Enhancing Student Engagement in a Flipped Hindi Classroom through Classroom Response Systems

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***Abstract*—Flipped learning, known for promoting critical thinking and learner-centric environments, faces a challenge in crafting effective in-class strategies, particularly in language classes. This study presents a flipped learning class centered around instant feedback integration. The goal is to enhance student engagement in a Hindi flipped classroom by combining Classroom Response System (CRS) with deliberate instructional strategies. While CRS is recognized for promoting active learning, limited research exists on designing effective in-class activities using CRS in a flipped setting. In this Hindi class, the flipped learning implementation extended beyond video lectures, encompassing quizzes and student-generated questions. This innovative approach emphasizes student autonomy, engagement, and critical thinking to foster active participation. A survey was conducted to evaluate the perceptions of 33 students enrolled in the 'Intermediate Hindi I' course regarding the CRS-based flipped learning, with focus on Satisfaction (S), Engagement (E), and Relevance (R). Employing a mixed-methods sequential explanatory design, the study revealed significant correlations between academic performance scores, attendance rates, and interest in CRS-based flipped learning. Higher academic performances were associated with increased interest, while lower academic performances showed diminished interest. A Focus Group Interview with low-performing students further supported these findings. Overall, this research sheds light on the effectiveness of CRS-based flipped learning in a language class, emphasizing the impact on student outcomes based on academic performances and attendance.**

***Keywords*—active engagement, Classroom Response System (CRS), Hindi flipped classroom, instant feedback, student-generated question**

I. Introduction

In recent years, there has been a growing interest in learner-centered teaching approaches within the field of education, aiming to enhance students' active class participation, problem-solving skills, and fostering a proactive and critical thinking [1]. Learner-centered education not only emphasizes the application of acquired knowledge but also stresses the ability to reconstruct knowledge. This approach is crucial for students as it encourages their active participation in the learning process, leading to a deeper understanding of the material and improved retention. Instructors cannot simply transfer knowledge to students; instead, it is the students' active process of constructing knowledge within their own minds that facilitates meaningful learning [2]. This active engagement with knowledge ultimately results in its meaningful assimilation and accommodation by learners [3].

This shift signifies a move from traditional teacher-centered instruction to a learner-centered approach in higher education [4]. Despite various attempts to implement learner-centered education in different educational settings since the 1990s, practical challenges have impeded its widespread adoption. These challenges stem from its multifaceted and somewhat vague nature, the persistence of traditional educational environments, and the absence of suitable teaching methods. However, the emergence of the internet and digital technology has disrupted the conventional belief that education solely occurs within the physical classroom, paving the way for a new digital educational environment and underscoring the potential of learner-centered education. In response to these changes, Bergmann and Sams initiated experimentation with a teaching method known as 'flipped learning', which flips traditional teaching methods on their head [5].

Flipped learning, renowned for its metacognitive learning benefits achieved through the integration of various elements in both online and offline contexts, is also gaining recognition as a self-directed learning approach [6–9]. Subsequently, students actively participate in various in-class activities to put their recently acquired knowledge into practical manner [5]. In this approach, students are motivated to engage in self-directed learning using online materials and are encouraged to seek clarification or pose questions during class, based on their individual challenges and needs [10]. Over the past decade, it has not only received considerable attention but has also been the central topic of extensive conversations among educators and researchers [11]. Additionally, it has gained significant interest in higher education for its capacity to enable students to access knowledge and information from a wide range of technological resources outside the classroom while still benefiting from traditional face-to-face instruction within the classroom [12, 13].

Hence, flipped learning has emerged as a significant educational trend in recent years [14, 15]. Numerous studies have explored various aspects of flipped learning, such as class design, satisfaction, learning effects, and motivation, student engagement, etc. [10, 16–20]. However, there is a noticeable scarcity of research regarding language-class activities, specifically focusing on communication and feedback with students during class time [10]. While flipped learning presents numerous advantages as a model for learner-centered education, it can be challenging to stimulate active student engagement in critical foreign language courses like Hindi. Even though various attempts have been made to implement flipped learning in language

classes [21–24], the inherent nature of these classes often makes it difficult for learners, who are in the process of acquiring a new language, to interact with one another, ask questions, and seek confirmation independently. In light of this context, this study aims to enhance active student involvement in the classroom by integrating feedback mechanisms into the flipped learning approach. The engagement of students has assumed a prominent role in the context of teaching and learning, particularly in the context of learner-centered education [25].

Therefore, this study intends to implement a flipped learning approach with instant feedback to enhance student participation and foster a more dynamic student-centered classroom environment. The effectiveness of this approach will be assessed through the implementation of a feedback-based flipped learning class, involving 33 students enrolled in the 'Intermediate Hindi I' course within the Department of Indian language at HanKuk University of Foreign Studies in Korea during the year 2022.

Active learning emphasizes the significance of students actively participating in the instructional process [26]. This approach has the potential to transform students' attitudes towards learning and greatly bolster their motivation [27]. It is increasingly recognized as a more effective teaching method compared to traditional lecturing [28, 29]. However, the generally positive perception of the effectiveness of active learning is counterbalanced by various observations that illuminate its challenges. Notably, a significant number of students refrain from actively engaging in group activities and often feel excluded from crucial processes, such as discussing, monitoring, and assessing their peers' contributions within the group [30].

