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Improving College Students' Listening Comprehension Performance During Off-Class Time and their Self-Regulation of Learning Using Rain Classroom

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ABSTRACT

English listening ability is essential yet remains a challenge for many learners at Lijiang Normal University, partly due to limited in-class listening practice. Listening assignments without structured environment bring unsatisfied learning result and no instant feedback to teachers. While self-regulated learning (SRL) positively influences language performance, its role in improving listening skills through technology outside the classroom has been underexplored. To address this gap, this study investigated the use of Rain Classroom technology to improve students' English listening comprehension and SRL during off-class time. Thirty-three Applied English majors at Lijiang Normal University participated in a three-week listening practice using news materials, following a quasi-experimental one-group pretest and posttest design. Instruments included a listening lesson plan, listening tests, and the Motivated Strategies for Learning Questionnaire (MSLQ). Results reveal a slight but not statistically significant improvement in listening comprehension, and a minimal rise in students' SRL scores. However, the Pearson correlation coefficient indicated that there is no meaningful association between SRL levels and listening comprehension. Findings suggest that while Rain Classroom offers a promising platform for extending listening practice beyond the classroom, technology alone is insufficient to significantly improve listening skills. To maximize the benefits of digital listening interventions, explicit training in self-regulated learning strategies is essential.

Keywords: Listening Comprehension; Rain Classroom; Off-class Time; Self-regulated Learning

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1. Introduction

Listening comprehension is a fundamental yet often underdeveloped skill in English language learning, serving as the foundation for other language abilities such as speaking, reading, and writing. According to Mendelsohn, listening accounts for 45%–50% of daily communication activities – more than speaking (25%–30%), reading (11%–16%), and writing (9%) combined [1]. As a receptive skill, listening is the primary channel through which learners are exposed to authentic language use, especially in the early stages of language acquisition. It enables learners to decode meaning, understand context, interpret speaker intent, and respond appropriately, all of which are essential for successful interpersonal communication [2]. Without adequate listening skills, learners struggle to engage in real-life conversations, academic discussions, and professional exchanges where understanding spoken language is crucial [3,4]. Listening is also closely linked with vocabulary acquisition, pronunciation, and overall language fluency, acting as the gateway to higher-level communicative competence. Despite its importance, however, listening instruction in China has not kept pace with the growing demand for international education [5]. Additionally, English listening teaching offers only basic preparation, failing to equip students for real-world English contexts [6]. In response to this mismatch, an educational shift is needed—one that develops linguistic skills, enhances intercultural communication competence, promotes self-regulated learning (SRL), and fosters comprehensive cultural literacy, as posited by Cao [7]. These evolving demands underscore the urgency of improving listening skill development both in and beyond the classroom to enable learners to navigate communication demands in global contexts [8].

At Lijiang Normal University (LJNU), formerly Lijiang Teachers' College (LJTC), the English curriculum has shifted toward real-life communication skills by emphasizing speaking and listening practice in courses such as the EANLIC (English Acquired as Native Language in China) program. This program is designed on the principle that extensive exposure to spoken language materials facilitates listening development, similar to native language acquisition. Although such exposure has been shown to improve students' speaking abilities enhancing tone, rhythm, and key information retrieval, listening skills still lag behind. For instance, students perform better in prepared presentations than in spontaneous conversations with foreign teachers. Additionally, despite preparing rigorously for the College English Test Band 4 (CET-4), many students identify listening, particularly to news, as their weakest area due to fast speech, unfamiliar vocabulary, and lack of background knowledge. Only 57.2% of LJNU's vocational English majors meet the CET-4 passing standard [9], indicating a gap between expected and actual listening proficiency. With only two periods of listening classes per week, in-class exposure is clearly insufficient. As Young [10] points out, practice plays a crucial role in consolidating and internalizing language skills, making off-class listening practice an essential area of intervention.

Another pressing issue is students' lack of self-regulation in learning. SRL has a proven positive relationship with academic success [11,12], yet many LJNU students misunderstand the concept, equating unsupervised library study with true self-regulated learning. High school graduates often lack clear learning motivation and insufficient self-monitoring and evaluation capabilities [13], entering university without developed habits of setting goals, monitoring progress, or adjusting strategies. Instead, they tend to rely heavily on test-based drills [14], neglecting rich and varied listening input and reflective practice. Therefore, improving SRL alongside listening practice is essential. Students must learn not only to engage in adequate listening activities but also to manage their learning processes intentionally and independently.

Although technology has become widespread in language education [15,16] and offers promising solutions encouraging active participation, instant assessment, and shifting classroom dynamics [17,18], its potential remains underutilized in certain areas. While studies have explored the application of Rain Classroom (RC) in English teaching [19–21], fewer or none (so far) have specifically investigated its role in developing students' listening comprehension and SRL during off-class time. RC has already demonstrated success in other subjects at LJNU, so this mobile learning technology is familiar to students and teachers. The easy operation will lower the cost of learning, and students will benefit from engaging

in direct experience and knowledge construction, which could significantly improve students' behavioral, social, cognitive and emotional engagements [22]. Studies [22,23] also showed that mobile learning technologies could significantly contribute to higher linguistics knowledge gain than traditional media tools. For teachers, besides the easy assignment compiling process, teachers are able to dynamically monitor students' learning outcomes and adjust instruction accordingly [20]. These characteristics distinguish RC from other technology-based learning tools. Thus, this study addressed the gap by investigating whether RC can enhance students' listening comprehension and self-regulation beyond the classroom, offering insights for educators seeking effective ways to improve these intertwined skills.

