academic performance, with students reporting improved learning outcomes and increased engagement [28, 29]. However, implementation challenges persist, particularly regarding student adaptation to increased responsibility for pre-class preparation and technological requirements. Overall, students view flipped classrooms as beneficial for active learning despite initial adjustment difficulties.

Based on these studies, in this research we surveyed student opinions on six aspects of Generative AI: Cognition, Usage, Functional Requirements, User Experience, Learning Efficiency, and Ethics and Safety. We also surveyed student opinions on six aspects of the flipped classroom: Pre-class Preparation Materials, Teaching Method, Technical Readiness, Anticipated Learning Outcomes, Time Management, and Assessment and Feedback.

# **3. Research Methods**

## *3.1 Research Design*

The study was designed to assess the opinions of students of different grades and majors regarding generative artificial intelligence and the flipped classroom at five comprehensive universities in Hangzhou City, China.

The population and sample of the study included students and teachers from five comprehensive universities in Hangzhou City, China. After the researchers determined the population, to obtain a representative sample, they randomly selected one professor from each of the five schools using a simple random sampling method; the five professors were from different disciplines. They randomly selected 80 students from each of the five schools, 20 from each grade from freshman to senior year, and these students were from different majors (400 total) to participate in the study. The sampling procedure ensured a balanced representation of different grade levels and academic disciplines within each institution. This method was appropriate for the quantitative nature of the study, which involved statistical analysis using paired sample t-tests.

**Table 1.**

General information of surveyed stakeholders (n=400).

		<b>n</b>	<b>Percent (%)</b>
Grade	Freshman	100	25
	Sophomore	100	25
	Junior	100	25
	Senior	100	25
Gender	Male	201	50.2
	Female	199	49.8
Age	18	98	24.5
	19	109	27.3
	20	101	25.4
	21	92	23.0

Table 1 provides a general overview of the surveyed stakeholders. The participants in this study were 400 students pursuing a Bachelor's degree from five comprehensive universities in Hangzhou City, China. Equal representation was maintained across all academic levels, including freshmen, sophomores, juniors, and seniors, each constituting 20%. The gender distribution was balanced, with males comprising 50.2% and females 49.8%. Age groups ranged from 18 to 21 years, with the majority of students aged 19 (27.3%), followed by students aged 20 (25.4%), 18 (24.5%), and 21 (23.0%).

### 3.2. Research Tools

The opinion questionnaires on both generative AI and the flipped classroom employed a five-point Likert scale to measure the degree of opinions, with the following interpretation ranges: 1.00–1.50 = Strongly Disagree, 1.51–2.50 = Disagree, 2.51–3.50 = Moderate, 3.51–4.50 = Agree, and 4.51–5.00 = Strongly Agree.

Reliability refers to the consistency and stability of questionnaire results when the same method is used to survey the same group. One of the most commonly used methods to test reliability is Cronbach's Alpha, which measures internal consistency. Developed by Cronbach [30] it remains a widely used tool in social science research. According to Nye [31] a Cronbach's Alpha between 0.6 and 0.7 indicates acceptable reliability, between 0.7 and 0.8 indicates high reliability, and above 0.8 reflects excellent reliability. Therefore, a questionnaire with a Cronbach's Alpha above 0.6 is considered useful, and one above 0.8 is seen as highly reliable. As shown in Table 2, the reliability analysis of the returned questionnaires revealed that the Cronbach's Alpha values for the dimensions related to student opinions on generative AI and flipped classroom were 0.836 and 0.858, respectively. Since all values exceeded 0.8, the questionnaire demonstrated excellent reliability across both areas. This confirms that the reliability of the instruments used in this study meets accepted standards and supports the trustworthiness of the data collected.

**Table 2.**

Summary of the reliability of the questionnaire.