In conventional classrooms, the lecturer's questions are often rhetorical, with only a small subset of students actively participating by raising their hands and offering answers. In contrast, in a flipped classroom, the primary objective should always be to engage all students actively. Flipped classrooms employ a diverse range of in-class activities to not only enhance students' academic achievements but also cultivate positive attitudes toward learning, inspiring them to actively participate in their own educational journey [31, 32]. The effectiveness of these activities depends on the specific cognitive processes they stimulate, irrespective of whether they occur in a traditional lecture-based classroom or a flipped classroom [32]. However, the challenge lies in how to encourage greater student participation in flipped learning-based language classes. Despite the general effectiveness of flipped language classes [21–23], the reality is that language classes are often less active than discussions and experiments in disciplines such as social sciences or engineering. Flipped learning-based language classes may prove less satisfying than traditional classes if students are not sufficiently engaged in class activities. In a traditional classroom, the instructor typically provides structured lectures and guidance throughout the class, which can be more passive for the students. In a flipped learning environment, students are expected to take a more active role in their learning, and a lack of engagement can lead to a less satisfying experience. The success of flipped learning hinges on both the instructor's course design and the students' willingness to engage actively in the learning process. When executed effectively, it can lead to a deeper understanding and more satisfying language learning experiences.

Therefore, classrooms should be viewed as intricate systems of interactions where social dynamics and instructional elements mutually influence and interact in intricate ways [33]. Instructors can employ a flipped speaking course as a strategy to enhance students' motivation and engagement, encouraging them to take on more responsibility for their own learning [34]. Flipped classrooms are renowned for their departure from the traditional format of in-class lectures and out-of-class homework. Instead, they promote independent student study through online learning materials and encourage students to pose questions related to their specific challenges during class. Flipped classrooms incorporate a diverse array of in-class activities, including role-playing, debates, problem-based learning, collaborative learning, and peer teaching, along with out-of-class activities. These approaches aim to not only enhance students' academic achievements but also to cultivate positive attitudes toward learning, prompting active and engaged roles in their education [31, 32]. Flipped learning represents a departure from the traditional classroom lecture format, emphasizing engagement in a range of activities [14]. In the flipped learning model, students assume a more active role by employing self-directed learning methods and participating in interactive activities during class. Thus, flipped activities should be designed to promote meaningful student discussions and should incorporate assessments that enable students to assess their own understanding and effectively track their progress [35]. In a flipped classroom, instructors should offer explicit guidelines and instructions to students regarding their involvement in class activities. Mere requests for participation without clear guidance can undermine the effectiveness of the learning experience.

One effective approach to encourage students' active participation in class may be to provide immediate feedback that addresses and resolves students' questions while adjusting the progression of their studies based on their individual level. Classes centered on feedback as a means to enhance student participation can significantly boost active learning and enrich the educational journey. Feedback-based classes that focus on student participation can empower learners to take an active role in their education and enhance their communication and critical thinking skills. It's crucial to strike a balance between encouraging participation and accommodating individual needs and learning styles to create a positive and effective learning experience.

In recent years, there has been a noteworthy shift in educators' understanding of feedback and the role of technology in supporting and enhancing the feedback process [36]. Traditionally, feedback has been viewed as information provided to students, often in the form of comments on their assignments or work [37]. Instructors can now allocate more in-class time to monitoring student progress and providing adaptive, real-time feedback to either individual students or groups [38–40]. Information, including feedback, provided to students, can influence their learning when students actively engage with it [36]. Instructors can indeed devote more time to actively engaging

with students rather than relying solely on lecturing. This shift offers valuable opportunities to provide personalized feedback and assistance. Furthermore, this approach encourages students to give feedback to their peers regarding the activities they are participating in, aiding in identifying areas of confusion and enhancing overall comprehension [35]. Feedback is often identified as the most influential factor in meta-analyses assessing the impact of various interventions on learning outcomes [41]. As new technologies advance, instructors should expand their understanding and utilization of feedback-a concept known as "teacher feedback literacy" [42]. This entails the competence to adeptly utilize feedback methods and technological tools to enhance the overall learning experience for students. It emphasizes the dynamic and interactive nature of the learning process and the importance of feedback in supporting effective learning.

The flipped classroom approach revolves around leveraging internet technology to enrich the classroom learning experience, enabling instructors to allocate more time to actively engage and communicate with students, departing from the traditional focus on delivering lectures. Fundamentally, the flipped classroom emphasizes student self-regulation and active participation in the learning process. The adoption of technology-mediated instructional strategies has shown to positively impact students' motivation, performance, and engagement in self-directed learning [43, 44]. Independent questioning can stimulate active participation among students, leading some foreign language educators to advocate the use of WebQuests for active learning [45, 46]. As technology and innovations continue to gain prominence in education, tools such as the Audience Response System (ARS) have been employed to enhance teaching. ARS, initially used in U.S. universities in the 1960s [47], allows students to participate anonymously, encouraging engagement, particularly among reserved students who might otherwise hesitate to participate [48]. This anonymity can reduce feelings of conformity, shame, and anxiety in the classroom [49].