2. Literature Review

2.1. Importance and Challenges of Listening Comprehension in English as a Foreign Language (EFL) Context

Listening comprehension is widely recognized as a foundational language skill essential for effective communication and language acquisition [24]. According to Mendelsohn [1] listening accounts for 45% of daily communication, more than speaking, reading, and writing combined, underscoring its importance in both academic and real-world contexts. Han and Qian [25] further argue that listening serves as a gateway to language learning by facilitating vocabulary development, pronunciation, and fluency. Despite this, listening instruction is often overshadowed by other language skills [5], particularly in China where emphasis has traditionally been placed on reading and writing. Cai [26] notes that the current English listening pedagogy in China provides only basic preparation for authentic listening situations, which inadequately equips learners for real-world English usage.

Empirical evidence highlights the challenges Chinese EFL learners face when engaging with authentic listening materials. Learners struggle with rapid speech rates, unfamiliar vocabulary, and culturally specific content, particularly in formats such as news broadcasts and academic lectures [9]. This difficulty is illustrated in the persistent

low pass rates in the listening section of national English proficiency exams like CET-4. Additionally, the limited classroom time allocated to listening—often restricted to just two periods per week fails to provide sufficient exposure and practice. The scarcity of in-class listening practice creates a barrier to proficiency, especially since effective listening development requires extensive and varied input over time.

While the importance of listening is clear, the literature reveals a critical gap regarding strategies to extend listening practice beyond formal instruction. Most research and pedagogical efforts focus on classroom-based interventions, leaving off-class listening practice largely unexplored despite its recognized potential to bridge the disparity between classroom knowledge and authentic verbal expression. This lack of emphasis on out-of-class activities presents an opportunity to explore innovative approaches such as technology-enhanced learning platforms that can provide learners with accessible, flexible, and engaging listening practice outside the classroom.

2.2. SRL in Language Acquisition

SRL is crucial for successful language acquisition as it empowers learners to begin in charge of their learning through goal-setting, monitoring, and strategy adjustment [27–30]. Robillos and Bustos [24] provides robust evidence of the positive correlation between SRL and academic achievement, emphasizing that learners who self-regulate effectively tend to perform better. In the context of language learning, SRL facilitates autonomy, which is essential for skills like listening comprehension that require ongoing practice and reflection [31]. The competence to manage one's learning encourages deeper engagement and more adaptive responses to diverse listening challenges [24].

However, research shows that many Chinese EFL students lack essential SRL skills when transitioning from high school to university. Guo and Chen [13] highlights that these learners often mistake passive study habits for self-regulation and lack clear goals, strategic planning, and reflective practices. The entrenched teacher-led learning culture limits their experience with autonomous study, leaving them ill-prepared to engage in effective off-class learning. Many scholars [24,32] argued that students predom-

inantly rely on repetitive, test-focused listening exercises rather than varied and meaningful input, which curtails the development of comprehensive listening skills and effective learning strategies.

Despite recognizing the importance of SRL, literature rarely integrates SRL development directly with listening instruction [4], especially in off-class settings where learners must independently regulate their learning. Most studies treat SRL as a broad psychological construct rather than a language-specific skill intertwined with listening practice [31]. This represents a notable gap: empirical investigations into pedagogical models that explicitly combine SRL training with listening development particularly through technological tools that support self-regulation are scarce. Addressing this gap could equip learners with the skills needed to sustain and improve listening proficiency autonomously.

2.3. Technology-Assisted Listening Practice and the Role of RC

Technology has increasingly been leveraged in language education to enhance listening skills by offering interactive, personalized, and flexible learning experiences. TeachThought Staff underline how digital platforms can foster learner engagement, provide immediate feedback, and support adaptive learning strategies. Studies on apps like Chaoxing Xuexitong [19] and blended learning programs [33] show promising outcomes in improving listening comprehension. RC, a tool integrating PowerPoint and WeChat, is particularly popular in Chinese higher education due to its accessibility and ease of use [19,33].

RC, developed by Tsinghua University and XuetangX, is an innovative teaching tool [23] that integrates computers, mobile devices, and other smart terminals to support teaching and learning across pre-class, in-class, and post-class phases [19]. It enhances teacher-student interaction and streamlines the learning process. Specifically, before class [19,20,22,23], teachers can upload various materials—videos, audio, texts, PPTs—which are instantly shared via students' WeChat, ensuring timely access to learning resources. During class [19,20,22,23], interactive features such as danmu (bullet curtain) comments, text uploads, recordings, and live polls actively engage students. The system can even generate word clouds from students'

danmu, visually displaying commonly used words to reflect their focus and participation. After class[19,20], [22,23], RC continues to support learning by allowing teachers to assign tasks like uploading recordings or written work. In addition, the platform offers both subjective and objective tests, complete with instant feedback and detailed explanations for each item to guide student understanding. Moreover, the system provides real-time data analysis, offering insights such as average test scores, common errors, incomplete assignments, and overall student progress. This comprehensive feedback loop enables teachers to monitor and adjust instruction effectively, ensuring a clearer picture of students' learning development.

From the aspect of English listening teaching, most research [34–37] focused on the application of RC in college English listening, that is teaching non-English majors English in universities. It is also studied from whole-round teaching and learning activities, and stresses the importance and necessity of applying RC to do pre-class preparations, so does various activities for in-class teaching. Many scholars analyzed the functions, features, and applications of RC, believing that RC can improve students' learning initiative, learning interest, attention, listening and speaking ability [34,35] and the facilitation of teaching is obvious [36,37].

