

The Effect of LINE Chatbot with Escape Game Design on English Learning Achievement, Situational Interest, and Student Engagement

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Abstract: The aim of the present research was to enhance students' English learning achievement, situational interest, and engagement through the use of a LINE chatbot with an escape room design. The participants in the study were 58 grade six students, with 29 students in the experimental group who engaged in the escape room design, and another 29 students in the control group who completed self-regulation tasks. The results indicated that students who participated in the LINE chatbot with escape room design were able to enhance their learning achievement, situational interests, and engagement with English learning, compared to students in the control group. However, the use of the LINE chatbot with escape room design did indeed have significant effects on students' learning achievement, situational interest, and engagement in three domains, due to its novel learning experience. For future research on chatbot design in English learning, it is suggested that the instruction of chatbot design should involve students at different levels and incorporate multiple learning content. Moreover, to gain a deeper understanding of the true effects of chatbot design on learning, it is suggested that future research should address more types of experimental groups.

Keywords: Chatbot, escape game design, English learning achievement, situational interest, student engagement

1. Introduction

This study aims to investigate the positive influence of involving grade six students in an escape game designed with a chatbot-integrated LINE chatbot on their English learning outcomes. By implementing a teaching design that combines a LINE chatbot and an escape room game, this research seeks to understand the effects of this teaching method on students' English learning performance, with a particular focus on enhancing students' learning outcomes, situational interest and their engagement. Based on the above research objectives, the main research question for this study is: ***Does the participation of grade six students in a LINE chatbot with escape game design have a positive influence on their English learning outcomes, situational interest, and engagement?***

2. Literature Review

2.1 Integration of Digital Learning Resources in English Teaching

A study by Sun and Rueda (2012) explored the enhancement of students' engagement through online learning resources and indicated that using online tools as multimodal resources has potential benefits for improving students' self-regulation. Increasing student engagement has been an important issue in educational research and teacher training, especially for students in remedial classes at the elementary school level.

The integration of teachers' digital teaching abilities in language instruction is a current trend in digital education development in Taiwan. Kang and Lu (2022) found a significant

increase in students' language use rate, from 19.05% to 54.09%, when incorporating tools into the language teaching environment compared to the control group (traditional teaching). This adjustment in students' response eagerness enhanced classroom interaction balance, improved teaching quality, and increased teaching efficiency.

2.2 Integration of Chatbots Escape Room Game Design in Teaching

Chatbots have attracted widespread attention as language learning assistants due to their ability to converse with students in natural language. According to Huang, Hew, and Fryer (2022), chatbots bring new possibilities to language teaching. Despite the perceived benefits of using chatbots in language classrooms, such as providing interaction opportunities or helping create a low-stress learning environment, there is limited knowledge about learners' actual use of chatbots and their impact on language learning motivation (Jeon, 2024). Another, this study aims to build on the aforementioned research by proposing the use of the LINE chatbot as a vehicle for grade six students' after-school autonomous learning. By incorporating the chatbot's interactive features, the study seeks to provide students with a more engaging and effective way to continue their English language education outside the classroom.

Gamification in instructional design can be categorized as either "learning by playing" or "learning for playing." Escape room games are a popular game format in Taiwan in recent years; during the escape room process, players must utilize diverse knowledge and methods, continuously brainstorm and reason, to deduce rules and solve puzzles, fostering logical thinking (Lin, 2012; Prensky, 2003). Especially, escape room games emphasize the importance of education focusing on cultivating students' higher order thinking and problem-solving abilities, rather than relying on repetitive exercises (Stone, 2001). These abilities are considered essential "portable skills" in education and crucial elements for practical problem-solving in life, take the example for Cabrera et al. (2020), incorporating escape room games in teaching showed that the escape room experience could enhance learners' academic achievement, motivation, and autonomy.

2.3 Situational Interest and Student Engagement for LINE Chatbot

The two aspects of interest provide a more comprehensive understanding, enabling us to gain deeper insights into learners' motivations and engagement with subjects, topics, or activities. Situational interest refers to a temporary emotional state that occurs when an individual is emotionally stimulated by a specific topic or environment. It is less stable and potentially short-lived (Anderson et al., 1987; Hidi, 1990; Hidi & Baird, 1986). For students' engagement in learning activities, Wang and Sun (2023) increase students' engagement through different digital tools for English learning, especially for behavioral and cognitive domains, the tools allow student to authentically participate in and arouse their cognition the learning content (Fredricks et al., 2004; Wang & Sun, 2023). Chien et al. (2022) focused on the use of LINE chatbots for situational English learning, examining their impact on learning engagement and achievement. The present research revealed that the contextualized design of LINE chatbots effectively enhanced students' self-efficacy and motivation in language learning tasks, while also arousing situational interest and engagement.

3. Methods

3.1 Participants

This study was conducted in an elementary school in Taiwan, with the participation of 58 grade six students and their teacher. The teacher holds a master's degree and is a senior teacher with five years of teaching experience. Prior to the official launch of the intervention, we informed the students' parents of the interventional plan and obtained their consent. The study consisted of 29 boys and 29 girls with an average age of twelve years old. All these students participated in the teacher's English courses, which was twice a week.