While ARS is often praised for its ability to enhance learner motivation and engagement, particularly in large classes [50], its impact on improving student academic performance, such as exam scores, remains less clear [51, 52]. Alternatively, a CRS can serve as a substitute tool for immediate and real-time assessment using interactive programs or Apps. CRS enables instructors to pose questions to students, swiftly collect their responses, and display the aggregated responses of the entire class. Emerging technologies like smartphone-assisted learning systems and student response systems, when integrated into flipped classrooms, have the potential to enhance language students' learning outcomes and motivation [53–56]. These technologies have been instrumental in improving agent-based multimedia learning, leading to increased comprehension and motivation among students [57].

CRS is known by various names, including Student Response System (SRS), Electronic Response Systems (ERS), Polling Systems, Clickers, and more. Studies indicate that the advantages of CRS encompass improved perceptions of class sessions as more interactive, captivating, and enjoyable. Educators and students both acknowledge that these systems increase awareness of students' comprehension levels, resulting in more adaptive teaching and enhanced understanding [58].

In recent years, there has been a growing need to create an environment where students can anonymously share their answers in class, safeguarding the privacy of their knowledge. The provision of instant feedback for both students and instructors on specific questions has become increasingly crucial. This approach allows students to express their thoughts without worry about potential public embarrassment or more vocal peers dominating the discussion. The adoption of CRS technology is on the rise in educational settings, cultivating a dynamic and interactive classroom atmosphere that enriches the learning experience for both instructors and students.

In the context of a flipped classroom, CRS offers an effective way for teachers to structure in-class activities, involving posing questions, collecting responses, displaying responses, and generating reports [21]. It is a technological tool that actively engages students in the learning process by allowing them to anonymously respond to questions posed by the instructor during class and providing instant feedback [59]. This makes CRS an ideal educational technology tool for instructors to use during flipped classroom instruction.

Therefore, this research introduces a unique and innovative aspect to flipped learning by integrating Classroom Response Systems (CRS). In contrast to traditional flipped learning methods, this approach places significant emphasis on real-time interaction and immediate feedback, creating an active and engaging learning environment for students. It not only allows students to address questions posed by the instructor but also encourages them to actively contribute and respond to their peers' inquiries, enhancing both individual and collective participation and strengthening the instructor's role as a facilitator. In summary, the distinctive aspect of this study lies in introducing CRS within the context of flipped learning. While existing literature often underscores the significance of in-class activities, this research specifically targets the incorporation of CRS technology to enhance active learning during in-class sessions, filling a notable research gap. Furthermore, the study recognizes the importance of not only utilizing the instructor's questions in the classroom but also integrating 'student-generated questions' to stimulate internal motivation.

II. Literature Review

The flipped teaching approach is often praised for affording students in the flipped classroom with more opportunities to develop higher-order thinking skills, guided by teachers and with peer support as needed. This shift occurs because traditional in-class lectures, which primarily engage lower-level thinking skills according to Bloom's Taxonomy (1984), are replaced with instructional videos, all while maintaining the depth of learning content [60]. The flipped classroom approach creates a student-centered, interactive, and communicative learning environment, which fosters student motivation [21]. Additionally, it enables in-class

activities to focus on communicative and productive tasks [22], fostering an active learning environment [61]. However, there is a noticeable lack of emphasis on well-thought-out instructional strategies for in-class activities while providing sustained support for students' self-regulation in language classrooms.

Two critical factors that influence students' self-regulation in learning English as a Foreign Language (EFL) are learning motivation and self-efficacy. Both learning motivation and self-efficacy significantly impact students' learning performance in the context of EFL, whether in a traditional instructional setting or a flipped class [10]. Creating a technology-based classroom environment that fosters active interaction is one of the most effective methods for nurturing students' proficiency in foreign languages [62]. The academic literature effectively demonstrates the significant impact of Information and Communication Technologies (ICTs) on student learning [63].

Recent research indicates that certain learner characteristics play a role in their ability to comprehend and utilize feedback effectively [64, 65]. It is also encouraged to offer comprehensive descriptions of the activities utilized for both in-class and out-of-class settings. The widespread availability of recording technology and web-based dissemination tools has made research on the flipped classroom relevant and cost-effective [15].

The skillful integration of technology into the learning process has the potential to yield substantial benefits for students' educational experiences [66]. Many scholars consider the integration of educational technology into language learning as one of the intriguing advancements in the field of language education [67]. Integrating technology into education equips students with the knowledge and skills necessary to meet the demands of the 21st century [68]. The implementation of innovation has been theorized to trigger a shift in both instructional and epistemological beliefs held by students [69]. Researchers have effectively utilized multimedia features to enhance the acquisition of different languages within the framework of flipped classrooms [70]. Digital technologies have significantly enhanced the capabilities of pedagogical agents, particularly when combined with problem-solving and inquiry processes and structured representation [57].

While previous studies have delved into the advantages of employing CRS, underscoring the positive influence on active student engagement and academic performance [16, 71–73], limited research exists on the application of CRS or feedback within the context of flipped learning [10, 16, 55, 56].

One common mistake made by instructors new to flipped instruction is overinvesting time in developing high-quality out-of-class video presentations or lectures, which can sometimes lead to inadequate preparation of engaging in-class activities [35]. In a typical flipped classroom approach, students have access to online video lectures before their in-class sessions, which equips them to engage in more interactive and higher-order activities, such as problem-solving, discussions, and debates, during their classroom time [9, 38, 39, 74]. Recent studies have focused on examining the impact of in-class activity design on students' learning outcomes, including the influence of team-based learning on student performance [75], inquiry-based learning, active learning, and peer learning [76], and the utilization of a Self-Regulated Learning system in a flipped classroom [70].