RD, 's design leverages tools that are already familiar to students and teachers, lowering the barrier to use and facilitating learning engagement [19,33]. By enabling goal setting, self-monitoring, and self-assessment through embedded learner analytics, provide quantitative evidence that RC's blended teaching approach enhances SRL components such as strategic planning and help-seeking.

Moreover, emerging research suggests RC can promote SRL. Xu [38] suggested teachers should actively utilize embedded learner analysis software, such as RC to obtain and analyze students' self-regulation learning data and to make further guidance. Shi [39] claimed that compared with the traditional learning model, RC could significantly improve students' self-learning ability in the aspects of setting goals and making plans, monitoring learning process, and assessing learning results. Zhang and Zeng [40] concluded that the mixed teaching of Rain Classroom could promote the students' SRL, especially in seeking help, planning strategy and self-assessment. It was also helpful

in self-management and lifelong learning ability. Despite these, there is a lack of rigorous experimental studies examining how RC features translate to improvements in off-class listening comprehension and the formation of sustained self-management.

At the same time, critical perspectives caution against overreliance on technology without thoughtful instructional design. Jiang [33] reported that some digital language learning tools fail to improve listening skills due to factors like passive learner engagement, inappropriate content, and technological limitations such as small screens or unreliable connections. Additionally, cognitive overload from excessive or poorly designed digital input could impair attention and memory, negatively affecting listening performance [19]. It suggested that carefully designed and integrated pedagogical approaches are needed.

Therefore, though many studies [19–21] explored RC in English learning, especially from all-process loop, RC's application in off-class English listening instruction remains limited in research [8,19], with most CNKI studies focusing on in-class or preparatory activities rather than autonomous listening practice outside the classroom. Additionally, studies [19,20] [39,40] emphasized technology enhanced learning (TEL) environment could improve students' SRL, and RC saw some successful cases, but few explored SRL in RC setting during off class time. These left a gap in the research in that there were few studies discussing how off class technological interventions influenced both listening comprehension and SRL, and especially how these two might interact. Building on the gap, this research endeavors to address the following research questions:

1. In what ways have English major students in LJNU leveraged RC during off-class time to influence listening comprehension performance?

2. Are the students' SRL enhanced after the utilization of RC during off-class time?

3. Materials and Methods

3.1. Design

The study employed a quantitative, quasi-experimental [41], one-group pre-and post-test design to investigate the effectiveness of RC in enhancing college students' listening comprehension and self-regulated learning (SRL). This design is suitable when random assignment and control groups are not feasible, allowing researchers to observe changes within the same group over time. It offers a practical approach for evaluating interventions in real educational contexts where strict experimental controls are limited. By focusing on within-subject comparisons over time, the quasi-experimental design provides valuable insights into changes attributable to the treatment, making it a widely accepted compromise between methodological rigor and feasibility in educational research.

3.2. Participants

The participants consisted of 33 students from Class Two, who were scheduled to take the listening course in the second term of the 2023–2024 academic year (A.Y). They were determined based on a purposive sampling technique. The participants comprised 4 male and 29 female students, with an average age of 20 years. The purposive sampling method was employed to ensure representation of students with varied listening proficiency levels, predominantly within the intermediate range as determined by their listening assessment results from the first term of the 2023–2024 A.Y. The results showed the average score is 74.4 out of 100, and the percentage of score frequency from 70–89 is 63%. Additionally, nearly every student would prepare for the CET-4 test in the next term, whose listening level matched the level of listening to audio selections. This selection strategy aims to provide a focused and relevant sample for examining the effectiveness of the intervention.

3.3. Instruments and Data Collection

3.3.1. Listening Audio Selections

The study used short English news clips (less than three minutes) from trusted websites and books, covering topics like social life, technology, and health. Students did two listening exercises each week through RC, each taking about 30 minutes. Every exercise had three parts: learning important vocabulary, practicing different types of listening questions, and analyzing tricky grammar in the passages. To ensure students followed the scheduled steps to the

listening exercise, they were asked to follow the procedure to give their real feedback, for the result would help them to understand their learning behaviors. To make sure these exercises matched the learning goals well, the researchers checked them using a method called the Index of Item-Objective Congruence (IOC). If the IOC score was above 0.5, the exercise was considered a good fit for what students needed to learn. This process helped ensure the listening materials were reliable and useful for the study.

3.3.2. Pre-Listening Test

The pre-listening comprehension test utilized materials from the CET-4 listening section A, which is part of a nationally recognized examination, ensuring the appropriateness and relevance of the content for the students. Seven news reports were carefully selected from this section, each followed by two to three comprehension questions. During the assessment, each news segment was played twice to allow adequate listening opportunities, while the questions were presented once. The test included a total of 15 questions, each worth one point, with a passing score set at 9. The pretest was conducted in a controlled classroom environment to maintain fairness and authenticity. To ensure the test's validity and alignment with learning objectives, the IOC was applied to evaluate the test items rigorously. To assess its reliability, the test was piloted with a group outside the study sample, yielding an internal consistency reliability coefficient (Cronbach's Alpha) of 0.79, considered acceptable.

3.3.3. Post-Listening Test

The post-listening test followed the same format and procedure as the pretest but employed a different set of seven news reports from the CET-4 listening section to measure students' progress. Consistent administration conditions were maintained to ensure comparability between pretest and posttest results. The validity of the posttest items was also confirmed using the IOC, reinforcing the reliability of the assessment in evaluating listening comprehension improvements. To assess its reliability, the test was piloted with a group outside the study sample, yielding a Cronbach's Alpha coefficient of 0.79, indicating acceptable internal consistency. All students participated in

the same listening exercises and completed the questionnaires, with no personal ethical concerns involved in data collection.