<b>No</b>	<b>Variable</b>	<b>Cronbach's Alpha</b>	<b>N of Items</b>
1	Student Opinions on GenAI	0.836	24
2	Student Opinions on FC	0.858	22

Semi-structured interviews were employed to gain expert insights, involving five professors from diverse academic disciplines (Education, Psychology, Information Technology, Health Sciences, and Humanities). The interview protocol included open-ended questions focusing on perceptions of integrating generative AI in flipped classroom settings, potential impacts on instructional strategies, and perceived challenges. Opinions on GenAI consisted of 6 questions, and opinions on the flipped classroom consisted of 7 questions. Interviews lasted 30-45 minutes each, were audio-recorded with consent, and subsequently transcribed verbatim for thematic analysis.

### 3.3. Data Collection

The data collection process involved questionnaires administered to 400 college students in September 2024. The data was gathered through an online platform using WenJuanXing. Interviews with 5 university professors were conducted using open-ended questions, recorded on paper, and audio-recorded with their knowledge and consent.

Ethical safeguards were in place, with approval from Zhejiang Shuren University's ethics committee (Certification No. EC-ZJSRU 20240920, effective September 25, 2024). Participants were informed of the study's objectives, procedures, and confidentiality measures under ethical guidelines.

### 3.4. Data Analysis

This mixed-methods study employed both quantitative and qualitative analyses. Quantitative data derived from surveys assessing students' perceptions of GenAI, flipped classroom, and emotional well-being were analyzed using descriptive statistics (means, standard deviations) and inferential tests (t-tests), with SPSS V29 statistical software utilized for this purpose. The primary analytical approaches include descriptive statistics: mean scores, standard deviations, and frequency distributions to summarize student attitudes, perceptions, and usage patterns of generative AI tools in flipped classroom

environments. The reliability of scales was verified through Cronbach's alpha. Qualitative data, obtained from semi-structured interviews, underwent thematic analysis following Braun and Clarke [32] approach.

Comprehensive Assessment Framework: Current studies examine both cognitive and affective outcomes, technology acceptance factors, and pedagogical effectiveness simultaneously, whereas earlier research typically focused on single outcome measures.

## 4. Results

### 4.1 Student Opinions Analysis Results

**Table 3.**

Student opinions of generative AI (n = 400).

Questions	Mean	SD	Level
<b>Cognition</b>			
1. I understand the basic concepts and principles of generative artificial intelligence	1.21	0.41	Strongly Disagree
2. I can distinguish between different types of generative AI tools (e.g., text generation, image generation, etc.).	3.87	0.57	Agree
3. I understand the current mainstream generative AI products	4.16	0.54	Agree
4. I know about the application of generative AI in education	2.62	0.74	Moderate
5. I can tell the difference between generative AI-generated content and human-generated content.	2.45	0.60	Disagree
Total	2.86	0.26	Moderate
<b>Usage</b>			
6. I often use generative AI tools to assist learning (such as content creation, data analysis, translation, etc.).	3.96	0.67	Agree
7. I use generative AI tools independently	3.44	0.79	Moderate
Total	3.70	0.52	Agree
<b>Functional requirements</b>			
8. Generative AI provides me with learning resources	4.89	0.31	Strongly Agree
9. Generative AI helps me sort out and summarize knowledge points	4.32	0.51	Agree
10. Generative AI can help me answer questions	4.95	0.22	Strongly Agree
11. Generative AI can help me come up with mock test questions	3.82	0.56	Agree
Total	4.50	0.20	Agree
<b>User experience</b>			
12. The interface of the generative AI tool I use is intuitive and easy to use	3.47	0.55	Moderate
13. The generative AI I use responds quickly enough for my needs	2.63	0.76	Moderate
14. The generative AI I use can accurately understand and respond to my input	2.52	0.74	Moderate
15. The information provided by the generative AI tool I use is accurate.	2.39	0.60	Disagree
Total	2.75	0.33	Moderate
<b>Learning efficiency</b>			
16. Using generative AI has improved my learning efficiency	5.00	0.05	Strongly Agree
17. Generative AI helps me better understand complex concepts	4.56	0.50	Strongly Agree
18. Generative AI has enhanced my critical thinking skills	3.57	0.75	Agree
19. Generative AI has significantly improved my learning outcomes.	3.99	0.68	Agree
Total	4.28	0.27	Agree
<b>Ethics and safety</b>			
20. I am concerned about data privacy issues when using generative AI	2.06	0.30	Disagree
21. I can tell the reliability of generative AI-generated content	3.24	0.80	Moderate
22. I understand the ethical issues that may arise from using generative AI (e.g., plagiarism, copyright, etc.).	1.72	0.46	Disagree
23. Ethical norms and laws and regulations for the use of generative AI need to be formulated	4.65	0.48	Strongly Agree
24. Generative AI needs rigorous ethical review and regulation.	4.64	0.49	Strongly Agree
Total	3.26	0.23	Moderate