In contrast to previous research that generally supports the flipped classroom concept, this study distinguishes itself by centering on the implementation of active learning methods facilitated by straightforward technology. The focus is on enabling students to actively participate during in-class sessions, with a specific emphasis on the novel use of Classroom Response System (CRS) technology in a flipped learning approach. This innovative method seeks to optimize the advantages of the flipped classroom model while simultaneously elevating student satisfaction.

While CRS is increasingly recognized for fostering active and engaged learning experiences, there is a notable gap in research concerning the design of interactive, captivating, and efficient in-class activities using CRS in a flipped classroom setting. This study proposes the use of CRS to assist instructors in structuring in-class activities within a flipped language classroom, employing a pre-experimental approach in a Hindi university classroom to evaluate its effectiveness. The study positions CRS as a valuable technological resource for fostering active learning in a Hindi flipped classroom, aiming to enhance student engagement through the integration of deliberate instructional strategies.

Notably, this research extends beyond conventional flipped learning practices by incorporating CRS beyond video lectures. It introduces a student-centric approach by integrating quizzes and questions generated by the students themselves, deviating from the reliance solely on instructor-created questions. This inventive approach places a strong emphasis on student autonomy, participation, and critical thinking, empowering students to actively shape the course's trajectory. Consequently, students assume a more engaged role, fostering inquiry, discussion, and a deeper exploration of the subject matter, enriching the overall learning experience.

In the context of flipped learning, designing engaging in-class activities is crucial for applying online knowledge effectively. Open expression of opinions fosters active participation [77], while motivation significantly influences learning performance [78]. Enhanced feedback mechanisms support self-regulated learning and motivation [79], essential in language learning [36].

Flipped classrooms, when combined with technology like CRS, promote active learning and optimize class time [70]. This study integrates CRS into flipped learning, aiming for a learner-centered approach to encourage active participation. Effective technology-driven activities are crucial for classroom success [38].

Through a case study in a Hindi language classroom, it aims to create a student-centered environment with activities like student-generated questions and instant feedback using CRS.

Therefore, this research proposes that CRS-based flipped learning is the most suitable approach for enhancing student motivation and sustaining the flipped learning model. It aims to address the following research questions:

1) What recommendations can be made to instructors to maximize the effectiveness of flipped learning in a Hindi classroom, particularly for promoting active student engagement?
2) Does CRS-based flipped learning show variations in class participation, motivation, and satisfaction based on academic performance?
3) What challenges and barriers may students and instructors encounter when implementing CRS for student-generated questions in a flipped classroom, and how can these challenges be effectively addressed?

III. Materials and Methods

A. Research Context: Student-Generated Questions Approach in a Flipped Classroom Utilizing CRS

In recent years, extensive research has delved into the effectiveness of flipped learning across various academic disciplines, focusing on learning outcomes, satisfaction levels, and class design. However, a noticeable gap exists in the exploration of instant feedback mechanisms to actively engage learners in the learning process. This study addresses this gap by investigating the integration of instant feedback through student-generated questions using Classroom Response Systems (CRS) in a flipped Hindi class.

The study was conducted over a 16-week period in the "Intermediate Hindi I" class at Hankuk University of Foreign Studies. During this course, students watched video lectures on Hindi grammar, completed related quizzes, and were encouraged to formulate their own questions. In-class activities involved team discussions and tasks centered around the video content (Table 1).

Table 1. Implementation of CRS with student-generated questions

Step	Process	Description
1	Selecting the CRS	▪ Choose a CRS platform that suits teaching objectives
2	Designing Pre-class	▪ Develop pre-class materials such as video lectures, readings, and quizzes
3	Encouraging question generation	▪ Instruct students to generate questions based on the pre-class materials for peers ▪ Encourage critical thinking and the creation of questions that address the material's key points
4	Utilizing CRS for in-class activities	▪ Employ the CRS for conducting quizzes and polls created by instructors ▪ Allocate time for students to present and discuss their own questions
5	Providing Feedback	▪ Offer feedback and clarification questions ▪ Ensure students' comprehension ▪ Check students' quiz score
6	Reflection on the class	▪ Identify both strength and weakness of the class ▪ Promote students' participation in generating questions for future improvement

The primary objective was to validate the effectiveness of incorporating instant feedback through student-generated questions in a flipped learning environment. This approach not only enhances student engagement but also fosters critical thinking and active participation. Additionally, it provides instructors with valuable data to adapt their teaching methods and empowers students to take a more proactive role in their education.

By integrating CRS with student-generated questions, instructors can create a dynamic learning environment where students are not only assessed but also encouraged to construct knowledge actively. This approach places students at the center of the learning process, leveraging their background knowledge and experiences to interact with peers and construct meaningful understanding.

Hence, in the classroom, it is essential not only to employ the instructor's questions but also to incorporate 'student questions' that stimulate internal motivation. Students, by thinking critically to formulate questions, can enhance their communication and collaboration skills through interactions and discussions. This process can also foster creativity. The flowchart illustrates the steps involved in students generating questions, submitting them to the instructor, incorporating them into the CRS. The instructor's role encompasses selecting questions, facilitating discussions, offering supplementary explanations, and summarizing the session to provide a comprehensive learning experience (Table 2).