3.3.4. Motivated Strategies for Learning Questionnaire (MSLQ)

A revised version of the MSLQ [42] was employed to assess students' SRL both before and after the intervention, specifically tailored to focus on listening-related learning behaviors. To ensure clarity and cultural appropriateness, the questionnaire was translated into Chinese, and its accuracy was verified by a qualified lecturer in psychology holding a master's degree and expertise in questionnaire design. The instrument included 81 items categorized into two main areas: motivation and learning strategies. The motivation section included three components—value, expectancy, and affective—while the learning strategies section covered cognitive strategies, metacognitive strategies, and resource management techniques strategies. The Participants self-rated their responses using a five-point Likert scale ranging from 1 ("not at all true of me") to 5 ("very true of me"). The questionnaire was administered at both pre-intervention and post-intervention stages to capture potential improvements in SRL due to the use of RC. The careful adaptation and validation process ensured that the tool was reliable, contextually relevant, and accessible for all participants in this study.

3.4. Intervention

The intervention in this study consisted of two integrated components: listening practice and SRL prompts, both delivered via students' smartphones using the RC platform. For the listening practice, students engaged in exercises designed to improve various aspects of listening comprehension, such as vocabulary acquisition, identifying main ideas, understanding supporting details, and interpreting complex sentence structures. Alongside these exercises, SRL questions were provided either before or after the listening tasks to enhance students' metacognitive awareness. These SRL prompts encouraged learners to reflect on their listening strategies, set personal goals, monitor their comprehension progress, and make necessary adjustments to optimize their learning process, thereby fostering great-

er self-regulation and autonomy in their English listening development.

To further support the effectiveness of the intervention, the advance organizer strategy, as proposed by Ausubel [43], was incorporated to help students connect new information with their existing knowledge base. This approach involved three phases: presenting the advance organizer, delivering the learning content, and reinforcing cognitive organization. English news served as the primary listening material across three learning periods. During the first phase of the initial two periods, students were intro-

duced to key vocabulary and engaged in predictive activities to reduce the initial difficulty of listening tasks. In the second phase, two instructional approaches were applied: bottom-up (focusing on details first, then general meaning) and top-down (starting from general understanding to specific details). This dual-method exposure aimed to heighten students' awareness of different listening strategies, enabling them to consciously adjust and regulate their approach to listening tasks according to the nature of the material and their individual learning needs. The process of intervention is showed in the following **Table 1**.

Table 1. The process of intervention.

Weeks	Content			
	Listening exercises			Questions to introspect students' SRL
	Presentation of advance organizer	Presentation of learning material:	Strengthening cognitive organization	
The first week: 2 exercises	Vocabulary and phrases	Bottom-Up: listening practice from detail to general	Sentence analysis	5 questions to each exercise
The second week: 2 exercises	Vocabulary and phrases	Up-Bottom: listening practice from general to detail	Sentence analysis	5 questions to each exercise
The third week: 2 exercises	Listening practice from general to detail		Vocabulary learning and sentence analysis	5 questions to each exercise

3.5. Data Analysis

For the analysis of the data obtained in this study, both descriptive and inferential statistical techniques were employed to ensure a thorough evaluation of the intervention's effectiveness. Frequency, mean, and standard deviation were calculated as descriptive statistics to present students' listening comprehension and SRL scores before and after the intervention, providing an overview of performance trends and variability. Paired sample t-tests were employed in the inferential analysis to determine whether significant differences existed between pretest and posttest scores, assessing the effect of the RC intervention. Furthermore, the Pearson Product-Moment Correlation Coefficient was applied to examine the strength and direction of the relationship between students' listening comprehension achievement and their SRL, offering insights into how improvements in listening skills might be associated with changes in self-regulated learning behaviors.

4. Results

4.1. Students' Pre- and Post Listening Comprehension Tests during Off-Class Time through RC

Table 2 presented the frequency and percentage distribution of students' listening comprehension scores during off-class time before and after the intervention. In the pretest, most students (27 or 82%) scored in the mid-range (6–10 points), showing basic but limited listening skills. Five students (15%) were in the lowest range (1–5 points), while only one student (3%) reached the highest range (11–15 points), indicating few had strong listening proficiency initially. After the intervention, the number of high scorers rose to 3 (9%), suggesting improvement for some learners. However, those in the lowest range also increased to 9 (27%), while 21 students (64%) remained in the mid-range, showing little change. These results indicated mixed

effects of the RC intervention and suggest that differences in individual factors such as engagement and self-regulation may have influenced the varied outcomes.

Table 2. Frequency and Percentage Distribution of students' listening comprehension scores during off-class time before and after the implementation of the intervention.

Students' Scores	Pre-Listening Test		Post-Listening Test	
	Frequency	Percentage	Frequency	Percentage
1–5	5	15%	9	27%
6–10	27	82%	21	64%
11–15	1	3%	3	9%
Total	33	5	33	100%

Table 3 provides a comparison of students' listening comprehension test outcomes before and after the inter-

vention during off-class time using RC. The pre-test results revealed a mean score of 7.15 (S.D. = 1.922) out of 15, indicating that most students had moderate listening comprehension skills with relatively consistent performance. The difficulty index was 0.41, suggesting a moderately challenging test. In the post-test, the mean slightly increased to 7.27 (S.D. = 2.466), with a comparable difficulty index of 0.418, showing that the test maintained a similar level of challenge. However, the t-value of −0.216 and a *p*-value of 0.831 exhibited no statistically significant improvement after the intervention. Although a few students showed better results, the wider spread in scores suggested varied engagement levels with RC during off-class practice, highlighting the need for more structured or motivating guidance to maximize its impact.