The results in Table 3 show that in the questionnaire of opinions on generative AI in all 6 aspects, the mean value ranges from 2.75 to 4.50, indicating that students thought the current generative AI had scope for improvement in cognition, usage, functional requirements, user experience, learning efficiency, ethics, and safety. In particular, students strongly agreed with the improved learning efficiency of generative AI (Mean=5.00, SD=0.05), and they generally believed that the current influence on learning efficiency of generative AI fully met their needs. Meanwhile, students strongly desired to focus on ethics and safety (Mean=4.65, SD=0.48) while using generative AI. Overall, students expressed dissatisfaction with the current use of generative AI, which provided prerequisites and essential clues for improving its current use, indicating that it was necessary to take measures to satisfy student opinions and to enhance the effectiveness and quality of generative AI usage.

**Table 4.**

Student opinions of the flipped classroom (n = 400).

Questions	Mean	SD	Level
<b>Pre-class preparation materials</b>			
1. I expect the pre-class materials to provide comprehensive content that supports my learning.	4.47	0.50	Agree
2. I expect the pre-class materials to be easy to understand and follow.	4.53	0.50	Strongly Agree
3. I hope the pre-class learning resources will be available in multiple formats (e.g., videos, readings, visuals).	4.48	0.50	Agree
Total	4.49	0.30	Agree
<b>Teaching method</b>			
4. I expect the independent learning tasks to be clearly explained and manageable.	4.33	0.71	Agree
5. I believe that in-class discussions and activities can help deepen my understanding of the subject.	4.27	0.71	Agree
6. I think using a flipped classroom approach could increase my motivation to learn.	4.37	0.67	Agree
Total	4.32	0.47	Agree
<b>Technical readiness</b>			
7. I feel confident using AI-based tools and online learning platforms.	4.36	0.64	Agree
8. I expect the use of AI technology to support my learning efficiency.	4.35	0.70	Agree
9. I believe there will be enough technical support available if I encounter difficulties.	4.39	0.63	Agree
Total	4.37	0.47	Agree
<b>Anticipated learning outcomes</b>			
10. I expect the flipped classroom to make me more engaged in learning.	4.22	0.70	Agree
11. I believe the flipped model will help me understand course content more deeply.	4.31	0.68	Agree
12. I expect this learning model to improve my ability to learn independently.	4.31	0.71	Agree
13. I hope the flipped classroom will positively affect my academic performance.	4.28	0.68	Agree
14. I believe the flipped classroom model can help reduce my stress from studying.	4.32	0.69	Agree
Total	4.29	0.39	Agree
<b>Time management</b>			
15. I am ready to manage my time for independent study before class sessions.	4.44	0.62	Agree
16. I expect in-class time to be used efficiently to support my learning.	4.43	0.62	Agree
17. I believe the flipped classroom model could help me improve my time management skills.	4.40	0.58	Agree
Total	4.42	0.44	Agree
<b>Assessment and feedback</b>			
18. I expect that the evaluation process will include more than just test scores.	4.37	0.66	Agree
I believe that class participation and contributions should be considered in the grading system.	4.30	0.65	Agree
20. I think self-evaluation and peer feedback should be included in the assessment.	4.39	0.67	Agree
21. I expect to receive timely and useful feedback from the instructor.	4.27	0.68	Agree
22. I believe the evaluation method should accurately reflect my learning progress.	4.33	0.66	Agree
Total	4.33	0.47	Agree