Table 2. Flow chart for student-generated questions in flipped learning

	Step	Description
Pre-class	1	Watch flipped learning video independently
	2	Self-generated questions related to the content
	3	Submit questions to instructor
	4	Question selection and pre-registered in CRS
In-class	5	CRS is utilized to share and address questions
	6	Participate by responding and discussing
	7	Instructor's supplementary explanation
	8	Summarize key points

CRS-based flipped learning enhances traditional flipped classroom methods by integrating CRS, also known as clickers, to provide immediate feedback and encourage active learning and teaching strategies. Using tools such as Socrative, teachers can efficiently provide immediate feedback to students, which is highly valued [67]. Accessible via web and mobile apps, Socrative enables real-time engagement and assessment by allowing teachers to create quizzes, polls and assessments with different types of questions. Students can actively participate by answering questions on their smartphones within a set timeframe, encouraging classroom engagement and providing teachers with immediate assessment opportunities.

In this approach, students engage with pre-class materials as usual, but Socrative is used during in-class sessions for real-time interaction and feedback. Students respond anonymously to questions posed by the instructor, facilitating formative assessment, comprehension and active engagement. CRS-based flipped learning provides valuable insights into student understanding, enabling teachers to adapt teaching methods based on immediate feedback.

Compared to traditional flipped learning, CRS-based flipped learning introduces a dynamic change by using CRS for instant feedback and anonymous interaction, encouraging open participation and fostering collaborative learning. Unlike traditional methods that rely on longer response times, CRS-based flipped learning offers immediate assessment and peer collaboration. At the end of the semester, students participated in a voluntary survey to provide feedback on the

use of CRS (Socrative) in a Hindi flipped classroom.

B. Analytic Framework: Perception of Satisfaction-Engagement-Relevance Survey

This research utilized a combination of quantitative and qualitative methods to comprehensively explore students' experiences with flipped learning using CRS (Socrative). An analytical framework was specifically designed for this study to evaluate students' perspectives on satisfaction, class engagement, and the relevance of CRS within the context of the course.

The survey was structured to align with the core principles of the flipped classroom model, which emphasizes student self-regulation and active engagement in learning [72]. It aimed to assess satisfaction, classroom engagement and the relevance of CRS within the course. Essentially, it sought to understand the key components that contribute to an active learning experience. Emphasizing three key factors - satisfaction (S), engagement (E) and relevance (R) - the survey aimed to assess students' perspectives on CRS-based flipped learning. It measured students' satisfaction with the learning process and outcomes, their interest and curiosity, and their connection to the knowledge and learning process.For students to maintain an enduring enthusiasm for learning, they must derive satisfaction from the learning process or its outcomes (S). The cultivation and perpetuation of students' inquisitiveness and interest are paramount (E), particularly when they generate their own questions and promptly receive feedback from both peers and instructors, thus fueling their motivation to learn. Moreover, students must establish a sense of connection with the knowledge and the learning process. This connection remains vital even if the content is relevant, as it makes students feel more proficient in their learning. This competence can be a motivating factor, especially when influenced by factors such as low confidence, overconfidence, or unrealistic expectations of success (R).

C. Focus Group Interviews

In addition to the survey, a single Focused Group Interview (FGI) was conducted as part of a mixed-methods sequential explanatory design [80]. The FGI involved students with lower academic performances from the flipped learning class, with the expectation that those students might show increased interest and motivation through the use of the classroom response system, which ensured anonymity.

However, the survey's descriptive statistics revealed unexpected outcomes, with students with high academic performances exhibiting lower performance. The FGI was conducted to explore the reasons behind this unexpected result, and the interview aimed to gain insights into the dynamics of student engagement in the flipped learning class. The interview lasted for 50 minutes with the participants' consent.

D. Classroom Description

The Intermediate Hindi I module is designed as a 16-week course with two-hour weekly sessions. A total of 33 students are enrolled in this course, with 22 sophomores and the remaining students being juniors and seniors. This includes 11 students who re-enrolled after not earning credits in the previous year. The course focuses on imparting Hindi grammar and sentence structure skills for intermediate-level communication and composition. This course is conducted in a blended format, combining online modules with interactive in-person or virtual sessions. Participants engaged in discussions, hands-on activities, and collaborative projects. Active participation and question generation are encouraged to simulate an engaging learning experience.

The study is divided into two distinct phases: one conducted before to the midterm exams and another conducted after. In the pre-midterm phase, a traditional flipped classroom approach was employed. Post-midterm, the study transitioned to a CRS-based flipped learning model using Socrative. The following sections provide a detailed comparison of the design and execution of the general flipped classroom and the CRS-based flipped approach (Table 3).