Table 3. Students' Listening Comprehension Achievement During Off-Class Time Before and After the Implementation of the Intervention.

Test	N	Total score	Mean	S.D.	Difficulty	*t*	*p*
Pre-test	33	15	7.15	1.922	0.41	−0.216	0.831
Post-test	33	15	7.27	2.466	0.418		

4.2. Overall Results on Students' SRL as Represented by MSLQ

The **Table 4** presents the overall analysis of students' SRL as represented by MSLQ, provides a comprehensive overview of how students' self-regulatory skills evolved before and after the intervention. The analysis highlighted specific categories: Value component, Expectancy component, Affective component, Cognitive and metacognitive strategies, and Resource management strategies. To illustrate:

In regard to value component, the mean score for value component slightly decreased from 3.36 (SD = 0.43) before the intervention to 3.35 (SD = 0.31) after the intervention. This minimal change ($t = 0.125$, $p = 0.901$) indicated that students' perceptions of the value of learning did not significantly shift as a result of the intervention. However, the consistency in their responses suggested that the RC app, while effective in other areas, may not have had a substantial impact on students' intrinsic or extrinsic motivation towards the subject itself. That being said, the interactive features of the app, such as engaging listening exercises, likely helped maintain students' perceived value of their learning, especially as they could access materials

at their own pace and revisit listening content.

Concerning 'expectancy' component, the mean score for expectancy component also showed a minimal decrease from 3.26 (SD = 0.42) before the intervention to 3.23 (SD = 0.30) after the intervention ($t = 0.327$, $p = 0.746$). This slight reduction suggested that students' expectations of their success did not experience significant change as a result of the intervention. The self-paced learning tools in RC, such as the ability to review recorded lessons or listening activities, might have contributed to maintaining realistic expectations. Although students' expectations didn't see a significant increase, they likely benefited from the app's support in achieving learning objectives, particularly in improving listening comprehension through targeted exercises.

In regard to 'affective' component, a modest rise in the mean score was observed for affective component from 3.28 (SD = 0.52) to 3.38 (SD = 0.59) ($t = -0.859$, $p = 0.397$), implying that the intervention had a mild impact on students' anxiety responses to the learning process. The unfamiliarity of doing listening assignments on phone may result in a negative emotion during the learning process. They would find the learning result may vary depending on different listening topics, which was a typical learning

stage in the more they learn, the more they would perceive what they do not know. These aspects may have contributed to a nervous attitude towards learning.

For 'cognitive and metacognitive strategies' component, the mean score for cognitive and metacognitive strategies increased slightly from 3.15 (SD = 0.32) before the intervention to 3.22 (SD = 0.29) after the intervention ($t = -1.116$, $p = 0.273$). While the increase was modest, it suggested that students became slightly more aware of and engaged in strategies related to thinking about their own learning processes. The reflection and self-monitoring tools available through RC might have helped students develop these strategies. For example, the app's ability to track progress in listening comprehension tasks might have encouraged students to examine their strengths and areas needing development, fostering better cognitive and metacognitive strategies.

For 'resource management strategies' component, the mean score for resource management strategies showed a small increase from 3.14 (SD = 0.28) to 3.21 (SD = 0.26)

($t = -1.056$, $p = 0.299$). This increase, while not statistically significant, suggested that students became somewhat more effective in managing their learning resources. The structured environment provided by the RC app, with its clear course materials and easily accessible resources for listening activities, likely contributed to this improvement. The app helped students manage their study time and materials more effectively, supporting their listening comprehension development.

The overall mean for self-regulation showed a slight increase from 3.26 (SD = 0.31) before the intervention to 3.30 (SD = 0.24) after the intervention ($t = -0.615$, $p = 0.543$). This small but positive change in overall self-regulation indicated that the intervention, along with the use of the RC app, helped students marginally improve their ability to regulate their learning processes. The app played a significant role by providing students with tools for independent learning, time management, and collaboration with peers, which likely contributed to these improvements in self-regulation.

Table 4. Overall Results on Students' SRL Before and After the Implementation of the Intervention.

Components	Before the Intervention		After the Intervention		*t*	*p*
	Mean	**SD**	**Mean**	**SD**		
Value component	3.36	0.43	3.35	0.31	0.125	0.901
Expectancy component	3.26	0.42	3.23	0.30	0.327	0.746
Affective Component	3.28	0.52	3.38	0.59	−0.859	0.397
Cognitive and metacognitive Strategies	3.15	0.32	3.22	0.29	−1.116	0.273
Resource management strategies	3.14	0.28	3.21	0.26	−1.056	0.299
Overall Mean	3.26	0.31	3.30	0.24	−0.615	0.543

4.3. Test of Relationship between Students' Listening Comprehension Tests and SRL

Table 5 presented the Pearson r between the students' listening comprehension performance and their SRL after the implementation of the intervention. The calculated r-value of −0.063 exhibits a marginal negative correlation between the two variables. This suggested that as students' self-regulated learning behaviours slightly increase, their listening comprehension scores tend to decrease marginally; however, this relationship was so minimal that it was practically negligible and did not indicate any meaningful association.

Moreover, the *t*-value of 0.113 and the associated

p-value of 0.770 confirmed that this correlation is not statistically significant, as the *p*-value was much higher than the established significance level of 0.05. The very low t-value indicated that the sample correlation did not deviate meaningfully from zero, reinforcing that there is no real relationship between the variables. The *p*-value of 0.770 further suggested that the observed weak correlation is likely due to random chance rather than reflecting a genuine association. Thus, the statistical evidence was insufficient to conclude the existence of any significant linear connection between learners' self-regulated learning approaches and listening comprehension achievement.