The results in Table 4 show that in the questionnaire of opinions on the flipped classroom across all six aspects, the mean value exceeded 4, ranging from 4.29 to 4.49, indicating that students believed the current flipped classroom method had room for improvement in learning resources, teaching methods, technical support, learning outcomes, time management, and evaluation methods. In particular, students were most eager to improve pre-class preparation materials (Mean=4.49, SD=0.30) and time management (Mean=4.42, SD=0.44). Meanwhile, students strongly desired to increase technical readiness (Mean=4.37, SD=0.47) while learning. Overall, students' opinions provided prerequisites and essential

clues for improving the current flipped classroom method, indicating that it was necessary to take measures to satisfy student opinions and to enhance the effectiveness and quality of the flipped classroom.

#### 4.2. Interview of Teachers

**Table 5.**

Results for interview of teachers' opinion on generative AI (n = 5)

Questions	Themes	Sub-themes
Q1: What is your understanding of generative AI and its applications in education?	- Cognition	- General knowledge - Specific applications - Innovative ideas
Q2: How have you integrated generative AI into your teaching practices?	- Integration in teaching	- Content creation and personalization - Interactive learning tools - Assessment and feedback
Q3: What benefits do you perceive generative AI brings to the learning process?	- Perceived benefits	- Engagement - Personalization - Efficiency
Q4: What challenges have you encountered when using generative AI in the classroom?	- Challenges	- Technical difficulties - Student resistance - Resource constraints
Q5: What ethical considerations do you take into account when implementing generative AI tools?	- Ethical considerations	- Privacy concerns - Bias
Q6: What additional support or resources do you need to effectively use generative AI in your teaching?	- Support and resources	- Training - Access to suitable tools

**Table 6.**

Results for interview of teachers' opinion on the flipped classroom (n = 5)

Questions	Themes	Sub-themes
Q1: What is the difference between the flipped classroom teaching method and the traditional teaching method?	- Comparison of teaching methods	- Instructional delivery - Classroom activities - Student participation - Assessment techniques
Q2: What potential advantages and challenges do you see in flipping the classroom for your teaching subject?	- Advantages and challenges	- Student engagement - Learning achievement - Teaching preparation - Technology integration
Q3: What resources and support are needed when implementing a flipped classroom?	- Resources and support	- Technological infrastructure - Professional development - Educational materials - Institutional support
Q4: What specific impacts do you think the flipped classroom has on students' learning achievement and emotional well-being?	- Impacts	- Improved understanding of material - Increased participation - Reduced anxiety through collaborative - Strengthened peer relationships through group activities
Q5: Which courses or subjects do you think are most suitable for the flipped classroom teaching model?	- Suitability of courses	- STEM subjects - Language and literature - Social sciences - Practical and applied sciences
Q6: In the implementation of the flipped classroom, what skills or abilities do students need to have in order to better adapt to this teaching model?	- Skills and abilities needed for students	- Self-regulation and time management - Technological proficiency - Critical thinking and problem-solving - Collaboration and communication
Q7: How would you rate student engagement and interaction in a flipped classroom?	- Student engagement and interaction	- Pre-Class participation - In-Class interaction - Peer collaboration - After-class review and homework