Table 3. Description of general flipped and CRS-based flipped

	General Flipped	CRS-Based Flipped
Pre-class	Video lecture	
	Readings	
	Quizzes/Self-assessment	
	null	Creating Questions
In-class	Peer Teaching & Learning	
	Group Discussion & Activities	
	Checking Quiz & Assignment	
	Teacher's Feedback /Review	Teacher's Instant Feedback anonymously with CRS
		Peer's Instant Feedback with CRS
	Group activities	Group as well as Individual activities
Post-class	Homework Assignment	
	Reflective Journals	
	null	Reflecting on peer's competency
Interaction	Depending on class dynamics & instructor facilitation	Real-time interaction & Anonymous participation
Feedback	Paper/oral	CRS/oral/screen
	Open	Anonymity
	Long-term/Delayed feedback	Short-term/instant feedback

Throughout the study, we conducted an analysis considering that student motivation may vary in relation to their academic performances. Students were categorized into five groups based on their academic performance: A+/A, B+/B, C+/C, D+/D, and F (Table 4). These grades were determined through evaluations conducted at the conclusion of the semester.

Table 4. Participant academic performance demographics

		Excellent	Very Good	Good	Not Bad	Bad	
gender	male	1	1	3	4	2	11
	female	7	2	5	5	3	22
total		8	3	8	9	5	33

IV. Result

In this study, we employed a questionnaire (refer to Appendix A) thoughtfully designed to assess the levels of satisfaction, class engagement, and the relevance of CRS within the course's framework. Essentially, the survey dissects the essential components and procedures that underlie the active learning experience. It posits that three fundamental factors—Satisfaction (S), Engagement (E), and Relevance (R)—serve as the primary building blocks for evaluating students' perspectives on CRS-based flipped

learning. Respondents provided ordinal responses on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The surveys were administered through the university's Learning Management System (LMS). The "e-class" LMS at Hankuk University of Foreign Studies functions as a digital platform overseeing course management, communication, assessments, and collaboration. It consolidates educational resources, fosters interaction between students and instructors, and provides support for progress tracking and analytics. We utilized these data in SPSS 21 to explore how each variable exhibit variation based on distinct student factors, including their academic performance, , attendance rate, and gender, among others.

The questionnaire had high reliability, Cronbach's α = 0.941 (Table 5).

Table 5. Reliability of survey

Cronbach's Alpha	N of Items
0.941	16

The means and standard deviations of SER by academic performance score are presented in Table 6. A one-way ANOVA was conducted to assess the impact of five distinct academic performances on satisfaction levels, class engagement, and the relevance of CRS with student-generated questions in a flipped Hindi classroom (Table 6). The result of the one-way ANOVA indicated statistically significant differences among at least two groups in Satisfaction ($F(4, 28) = 4.911$, $p = 0.004$), Engagement ($F(4, 28) = 5.002$, $p = 0.004$), and Relevance $F(4, 28) = 6.136$, $p = 0.001$).

Table 6. Overall results of SER by academic performance score

		Group	M	SD
Satisfaction	A	Excellent (A+)	4.725	0.44
	B	Very Good (A)	4.600	0.40
	C	Good (B+)	4.657	0.39
	D	Not Bad (B)	4.114	0.47
	E	Bad (C+/below)	3.725	0.74
Engagement	A	Excellent (A+)	4.725	0.46
	B	Very Good (A)	4.333	0.42
	C	Good (B+)	4.371	0.44
	D	Not Bad (B)	3.914	0.56
	E	Bad (C+/below)	3.575	0.72
Relevance	A	Excellent (A+)	4.688	0.35
	B	Very Good (A)	4.500	0.50
	C	Good (B+)	4.119	0.71
	D	Not Bad (B)	3.714	0.61
	E	Bad (C+/below)	3.417	0.58

Post hoc analyses using Scheff*é*'s test and the Games-Howell test for multiple comparisons revealed notable distinction in SER scores between various groups. Specially, the post-hoc test for satisfaction showed that group E exhibited significantly lower than both group A ($p = 0.017$, 95% C.I. = –1.87, –0.13, M.D. = –1.000) and group C ($p = 0.039$, 95% C.I. = –1.83, –0.03, M.D. = –0.932). Regarding Engagement scores, group A showed significantly higher engagement compared to group E ($p = 0.008$, 95% C.I. = 0.24, 2.06, M.D. = 1.150). For Relevance, group A is higher than group D ($p = 0.048$, 95% C.I. = 0.007, 1.94, M.D. = 0.97) and group E ($p = 0.004$, 95% C.I. = 0.34, 2.20, M.D. = 1.27).

The means and standard deviations of SER by academic performance and attendance are presented in Table 7 and Table 8 respectively.

Table 7. ANOVA results of SER by academic performance score

		Sum of Squares	df	Mean Square	F	Sig.	Post-hoc
S	Between	5.470	4	1.367	4.911	0.004	A, C > E
	Within	7.796	28	0.278			
E	Between	6.117	4	1.529	5.002	0.004	A > E
	Within	8.560	28	0.306			
R	Between	7.883	4	1.971	6.136	0.001	A > D, E
	Within	8.993	28	0.321			

Table 8. Overall results of SER by attendance rate

		Group	M	SD
Satisfaction	A	Excellent (100%)	4.627	0.39
	B	Very Good (95%)	4.720	0.41
	C	Good (90%)	4.033	0.43
	D	Not Bad (85%)	3.800	0.85
	E	Bad (80%~75%)	3.600	0.86
Engagement	A	Excellent (100%)	4.507	0.55
	B	Very Good (95%)	4.560	0.54
	C	Good (90%)	3.767	0.34
	D	Not Bad (85%)	3.600	0.28
	E	Bad (80%–75%)	3.440	0.67
Relevance	A	Excellent (100%)	4.489	0.44
	B	Very Good (95%)	4.400	0.63
	C	Good (90%)	3.389	0.46
	D	Not Bad (85%)	3.750	0.12
	E	Bad (80%–75%)	3.200	0.63

A one-way ANOVA was executed to compare the effects of five attendance rates on satisfaction, engagement, and the relevance in a CRS-based flipped Hindi classroom (Table 8). The result of the one-way ANOVA demonstrated statistically significant differences among groups in Satisfaction ($F(4, 28) = 5.497$, $p = 0.002$), Engagement ($F(4, 28) = 5.961$, $p = 0.001$), and Relevance ($F(4, 28) = 9.958$, $p = 0.000$).