This result implied that variations in self-regulated

learning levels among the participants were not associated with corresponding variations in listening comprehension test scores. The high p-value and extremely low *t*-value, alongside the nearly zero *r*-values, consistently indicated that these two variables were statistically unrelated in this study. Therefore, the statistical data supported the conclusion that there was no significant correlation between students' use of self-regulated learning strategies and their performance on the listening comprehension test. This suggested that factors such as the way students engaged with RC during off-class time may not have consistently contributed to measurable gains in listening comprehension. Some students may have benefited from additional exposure, while others may not have fully utilized the platform for off-class learning, leading to minimal correlation between the two variables.

Table 5. Pearson Correlation Coefficients (r) between the students' listening comprehension performance and their SRL after the implementation of the intervention.

Variables	*r*-value	*t*-value	*p*-value
Listening Comprehension Performance Self-Regulated Learning (SRL)	−0.063	0.113	0.770

5. Discussion

5.1. Students' Listening Comprehension Performance Using RC during Off-Class Time

The findings from the study highlighted mixed outcomes of the RC intervention, demonstrating both its potential and limitations in enhancing students' listening comprehension. The increase in high-performing students, from 1% in the pre-test to 3% in the post-test, aligned with prior research emphasizing the effectiveness of technology-enhanced learning tools in improving language skills. For example, a study by Wang et al. [21] found that digital platforms foster engagement, provide personalized learning opportunities, and promote active listening, particularly when used for language skill development during off-class time. The interactive and adaptive features of RC may have benefited students who actively engaged with the platform beyond scheduled class hours. Features such as on-demand audio resources, self-paced exercises, and

instant feedback likely played a role in reinforcing listening skills for these students, particularly those with strong self-regulation abilities.

However, the stability of scores for the majority of students in the mid-range (6–10 points) indicated limited progress, which aligned with findings by Sun et al. [44] and Jiang et al. [45] highlighting that while digital interventions maintain skill retention, they may fall short of pushing students to higher levels of proficiency without additional instructional support. A potential explanation for this stagnation lay in students' varying levels of engagement with RC during off-class time. While the platform offered listening exercises outside regular sessions, not all students may have maximized these resources independently. Law et al. [46] suggested that interventions focusing solely on skill practice without tailored scaffolding may not adequately challenge learners to achieve substantial improvement. This suggested that additional structured activities, such as guided listening tasks or instructor-facilitated review sessions, might be necessary to enhance mid-range performers' listening comprehension outside class hours.

Moreover, it is important to consider potential confounding variables that may have influenced these results. For instance, students' prior exposure to English outside the classroom, access to technology or stable internet at home, and even background knowledge of the test content could have contributed to their performance independently of the RC intervention. These variables were not directly controlled in this study and may partially account for the variation in student outcomes, particularly among mid-range performers.

The regression observed in the lower-performing group (1–5 points), with an increase from 15% in the pre-test to 27% in the post-test, reflected challenges that some students face in adapting to self-directed, technology-based interventions. Previous research by Robillos and Bustos [24] supported this finding, emphasizing the role of self-regulation in determining the success of autonomous learning tools. Students lacking self-regulation skills often struggled with motivation, task engagement, and time management, leading to lower performance. In this study, it was possible that some students experienced anxiety, which was shown by the MSLQ affective component result. They might not engage meaningfully with the RC platform out-

side of class, limiting their exposure to listening practice and reducing the effectiveness of the intervention. Additionally, distractions and a lack of structured guidance during off-class time may have contributed to their difficulties. These findings highlighted the need for embedding explicit self-regulation training into interventions like RC to encourage productive off-class engagement.

Overall, the study's findings corroborated prior literature on the benefits and limitations of technology-assisted language learning. While RC provided opportunities for extended practice beyond the classroom, its effectiveness was dependent on learners' skill in directing their own learning process. The results emphasized the importance of addressing learner variability to optimize outcomes. By integrating features that foster self-regulation, encouraging structured engagement during off-class time, and providing differentiated support for struggling learners, the RC intervention could achieve more comprehensive improvements in listening comprehension.

5.2. The Students' Cognitive and Metacognitive Self-regulation was Enhanced by Using RC

The findings of the study suggested a slight improvement in students' cognitive and metacognitive self-regulation strategies following the intervention. The increase in rehearsal, elaboration, and organization strategies suggested that students became more engaged in strategic learning behaviors that facilitate knowledge retention and comprehension.

The increase in rehearsal, from 3.17 to 3.27, suggested that students enhanced their ability to repeat and practice information, which was crucial for improving retention. This improvement aligned with Flavell's [47] theory, which highlighted the importance of rehearsal as a cognitive strategy that strengthened learning by allowing repeated exposure to information. In this study, the systematic design of the intervention likely played a significant role by providing students with consistent opportunities to engage in repetition, thus fostering incremental gains in memory consolidation. The use of the RC app further facilitated this process by incorporating interactive exercises that encouraged students to actively practice the material. This aligned with Benjamin and Tullis [48] research, which supported

the idea that distributed practice, or spacing out learning over time, was highly effective in enhancing retention. The app's real-time feedback and the ability to revisit and rehearse lessons at their own pace allowed students to engage in more focused, sustained practice, reinforcing their learning. Overall, these factors combined may have contributed to the observed improvement in rehearsal, reinforcing students' capacity to retain and recall information more effectively.