The teacher opinion interviews contained 6 questions for generative AI in Table 5, 7 questions for flipped classroom in Table 6. Through interviews with 5 teachers from different disciplines, this study learned that they relied mainly on traditional teaching methods for most courses. Although they used some methods to increase student interest and engagement in teaching, these approaches had yet to produce significant results. Student attitudes towards generative AI and flipped classrooms were generally low, possibly related to academic pressure, anxiety, and fear of difficulty. It was recommended to explore more attractively engaging pre-class activities, incorporate interactive classroom activities, and utilize technology better to stimulate interest. The teachers agreed that flipped classrooms and generative AI are trends of future education, with more advantages than challenges, and can be reasonably integrated and practiced in teaching. In future teaching, generative AI should be integrated into various subjects to cultivate the digital literacy of teachers and students. The teachers are also optimistic about the development potential of generative AI in future teaching. However, considering the lack of students' experience with these tools, they suggest that special attention should be paid to training, guidance, and the correct use of these tools, especially regarding issues such as privacy and bias. At the same time, the professors emphasized that both individuals and schools should attach great importance to this and provide more resources and support in terms of environment, professionals, and technology. In short, the teachers expressed their willingness to try new teaching methods to provide a more inspiring, innovative, and practical educational experience, and are enthusiastic about the continuous improvement of education.

## **5. Conclusion**

### **5.1. Implications**

In this study, the goal was to understand students and teachers' opinions about generative AI and flipped classroom based on real-life conditions.

Responses from 400 college students were gathered through a questionnaire about their opinions. The results showed students were unsatisfied with the current generative AI tools and flipped classroom approach. Students highly recognized the generative AI tools in improving learning efficiency and answering questions, but were dissatisfied with the standardized use and ethics of generative AI. They hoped to have a deeper understanding of generative AI and expected generative AI tools with more comprehensive functions and better user experience, and these AI tools would be more reassuring in terms of ethics and safety.

This study also investigated students' views on flipped classrooms, and they were positive about them. Students believed that flipped classrooms improved learning enthusiasm, course understanding, and independent learning ability, and that the evaluation system was diversified and timely. Students believed that the more comprehensive and easier-to-understand the preview materials were, the better, and they expected more diverse formats. Students also reported on the effectiveness of flipped classrooms in time planning and the use of technology tools. Overall, flipped classrooms showed good results in promoting student learning.

From the teachers' perspective, interviews revealed that exam-focused education makes students lose interest in many theoretical courses. Teachers felt the traditional flipped classroom approach was not very effective or creative in actual teaching situations. Pre-class materials provided to students were considered boring and unappealing. Teachers thought classroom activities needed better design to encourage student interest and active involvement. Teachers wanted to use technology or varied teaching methods to improve current teaching practices.

When information from students and teachers was combined, one main theme became clear: both groups were concerned about instructional design and teaching methods. They were positive about making changes to current instructional models and using technology in teaching. The recognition of technology's potential benefits in education indicates that people are ready to accept change and explore new methods to create more effective and engaging learning experiences.

The findings from this study on college students' opinions regarding generative AI and the flipped classroom will serve as foundational data for developing an integrated pedagogical model. Future research will utilize these insights to design a comprehensive framework that effectively combines generative AI tools with flipped classroom methodologies, addressing student preferences and concerns identified in this investigation to optimize learning outcomes.

### **5.2. Limitations**

Research shows that the flipped classroom method can improve learning results and academic performance better than traditional methods [33]. But applying this method usually takes more time, effort, and resources from teachers. This approach also has its problems. A major issue is that teachers can't check if students have finished their pre-class tasks until the students attend class. This method strongly depends on students' motivation and ability to learn on their own [34]. Before class, students might not even open the materials given by teachers. As a result, they enter the class without knowing the basic concepts and are unable to answer questions. Students then become frustrated and start avoiding participation because they worry about answering incorrectly or being asked questions they can't answer. This weakens their confidence and makes them feel down. The teacher must then spend class time going through the learning materials again, which he had already prepared. Eventually, students become passive learners, and this reduces the time available for teamwork, problem-solving, and discussion. To solve the issue of students not preparing adequately, using AI-based applications designed to motivate students naturally is recommended.