Post hoc analyses, utilizing Scheff*é*'s test and the Games-Howell test for multiple comparisons uncovered noteworthy distinctions in scores various groups. Specially, in the satisfaction score, significant differences were found between groups A and E ($p = 0.015$, 95% C.I. = 0.15, 1.90, M.D. = 1.027), and groups B and E ($p = 0.037$, 95% C.I. = 0.46, 2.19, M.D. = 1.120). Regarding Engagement scores, group A exhibited significantly higher engagement compared to group E ($p = 0.014$, 95% C.I. = 0.161, 1.97, M.D. = 1.067), and group B also indicated the significant difference with group E ($p = 0.047$, 95% C.I. = 0.01, 2.23, M.D. = 1.12). For Relevance, a substantial difference was observed between groups with good attendance and those with poor groups; group A was significantly higher than group C ($p = 0.003$, 95% C.I. = 0.31, 1.89, M.D. = 1.10) and group E ($p = 0.001$, 95% C.I. = 0.44, 2.14, M.D. = 1.29). Group B also showed the differences with group C ($p = 0.045$, 95% C.I. = 0.016, 2.01, M.D. = 1.01) and group E ($p = 0.017$, 95% C.I. = 0.16, 2.24, M.D. = 1.20).

Significant differences in SER were observed among groups based on academic performances and attendance,

with variations noted in these factors (Table 9). However, no discernible differences were found in SER concerning gender and year.

Table 9. ANOVA results of SER by attendance rate

		Sum of Squares	df	Mean Square	F	Sig.	Post-hoc
S	Between	5.835	4	1.459	5.497	0.002	A, B > E
	Within	7.431	28	0.265			
E	Between	6.750	4	1.687	5.961	0.001	A, B > E
	Within	7.927	28	0.283			
R	Between	9.910	4	2.477	9.958	0.000	A, B > C, E
	Within	6.966	28	0.249			

This discrepancy implies that attendance patterns may be a contributing factor to variations in the variable "R" between these two sets of groups. The contrast in attendance levels appears to be associated with discernible distinctions in the measured variable, emphasizing the potential impact of attendance on the observed outcomes related to "R" in the respective groups. Further exploration may shed light on the specific nature of this relationship and its implications.

V. Discussion

A. Significant Results in Terms of the Variables of Academic Performance and Attendance

This research, although constrained in its ability to compare general flipped learning classes with those incorporating the Classroom Response System (CRS), primarily focused on investigating learners' perceptions of CRS-based flipped learning. The study aimed to explore satisfaction, class participation, and effectiveness while identifying potential correlations with variables such as learner academic performance, attendance rate, gender, and year. One-way ANOVA tests were applied across three domains: Satisfaction, Engagement, and Relevance between groups.

In terms of learner academic performances, the findings revealed that students with higher academic performances expressed significantly greater satisfaction with the CRS-based flipped learning class compared to those with lower academic performances. Notably, no significant disparity was observed between high and middle-academic performance groups. This implies a heightened interest among higher-academic performance students in classes incorporating CRS, a preference for classes with self-generated questions, and a perceived contribution of CRS to increased focus during class.

Furthermore, distinctions in engagement were noted between higher and lower-academic performance groups. Students with higher academic performances exhibited more active participation, attributing the anonymity of CRS as a factor reducing academic burden and shame. They also demonstrated increased involvement in generating their own questions and actively contributing to class discussions.

In terms of Relevance, differences were observed between higher and lower-academic performance groups, as well as the middle-academic performance group. The higher the academic performance of a student, the more apparent the effects seemed to be in terms of understanding the lesson, overcoming weaknesses, restoring confidence, collaborating with peers, and engaging in learner-centered teaching.

In summary, the study suggests that CRS-based flipped learning classes may yield positive effects on participation, interest, and satisfaction for students with higher academic performances but could pose challenges for those with lower academic performances.

The analysis revealed that disparities in academic performances were evident primarily between the upper and lower groups. However, distinctions in attendance rates were not only observed between the upper and lower groups but also between the middle and lower groups. This suggests that, despite not achieving high academic performances, students with fewer absences and consistent class participation display a preference for Classroom Response System (CRS)-based flipped learning. These students tend to express higher levels of class satisfaction, learning motivation, and perceived learning effectiveness compared to their counterparts who are frequently absent.

Therefore, the study revealed significant results with respect to the variables of academic performance and attendance as shown in table 6-9. Specifically, there were notable differences in outcomes based on the academic performance levels of participants and their attendance rates. Further details on these significant findings are essential for a comprehensive understanding of the impact of academic performance and attendance on the study's variables.