The slight increase in critical thinking, from 3.14 to 3.19, suggested a modest improvement in students' ability to analyze and evaluate information. This aligned with Robillos and Bustos [24] argument that critical thinking skills develop gradually through structured, interactive learning environments. While the increase was not substantial, it pointed to a positive trend, reinforcing El Soufi and See [49] findings that critical thinking required continuous and explicit instruction to be effectively cultivated. The RC app likely contributed to this increase by offering students problem-solving tasks that prompted them to engage in critical analysis, encouraging them to reflect on their reasoning and decision-making processes. However, the minimal increase indicated that critical thinking was a complex skill that may not fully develop in short interventions. This suggested that further enhancements to the intervention, such as integrating more reflective questioning techniques, debate activities, or opportunities for metacognitive reflection, could better foster critical thinking abilities. It is also important to note that critical thinking may benefit from extended exposure to such exercises, as students need time and repetition to build a robust understanding of how to analyze and evaluate different types of content.

The improvement in organization, reflected by the increase in scores from 3.05 to 3.18, suggested that students became more proficient at arranging and categorizing information in a way that facilitated their learning. This aligned with the work of Weinstein and Mayer [50] who argued that organizational strategies, such as categorization and the use of structured frameworks were essential for improving comprehension and long-term memory retention. Organizational skills helped learners make sense of new information, making it easier to recall and apply in the future. The use of the RC app likely contributed to this development by offering digital tools and features that guid-

ed students in structuring their learning, such as the ability to organize content in various formats, track progress, and visualize connections between topics. This aligned with the findings of Law [46] who showed that digital scaffolding could effectively support learners by providing frameworks for organizing information. Their work emphasized that structured learning environments, whether digital or traditional, were particularly beneficial for students who may struggle to develop organizational skills on their own.

The slight decrease in metacognitive self-regulation, from 3.20 to 3.18, suggested that while students showed progress in cognitive strategies, their ability to independently plan, monitor, and evaluate their learning remained relatively stable. This finding aligned with Robillos & Bustos [24] research, which suggested that metacognitive skills, such as planning and self-monitoring, require ongoing development and explicit instruction over time. The minor decline observed in this study could be due to students still being in the process of internalizing these self-regulatory practices, or unfamiliar with the use of tech-based approaches in listening exercises, indicating that further support may be needed. Even though the RC app provided some metacognitive scaffolding, such as prompts for self-reflection, it was possible that more focused interventions were required to foster deeper metacognitive engagement. The inclusion of more structured activities for reflection could be beneficial. In line with Dabbagh and Kitsantas [51], who advocated for incorporating guided reflection exercises, this study suggested that students would benefit from additional opportunities to reflect on their learning experiences, helping them develop greater self-regulation skills. Despite the stable level of metacognitive self-regulation, the findings still indicated that the RC app provided a supportive structure that enhanced students' cognitive engagement and helped them develop more effective learning behaviors. However, for significant improvements in metacognitive regulation, future interventions should aim to include more explicit and reflective practices that help students refine their ability to independently monitor and evaluate their learning strategies.

5.3. Relationship between Students' Listening Comprehension and SRL

Table 5 presented the Pearson Correlation Coefficients (r) between listening tests and SRL after the intervention. The results revealed important insights into the relationship between the two variables and how the intervention may have influenced these relationships.

The r-value of −0.063 suggested a very weak negative correlation with the other variable, indicating almost no linear relationship after the intervention. The t-value of 0.113, which was quite low, further supported this, suggesting the correlation was not statistically significant. The p-value of 0.077 was above the standard significance level of 0.05, confirming that the relationship between listening comprehension and SRL was not statistically significant. These findings were consistent with prior research that suggested interventions focusing on listening comprehension alone may not result in significant changes in SRL unless they are specifically targeted for improvement [52]. Research by Vandergrift and Goh [52] also pointed out that listening comprehension was influenced by various factors such as cognitive load and prior knowledge, which may not have been directly addressed by the intervention in this study. Goh [3] and Robillos [4] similarly noted that listening comprehension skills often developed more slowly than other language skills, which could explain the weak or absent correlation found in this study.

One possible explanation for the lack of a significant correlation between listening comprehension and SRL was how students engaged with off-class learning opportunities. Although the intervention provided structured listening activities, the way students utilized RC outside of class varied. Some students may have actively engaged with listening exercises during off-class time, while others may not have fully taken advantage of these resources. This inconsistency in engagement could have contributed to the absence of a strong correlation, as not all students reinforced their listening comprehension skills beyond the classroom setting. The findings suggested that listening comprehension did not show a significant relationship with SRL.

Moreover, though studies showed using RC could improve students' English learning outcomes [19–23], and students would improve their SRL in a TEL environment [39,40], the result of this research indicated the relation of SRL improvement and listening comprehension by utilizing

RC has weak relation. It indicated RC was not an essential tool in enhancing students' SRL to improve their listening comprehension. Given the fact that SRL is a long-term cultivation and a three-week intervention was obviously inadequate, future interventions could either extend the intervention process of SRL or explore other explicit strategies to attract students' attentive participation in off-class listening activities. By promoting longer SRL guidance, participation and providing structured guidance, educators can help students maximize the benefits of using technology-based tools to stronger improvements in listening comprehension [12,30].

6. Conclusions

The insights gained from this study offer important insights into the complex relationship between technological interventions and language learning outcomes. While RC demonstrated potential in supporting some students' listening comprehension and SRL, its impact was far from uniform. The variation in student performance suggests that technology alone, without sufficient guidance or learner readiness, may not guarantee consistent improvement. This underscored the necessity of designing interventions that are sensitive to individual learning differences and that provide structured support to maximize the benefits of digital tools beyond classroom instruction.