In spite of the rich insights from this survey study, a number of the study's limitations must be acknowledged. First, the sample's generalizability limits the findings. The study comprised students and teachers from varied academic backgrounds but only from comprehensive universities; it does not include science and engineering, medicine, teacher



training, finance, art, agriculture, and forestry, etc. The findings might not be representative of the experiences of teachers or learners from a wider university system, educational system, or even from different countries [35].

Second, the study relied on self-reported data collected through questionnaires and interviews, which may be influenced by social desirability bias or inaccurate self-assessment, especially when participants were asked about technology use [36]. Although the use of both quantitative and qualitative methods helped reduce this risk, self-reporting remains a common limitation in educational research.

Third, this study provides a snapshot of students' current opinions and perceptions but does not explore how these may change over time. Without a longitudinal approach, it is difficult to understand how students' learning experiences evolve as they become more familiar with generative AI tools or flipped classroom practices.

Lastly, the rapidly changing nature of generative AI presents a challenge for researchers. As new tools and features emerge, user experiences and educational applications can shift quickly, making it difficult to keep research frameworks and measurements up to date [37]. Ongoing studies will be necessary to track these developments and ensure that findings remain relevant.

### 5.3. Future research suggestions

Addressing these limitations in future research will be important for improving the design and evaluation of generative AI-supported flipped classrooms and helping to better support student learning. Future studies might include multiple universities or countries as part of their sample to strengthen external validity. Additionally, future research using a longitudinal design could provide deeper insights into these changes.

The Ten-Year Plan for Education Informatization (2011-2020) placed a strong emphasis on utilizing digital means efficiently in facilitating learning and collaboration. It underlined the necessity for learners to be more proactive in their own learning. Simultaneously, enhancing teachers' and learners' digital literacy, as well as developing better teaching and learning paradigms, were necessary to address challenges of the time. Therefore, digital literacy is also a direction that can be further studied in the future.

This study collected feedback from both teachers and students, bringing together professional insights and real learning experiences. These findings will serve as a foundation for designing a more effective, practical, and learner-centered teaching model in the next phase.

## References

- [1] M. Bond, "Facilitating student engagement through the flipped learning approach in K-12: A systematic review," *Computers & Education*, vol. 151, p. 103819, 2020. <https://doi.org/10.1016/j.compedu.2020.103819>
- [2] G. Akçayır and M. Akçayır, "The flipped classroom: A review of its advantages and challenges," *Computers & Education*, vol. 126, pp. 334-345, 2018. <https://doi.org/10.1016/j.compedu.2018.07.021>
- [3] D. C. D. van Alten, C. Phielix, J. Janssen, and L. Kester, "Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis," *Educational Research Review*, vol. 28, p. 100281, 2019. <https://doi.org/10.1016/j.edurev.2019.05.003>
- [4] C.-L. Lai and G.-J. Hwang, "A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course," *Computers & Education*, vol. 100, pp. 126-140, 2016. <https://doi.org/10.1016/j.compedu.2016.05.006>
- [5] S. Lopez, "Flip your classroom - reach every student in every class every day," *SSRN Electronic Journal*, p. 7, 2025. <http://dx.doi.org/10.2139/ssrn.5074342>
- [6] D. Baidoo-anu and L. Owusu Ansah, "Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning," *Journal of AI*, vol. 7, no. 1, pp. 52-62, 2023. <https://doi.org/10.61969/jai.1337500>
- [7] P. Smutny and P. Schreiberova, "Chatbots for learning: A review of educational chatbots for the Facebook Messenger," *Computers & Education*, vol. 151, p. 103862, 2020. <https://doi.org/10.1016/j.compedu.2020.103862>
- [8] A.-M. M. Gasaymeh and R. M. AlMohtadi, "The effect of flipped interactive learning (FIL) based on ChatGPT on students' skills in a large programming class," *International Journal of Information and Education Technology*, vol. 14, no. 11, pp. 1516-1522, 2024. <https://doi.org/10.18178/ijiet.2024.14.11.2182>
- [9] E. Kümmel, J. Moskaliuk, U. Cress, and J. Kimmerle, "Digital learning environments in higher education: A literature review of the role of individual vs. social settings for measuring learning outcomes," *Education Sciences*, vol. 10, no. 3, p. 78, 2020. <https://doi.org/10.3390/educsci10030078>
- [10] L. A. Schindler, G. J. Burkholder, O. A. Morad, and C. Marsh, "Computer-based technology and student engagement: A critical review of the literature," *International Journal of Educational Technology in Higher Education*, vol. 14, no. 1, p. 25, 2017. <https://doi.org/10.1186/s41239-017-0063-0>
- [11] P. Strelan, A. Osborn, and E. Palmer, "The flipped classroom: A meta-analysis of effects on student performance across disciplines and education levels," *Educational Research Review*, vol. 30, p. 100314, 2020. <https://doi.org/10.1016/j.edurev.2020.100314>
- [12] M. Muqri, S. Obeid, and G. Duclos, "Generative AI in education: Platforms, applications, and ethical considerations," in *2025 Northeast Section Conference Proceedings*, 2025.
- [13] L. Ding, "A study on the implementation effects of flipped classrooms versus traditional classrooms," *Higher Education and Practice*, vol. 1, no. 7, pp. 27-32, 2024. <https://doi.org/10.62381/h241705>
- [14] A. Renz, *AI in education: Educational technology and AI: Challenges and requirements for the educational technologies of the future. Work and AI 2030: Challenges and Strategies for Tomorrow's Work*. Wiesbaden: Springer, 2023.
- [15] S. Amar and K. Benchouk, *The role of generative AI in higher education: Fostering teamwork and interaction as a virtual teaching assistance. General Aspects of Applying Generative AI in Higher Education: Opportunities and Challenges*. Cham: Springer, 2024, pp. 39-53.