3.2 Research Model and Experimental Procedure

This study was conducted with quasi-experimental design, both of control group and experimental group were taught as the same learning content: “country” and “transportation” topic, but after school, they review the contents with different learning mode. In the present study, each student was assigned to “Self-Study group” as a control group and “LINE Chatbot group” as an experimental group to review English lesson contents after school. Each of the control group and experimental group has twenty-nine students.

Students in control group are required to complete the weekly self-study assignments provided before the English course, the self-study content serves as the learning material for the English final assessment, and students practice listening and reading repeatedly by playing audio files from the textbook. Moreover, the experimental group in this study, in addition to completing the same self-study progress as the control group, during the experiment, three different game tasks were designed, and students engaged in these games after class using LINE app; students in this group were required to fully participate in three LINE chatbot-integrated escape room games, which content was based on the both learning topics, “country” and “transportation”. After completing the self-study (control group) or the third game (experimental group), post-test scales were administered to observe any changes in the participants' situational interest and learning engagement at that time. Both groups took the post-test to assess their English learning effectiveness after the English final assessment. The experimental process of the study is illustrated in Figure 2.

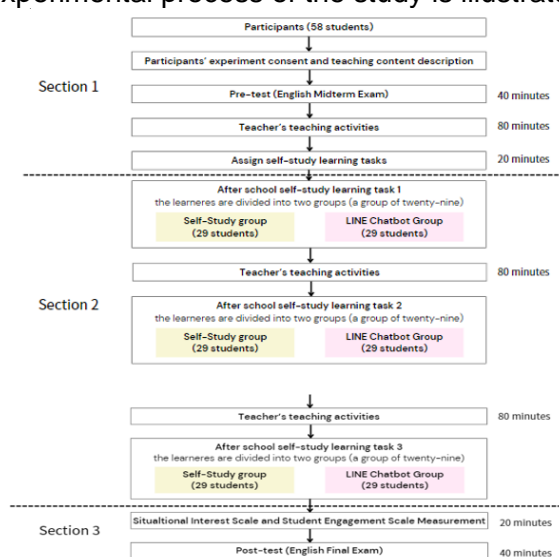


Figure 2. Experimental Procedure.

3.3 Research Materials and Data Analysis

3.3.1 Research Materials

The researcher developed a LINE chatbot for individual student learning consultation and analysis, and designed three chatbot-integrated escape room game challenges. The learning content of the games was based on the material for the English final assessment, specifically 12 designated vocabulary words under the themes of "Countries" and "Modes of Transportation" and 4 designated sentence patterns. Three different situational contexts were created for the three time points (an English teacher traveling to Japan, Christmas holiday, and a school sports day).

Within the escape room scenarios, students had to enter specific passwords to unlock each escape room, with game paths differing based on their grade level. Subsequently, they would encounter questions in situational themes in the escape room, requiring them to input the correct words or sentence patterns. The system would only allow progression to the next

question upon correct answers, using level clearance as positive reinforcement for correct responses (as shown in Figure 2).



Figure 2. Entrance Mode of Escape Game in LINE Chatbot (User Interface).

3.3.2 English Learning Achievement Exam (pre-test and post-test), Situational Interest Scale and Student Engagement Scale

Both the experimental group and control group students participated in regular school assessments. The English mid-term exam scores of the first semester in sixth grade were used as the pre-test, and the final exam scores were used as the post-test, with a total score of 100 for each. The regular assessment items administered at the school had undergone two-way specification table analysis for content validity as an achievement test and were reviewed and piloted by three expert teachers.

The situational interest scale was developed by Hung (2022) based on the measure compiled by Yu, Sun, and Chen (2019), with reference to that of Chen, Darst, and Pangrazi (1999). The questionnaire was reviewed by two digital learning experts for expert validity. The questionnaire demonstrated good reliability (overall Cronbach's $\alpha = .89$) with a total of 23 items. It measured students' post-experimental situational interest using the constructs of exploratory intention (4 items), instant enjoyment (4 items), novelty (3 items), attention quality (4 items), challenge (4 items), and total interest (4 items) in sequence.

The student engagement scale was developed by Sun, Yu, and Chao (2019) based on the measure proposed by Fredricks, Blumenfeld, Friedel, and Paris (2005). The questionnaire was a 5-point Likert scale with five questions on behavioral engagement (5 items, Cronbach's $\alpha = .72$), three questions on emotional engagement (3 items, Cronbach's $\alpha = .87$), and six questions on cognitive engagement (6 items, Cronbach's $\alpha = .75$), which demonstrated good reliability with a total of 14 items. An example question for cognitive engagement is, "When I'm in the game, I ask myself questions to make sure I understand what it is about." Both scales for grade six students, 5-point Likert scales were used (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree), and ANOVA analysis was conducted using SPSS Statistics 22 software.