Moreover, the limited gains in SRL and lack of a significant correlation between SRL and listening comprehension indicated that fostering self-regulation requires more than the provision of technological features; it demands deliberate instructional design, sustained practice, and possibly personalized coaching. These results pointed to the need for future research to explore how learners engage with self-regulation prompts and how such engagement could be meaningfully integrated with language skill development. Ultimately, while RC holds promise, its effectiveness depends on how thoughtfully it is embedded within a broader pedagogical framework that actively cultivates learners' strategic awareness, autonomy, and sustained engagement.

This research adds valuable findings to the expanding field of technology-integrated language learning by highlighting the nuanced effects of integrating platforms like RC in listening comprehension and self-regulated learning development. Pedagogically, the findings emphasize the importance of coupling technological tools with explicit strategy instruction and ongoing support to foster deeper learner engagement and effective SRL practices. Educators are encouraged to design interventions that not only provide access to digital resources but also guide students in how to strategically utilize these tools for independent learning. Additionally, this research points to the pivotal role of off-class learning environments, suggesting that enhancing students' motivation and self-regulation outside the classroom is essential for maximizing the impact of blended learning approaches. By addressing these factors, future instructional designs can better tap into the capabilities of technology to support personalized and sustainable language learning.

7. Limitations

Although RC offers multiple advantages as a digital learning tool, a key limitation was the lack of direct teacher supervision over how students engage with the platform during off-class time. While teachers could monitor time spent and question results, they could not observe how students' complete assignments or ensure meaningful engagement. To address this, future implementations should incorporate structured guidance, such as checkpoints or interactive tasks, to promote more accountable and active learning outside class hours.

The gender imbalance was noticeable in the research. English majors were preferred by girls and boys counted for one tenth in an English major class in LJNU. Moreover, the number of participants was small. Both factors may result in the sample not reflecting the real result of the effectiveness of RC in English listening and SRL learning after class, and may also lead to a decrease in the applicability of supervising strategies to male students.

The intervention lasted three weeks, which was not long enough to cultivate students' SRL. The future study could prolong the intervention time by incorporating more explicit training on self-regulation strategies to help students develop stronger self-regulation habits and sustain their learning progress outside the classroom.

The method applied a quasi-experimental approach.

The lack of a control group reduced the causal validity of findings. All the data were quantitative also pointed to the limitation that no qualitative date were used to explore how students interacted with RC. The future study includes qualitative research like interviews, logs and the like.

Another limitation concerned the absence of consideration for students' diverse learning styles. Since learners process the same material differently, a uniform approach may not effectively meet individual needs. It is recommended that future interventions provide more personalized content delivery, including multimodal materials such as videos or interactive exercises, which can enhance motivation and accommodate varied learning preferences.

The mixed results in listening comprehension improvement also pointed to a limitation in the range and difficulty of listening materials used. The study primarily utilized news audio clips, which may not have been equally accessible or engaging for all students. Future research should tailor listening materials to individual proficiency levels and include a broader variety of accents, topics, and difficulty levels to sustain interest and address diverse comprehension challenges.

Findings suggest that while RC offered a promising platform for extending listening practice beyond the classroom, technology alone was insufficient to significantly improve listening skills. To maximize the benefits of digital listening interventions, explicit training in self-regulated learning strategies is essential. To foster stronger metacognitive awareness and learner autonomy, RC should integrate goal-setting guidance, progress monitoring tools, and reflective exercises into its design.

Finally, the weak correlation between SRL and listening comprehension indicated that other factors may influence students' listening progress. Future studies should explore variables such as listening anxiety, cognitive load, and motivation, which may moderate the effectiveness of technology-enhanced learning. Investigating adaptive features like AI-driven content adjustments or personalized learning pathways within RC could optimize engagement, especially for learners with varying self-regulation skills.

Longitudinal research is also needed to assess the long-term impact of sustained use and additional scaffolding, such as peer collaboration and guided metacognitive instruction, on both SRL development and listening proficiency.

Author Contributions

All authors were actively involved in the conception and design of the study. W.W. took the lead in collecting and analyzing data and prepared the initial manuscript draft. R.J.R. played a central role in shaping the research framework and offered in-depth revisions to improve the clarity and academic quality of the manuscript. Both authors collaborated in the final stages of editing and refining the paper. All authors have reviewed and given their approval for the final version to be published.

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Institutional Review Board Statement

This study received ethical clearance from the Khon Kaen University Ethics Committee for Human Research (Approval No. HE673342). Informed consent was obtained from all participants, including both students and experts. For participants under the age of 18, parental consent was obtained alongside assent appropriate to their age. Data collection commenced only after securing all necessary institutional approvals. Throughout the research process, strict measures were followed to protect confidentiality and ensure participants' rights were respected, including their right to withdraw at any time without penalty.

Informed Consent Statement

All participants, including experts and students, provided informed consent through formal documentation. For participants under 18 years of age, parental consent was obtained alongside age-appropriate assent forms. The research instruments and procedures were rigorously reviewed for ethical compliance, adhering to the principles outlined in the Belmont Report and the Good Clinical Practice (GCP) guidelines for Social and Behavioral Research. Data collection commenced only after securing all necessary institutional approvals, with strict protocols in place to ensure confidentiality and protect participants' rights, including the right to withdraw from the study without any repercussions.

Data Availability Statement

Acknowledgments

Conflicts of Interest

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