- [16] N. Abbas, I. Ali, R. Manzoor, T. Hussain, and M. Hussaini, "Role of artificial intelligence tools in enhancing students' educational performance at higher levels," *Journal of Artificial Intelligence, Machine Learning and Neural Network*, vol. 3, no. 5, pp. 36-49, 2023. <https://doi.org/10.55529/jaimlenn.35.36.49>
- [17] S. Korkut, R. Dornberger, P. Diwanji, B. Puthur Simon, and M. Maerki, "Success factors of online learning videos," *International Journal of Interactive Mobile Technologies (iJIM)*, vol. 9, no. 4, pp. 17-22, 2015. <https://doi.org/10.3991/ijim.v9i4.4460>
- [18] N. Cong-Lem, T. N. Tran, and T. T. Nguyen, "Academic integrity in the age of generative AI: Perceptions and responses of Vietnamese EFL teachers," *Teaching English with Technology*, vol. 24, no. 1, pp. 28-47, 2024.
- [19] H. Y. Jang and H. J. Kim, "A meta-analysis of the cognitive, affective, and interpersonal outcomes of flipped classrooms in higher education," *Education Sciences*, vol. 10, no. 4, p. 115, 2020. <https://doi.org/10.3390/educsci10040115>
- [20] M. Kus, "Effectiveness of the flipped classroom model in higher education: A meta analysis study," *Journal of Computer and Education Research*, vol. 13, no. 25, pp. 628-653, 2025. <https://doi.org/10.18009/jcer.1625784>
- [21] Z. Zainuddin and S. H. Halili, "Flipped classroom research and trends from different fields of study," *The International Review of Research in Open and Distributed Learning*, vol. 17, no. 3, 2016. <https://doi.org/10.19173/irrodl.v17i3.2274>
- [22] J. Blahopoulou and S. Ortiz-Bonnin, "Student perceptions of ChatGPT: Benefits, costs, and attitudinal differences between users and non-users toward AI integration in higher education," *Education and Information Technologies*, 2025. <https://doi.org/10.1007/s10639-025-13575-9>
- [23] C. K. Y. Chan and W. Hu, "Students' voices on generative AI: Perceptions, benefits, and challenges in higher education," *International Journal of Educational Technology in Higher Education*, vol. 20, no. 1, p. 43, 2023. <https://doi.org/10.1186/s41239-023-00411-8>
- [24] J. M. Golding, A. Lippert, J. S. Neuschatz, I. Salomon, and K. Burke, "Generative AI and college students: Use and perceptions," *Teaching of Psychology*, vol. 52, no. 3, pp. 369-380, 2025. <https://doi.org/10.1177/00986283241280350>
- [25] J. M. Campillo-Ferrer and P. Miralles-Martínez, "Effectiveness of the flipped classroom model on students' self-reported motivation and learning during the COVID-19 pandemic," *Humanities and Social Sciences Communications*, vol. 8, no. 1, p. 176, 2021. <https://doi.org/10.1057/s41599-021-00860-4>