4. Results

4.1 English Learning Achievement Exam: Pre-test (English Midterm Exam) and Post test (English Final Exam)

With the insignificant result of the homogeneity test, the ANCOVA results showed that the effect of interaction between the covariates (the pre-test scores of the two groups) and variables was non-significant ($F = 3.87$, $p > .05$), but the effect of the post-test results on students' learning achievement ($F = 5.57$, $p < .00$). The results demonstrate that the post-test had a significant effect on students' English achievement. More specifically, after controlling for the pre-test effect, the post-test still had a significant effect ($F = 5.57$, $p < .00$).

Table 1. Summary of covariance analysis results

Source of Variance	SS	df	MS	F	p	Partial η^2
Covariate (pre-test)	.374	1	.374	3.87	.06	9.7%
Intergroup (post-test)	10.75	20	.54	5.57	.00	75.6%
Intragroup (Error)	3.48	36	.10			
Overall	145.00	58				

4.2 Situational Interest Scale and Student Engagement Scale

The results show significant differences in total situational interest ($F_{(1,56)} = 55.64$, $p < 0.01$, $\eta^2 = .409$), attention quality ($F_{(1,56)} = 37.74$, $p < 0.001$, $\eta^2 = .11$), instant enjoyment ($F_{(1,56)} = 83.58$, $p < 0.01$, $\eta^2 = 1.04$), and total interest ($F_{(1,56)} = 66.75$, $p < 0.001$, $\eta^2 = .30$). Thus, it can be concluded that the LINE chatbot with escape game design was more effective in enhancing students' situational interest in learning English after school.

Table 2. *Descriptive statistics and a summary of one-way ANOVA for situational interest, novelty, challenge, attention demand, instant enjoyment, and total interest*

Variables	Groups		F	η^2
	LINE Chatbot Group (n=29)	Self-Study Group (n=29)		
	M (SD)	M (SD)		
Total situational interest	4.36 (.86)	2.62 (.90)	55.64**	.41
Novelty	4.28 (.92)	3.93 (.99)	1.87	1.54
Challenge	2.31 (1.44)	2.69 (1.13)	1.24	.24
Attention quality	4.52 (.78)	2.76 (1.33)	37.74***	.11
Instant enjoyment	4.65 (.67)	3.03 (.68)	83.58**	1.04
Total interest	4.69 (.66)	3.24 (.69)	66.75***	.30

** $p < .01$, *** $p < .001$

For behavioral engagement, the results show a significant difference among the two groups ($F_{(1,56)} = 200.49$, $p < .001$, $\eta^2 = .03$); for emotional engagement, it shows a significant difference among groups ($F_{(1,56)} = 78.68$, $p < .001$, $\eta^2 = .08$); and for cognitive engagement, it shows a significant difference among groups ($F_{(1,56)} = 78.68$, $p < .001$, $\eta^2 = .01$). Thus, it can be concluded that the LINE chatbot with escape game design was more effective in enhancing students' engagement.

Table 3. *Descriptive statistics and a summary of one-way ANOVA for constructs of behavioral engagement, emotional engagement, and cognitive engagement*

Variables	Groups		F	η^2
	LINE Chatbot Group (n=29)	Self-Study Group (n=29)		
	M (SD)	M (SD)		
Behavioral engagement	4.79 (.77)	2.31 (.54)	200.49***	.03
Emotional engagement	4.66 (.61)	3.17 (.66)	78.68***	.08
Cognitive engagement	4.65 (.61)	3.17 (.66)	78.68***	.01

*** $p < .001$

5. Discussion and Conclusion

Conclusions are verified based on the results from Section 4. The post-test reveals that the LINE chatbot with escape game design for English lesson learning has a significant impact on the learning effectiveness of grade six students compared to the pre-test results. The measurement results of the experimental group students on the situational interest and student engagement are highly representative, indicating that participating in this game design helps students maintain high concentration and interest in English learning tasks, thereby enhancing their motivation in English learning; and even exhibit higher engagement during the task process, which indicating their willingness to spend after-school time actively participating in English learning with high levels of engagement and positive motivation. The research verification results demonstrate that grade six students' participation in the LINE chatbot with escape game design has a positive impact on their English learning outcomes, including learning achievement, situational interest, and learning engagement.

Based on above, instructors can design escape room game tasks for teaching and homework assignments. It is expected that they will collaborate to develop teaching examples that support the trend of digital integration in language teaching in Taiwan. Future research can focus on students aged K9-12 as research subjects to obtain diverse research results influenced by various cognitive development periods to enhance the application of chatbots combined with escape room game design in English teaching; furthermore, it's recommended to divide the experimental group into a chatbot group (experimental group 1) and a chatbot combined with escape room game group (experimental group 2) to investigate whether different variables have varying impacts on students' learning effectiveness, situational interest, and learning engagement.

Acknowledgements

This research was supported by the lab members of NYCU's ILTM (Interactive Learning Technology and Motivation) lab, which can be found at <http://ILTM.lab.nycu.edu.tw>, to conduct the relevant study. Our gratitude goes to the lab members of NYCU's ILTM lab and the grade six students who participated in the research.

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