B. Why Lower Academic Performances Students Were not Affected by CRS-Based Flipped Learning

This research investigated the impact of utilizing a Classroom Response System (CRS) within the context of flipped learning, aiming to enhance class participation, learning satisfaction, interest stimulation, and active interaction among learners. The approach encouraged students to pose self-generated questions rather than relying solely on instructor-provided queries. The initial expectation was to foster a learner-centered environment and facilitate a shared understanding among peer learners. Contrary to these expectations, the survey analysis revealed a noteworthy trend: higher academic performances correlated with increased interest in CRS-based flipped learning, while lower academic performances were associated with diminished interest. To delve deeper into the reasons behind this pattern, focus interviews were conducted with three students who exhibited lower academic performance in the class.

The summarized responses from these students shed light on several key factors. Initially, the introduction of the Socrative app at the beginning of the class captured their interest. However, the subsequent routine of mechanically repeated questions and answers every week transformed the interactive aspect into what felt more like a test than an engaging quiz, leading to a loss of interest. The additional task of generating questions related contents when grappling with challenging class content became burdensome. Furthermore, students expressed feelings of shame and inadequacy when confronted with the problems they created

themselves. Participation in class proved to be an inevitable burden, with the real-time comparison of learners' capabilities based on correct answers and feedback adding an additional layer of stress. Particularly in subjective questions, many students opted to leave them blank, perceiving such exercises as a futile use of time. Moreover, the perceived lack of accomplishment, especially when compared to the academic achievements of peers, contributed to a sense of inadequacy for these students.

To improve or adapt Classroom Response System (CRS)-based flipped learning with student-generated questions, instructors should provide clear guidelines for crafting effective questions. Emphasizing the significance of clarity, relevance to the content, and the potential for fostering discussions is crucial. Additionally, it is recommended to motivate students to diversify question types, encompassing both multiple-choice and open-ended formats. Instructors should also consider rotating the responsibility of posing questions among students. By clarifying the instructor's guidance and role in responding to student-generated questions, we can cultivate a more dynamic and engaging CRS-based flipped learning environment, harnessing the potential of student-generated questions to elevate the overall learning experience.

VI. Conclusion

Flipped learning has been shown to be beneficial for student performance and skill development but developing effective teaching strategies for in-class activities remains a challenge, especially in language courses. To address this, this study introduces feedback-based instruction that integrates CRS technology to enhance engagement in a Hindi flipped classroom.

The research, conducted in the "Intermediate Hindi I" course in 2022, is distinctive for its pre-experimental intervention, utilizing CRS in a sustainable and dynamic flipped classroom. It encompasses CRS-based flipped activities over a semester, incorporates student-generated questions, compares general flipped learning with CRS-based flipped learning, and evaluates student satisfaction, class engagement, and CRS relevance within the course context.

However, the study acknowledges several limitations that should be considered for future research. Firstly, the research involved a relatively small sample of students from a single course, which may limit the generalizability of the findings. Additionally, the study did not conduct a survey on flipped learning classes with and without CRS, making it challenging to compare the learning effects and students' perspectives before and after the application of CRS. Secondly, the study focused on variables such as student satisfaction, class engagement, and the relevance of CRS. However, future research could explore additional outcome measures, including academic performance, retention rates, or long-term impacts on students' language skills to provide a more comprehensive understanding of the impact of CRS-based flipped learning. Thirdly, the assumption was made that CRS and student-generated questions were implemented consistently. However, future research could investigate the extent to which these methods were faithfully employed by different instructors, considering potential variations in implementation. Lastly, this study did not delve into the potential influence of social or cultural factors on student engagement. Future research could explore these factors to better understand how cultural and social contexts may impact the effectiveness of CRS-based flipped learning with student-generated questions.

Addressing these limitations in future research will contribute to a more nuanced understanding of the effectiveness and applicability of CRS-based flipped learning with student-generated questions across various educational settings.

Appendix

Table A. Perception of satisfaction-engagement-relevance survey

	Items of CRS-Based Flipped Learning Survey
S1	I found using the Classroom Response System (CRS) during class time to be beneficial.
S2	I believe that using the CRS increased my interest in the class.
S3	I found the class more enjoyable after using the CRS compared to before the midterm exam.
S4	The anonymity provided by the CRS for asking questions was beneficial, unlike traditional classes.
S5	The use of the CRS is easily accessible for everyone.
E1	I found that I participated more in the class after using the CRS.
E2	I believe that using the CRS helps me stay focused during class.
E3	I responded sincerely to the questions presented through the CRS.
E4	The CRS provides motivation for class participation.
E5	The anonymity of CRS reduces the pressure associated with participation.
R1	I learned more by using the CRS compared to when it was not used in the class.
R2	The questions and reviews provided through the CRS enhanced my understanding of the class material.
R3	I was able to overcome my weaknesses by asking questions anonymously through the CRS.
R4	The CRS helped me understand not only the professor's perspective but also the viewpoints of other students.
R5	I consider the CRS to be an effective teaching method.
R6	I believe that students asking questions to the professor through the CRS is more effective than the professor asking questions to the students.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Koh conducted the data collection and analysis; Koh and Kim wrote and revised the paper; Kim acquired the fund; both authors had approved the final version.

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