- [26] E. Colomo-Magaña, R. Soto-Varela, J. Ruiz-Palmero, and M. Gómez-García, "University students' perception of the usefulness of the flipped classroom methodology," *Education Sciences*, vol. 10, no. 10, p. 275, 2020. <https://doi.org/10.3390/educsci10100275>
- [27] J. Bishop and M. A. Verleger, "The flipped classroom: A survey of the research," in *2013 ASEE Annual Conference & Exposition*, 2013.
- [28] Y. Sun, X. Zhao, X. Li, and F. Yu, "Effectiveness of the flipped classroom on self-efficacy among students: A meta-analysis," *Cogent Education*, vol. 10, no. 2, p. 2287886, 2023. <https://doi.org/10.1080/2331186X.2023.2287886>
- [29] Q. Zhang, E. S. Cheung, and C. S. Cheung, "The impact of flipped classroom on college students' academic performance: A meta-analysis based on 20 experimental studies," *Science Insights Education Frontiers*, vol. 8, no. 2, pp. 1059-1080, 2021. <https://doi.org/10.2139/ssrn.3838807>
- [30] L. J. Cronbach, "Coefficient alpha and the internal structure of tests," *Psychometrika*, vol. 16, no. 3, pp. 297-334, 1951.
- [31] J. V. Nye, "Revisionist tariff history and the theory of hegemonic stability," *Politics & Society*, vol. 19, no. 2, pp. 209-232, 1991.
- [32] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77-101, 2006. <https://doi.org/10.1191/1478088706qp063oa>
- [33] S. A. Gondal, A. Q. Khan, E. U. Cheema, and I. S. Dehele, "Impact of the flipped classroom on students' academic performance and satisfaction in Pharmacy education: A quasi-experimental study," *Cogent Education*, vol. 11, no. 1, p. 2378246, 2024/12/31 2024. <https://doi.org/10.1080/2331186X.2024.2378246>
- [34] R. Rajhans and T. Saroh, "Impact of flipped classroom approach on academic achievement of postgraduate students," *International Journal of Multidisciplinary Research in Arts, Science and Technology*, vol. 2, no. 8, pp. 30-41, 2024. <https://doi.org/10.61778/ijmrast.v2i8.75>
- [35] R. Ray, "Designing and conducting mixed methods research," *Qualitative Research Journal*, vol. 7, no. 2, pp. 90-91, 2007. <https://doi.org/10.3316/qjrj0702090>
- [36] P. M. Podsakoff, S. B. MacKenzie, J.-Y. Lee, and N. P. Podsakoff, "Common method biases in behavioral research: A critical review of the literature and recommended remedies," *Journal of Applied Psychology*, vol. 88, no. 5, pp. 879-903, 2003. <https://doi.org/10.1037/0021-9010.88.5.879>
- [37] 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?," *International Journal of Educational Technology in Higher Education*, vol. 16, no. 1, p. 39, 2019. <https://doi.org/10.1186/s41239-019-0171-0>