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# **Using Gamification and Augmented Reality to Encourage Japanese Second Language Students to Speak English**

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## **Abstract**

Language anxiety is one of the key problems that hinder language learners to speak a target second language. This problem is especially relevant for Japanese second language learners, who tend to have difficulties in English. To alleviate this problem, researchers have succeeded in leveraging modern technologies to help second language learners practice various language skills, including speaking. These research papers introduce modern technologies into the field of education, which is the guide and basis of this paper. This study aims to help Japanese second language students to overcome the barrier of speaking English by designing a game-based language learning tool that incorporates elements of Augmented Reality (AR) technology.

In this study, we try to encourage students to speak English by designing an AR-aided cooperative game. The GOAT (Gamified cOmunicAtion Tool) application was developed with gamification and AR technology. The tool was evaluated with 39 second language students at the different stages of its development during a period of eight months. The results suggest that the GOAT app has a high potential to help students to overcome their language anxiety and ultimately the barrier of speaking English. The findings of this study serve to prove that the use of gamification in the designed tool has a positive influence on second language learners. In particular, the GOAT app was found to promote students' confidence and to encourage communications in a public setting. The enhanced confidence and more frequent communications ultimately lead Japanese students to be able to converse in English in a more natural and fluent manner. Nonetheless, the evidence with regard to whether the use of AR elements imposes a direct positive influence on second language learners' confidence is not sufficient enough. Further research along this path is recommended for a more concrete conclusion to be made.

## **Sammanfattning**

Språkångest är ett av de viktigaste problemen som förhindrar språkstudenter att tala ett annat språk. Detta problem är särskilt relevant för japanska språkstudenter, som har svårigheter att lära sig tala engelska. För att lösa detta problem har forskare visat att man kan använda modern teknik för att hjälpa språkstudenter att öva olika språkfärdigheter, inklusive den muntliga språkfärdigheten. Denna studie syftar till att hjälpa japanska andraspråks studenter att överkomma svårigheter för att tala engelska genom att designa och utvärdera ett spelbaserat språkinlämningsverktyg som innehåller element av Augmented Reality (AR) teknologi.

I denna studie försöker vi uppmuntra japanska andraspråks studenter att tala engelska genom att designa ett AR-baserat spelverktyg, GOAT (Gamified cOmmunicAtion Tool). Verktöget utvärderades med 39 andraspråkstudenter i olika stadier av dess utveckling under en period av åtta månader. Resultaten tyder på att GOAT app har potential att hjälpa studenterna att överkomma språkångest och svårigheter att tala engelska. Studier visar att användningen av spelelementen i det utformade verktyget har ett positivt inflytande på studenter. I synnerhet fann vi att GOAT kan utveckla studenternas förmåga att kommunicera på engelska i en offentlig miljö. Däremot behövs det en vidare forskning på hur användningen av AR-element påverkar japanska andraspråksstudenters utveckling av deras förmåga att tala engelska.

# Using Gamification and Augmented Reality to Encourage Japanese Second Language Students to Speak English

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## ABSTRACT

Language anxiety is one of the key problems that hinder language learners to speak a target second language. This problem is especially relevant for Japanese second language learners, who tend to have difficulties in English. To alleviate this problem, researchers have succeeded in leveraging modern technologies to help second language learners practice various language skills, including speaking. These research papers introduce modern technologies into the field of education, which is the guide and basis of this paper. This study aims to help Japanese second language students to overcome the barrier of speaking English by designing a game-based language learning tool that incorporates elements of Augmented Reality (AR) technology.

In this study, we try to encourage students to speak English by designing an AR-aided cooperative game. The GOAT (Gamified cOmmunicAtion Tool) application was developed with gamification and AR technology. The tool was evaluated with 39 second language students at the different stages of its development during a period of eight months. The results suggest that the GOAT app has a high potential to help students to overcome their language anxiety and ultimately the barrier of speaking English. The findings of this study serve to prove that the use of gamification in the designed tool has a positive influence on second language learners. In particular, the GOAT app was found to promote students' confidence and to encourage communications in a public setting. The enhanced confidence and more frequent communications ultimately lead Japanese students to be able to converse in English in a more natural and fluent manner. Nonetheless, the evidence with regard to whether the use of AR elements imposes a direct positive influence on second language learners' confidence is not sufficient enough. Further research along this path is recommended for a more concrete conclusion to be made.

## KEYWORDS

Augmented Reality (AR), Gamification, Game-based learning, Second Language Anxiety (SLA), Higher education, Speaking

## 1. Introduction

According to statistics from the World Economic Forum, almost 1.5 billion people around the world speak English on a day-to-day basis [15]. It is a vital language skill to master. However, the majority of English speakers are not native. They mainly receive English education from school. “*Of the approximately 1.5 billion people who speak English, less than 400 million use it as a first language*” [15, p.2]. Compared to European countries, Asian countries lag in their English level. For example, in 2016, Japan scored 51.69 out of 100 in the English proficiency index, while Singapore claimed a leading score of 63.52 among Asian countries, whereas Netherland gets the highest score of 72.16 all over the world and Sweden ranks third with a score of 70.81 [15]. It goes beyond doubt that Asian countries need to find more effective approaches to improve their English skills.

Various reasons exist to explain Asian students' barriers in acquiring English as a second language, including a significant difference between the language systems and culture. This difference frequently leads to anxiety and diffidence when Asian students try to speak English [30]. Language anxiety, especially *second language anxiety*, is considered to be a nonnegligible issue [16, 17]. Pino [17] for example, indicates that students experience considerably more anxiety in their foreign language classes compared with mother tongue language courses; the problem is found to be attributed to students' communication apprehension, social evaluation and test anxiety [17]. These types of barriers are encountered in countries such as Japan and China. Helgeson [18] points out that “*Japanese students rarely initiate conversation, avoid bringing up new topics, do not challenge the teacher, seldom ask for clarification, and do not volunteer answers*” (p. 38). Also, Japanese students have been found to be reluctant to talk in settings where they would stand out in front of their peers [17]. All this suggests that the Japanese learners' barriers to the second language acquisition are caused by their social and cultural codes for speaking, either privately or in a more social setting. As a result, technologies such as gamification and AR technology have recently been introduced to the field of education to facilitate the learning process for language students.

*Man only plays when he is in the fullest sense of the word a human being, and he is only fully a human being when he plays.*

— Friedrich Schiller

Serious games and game-based learning are popular topics in the fields of education, information study, and human-computer interaction [31]. Gamification, which here refers to digital game-based learning in the education area [31], has been applied in an effort to reduce language anxiety among second language students for the purpose of this study. Gamification is a method to encourage learners to spend more time on learning [13]. Students are found to be motivated to achieve their goals via game-based mechanics, such as missions and rewards [9]. Research has shown that gamification can effectively improve the performance of participants during study, including concentration, interest and enjoyment [13]. Learners were observed to be more motivated to spend more time and effort when games are used in their learning practices [8]. However, there are downsides of gamification. Luis's research [40] argues that gamification fosters shallow learning, which is not good for the long-term learning process.

Apart from gamification, AR technology has also been considered in this study. AR is a complex combination of tracking technologies, visual simulation and interactions [37]. It can create an immersive environment (i.e., a digital layer superimposed on the physical world, combining both virtual and real information to enhance the authentic world), which serves to increase productivity [29]. Researches utilize AR technology in education to help learners practice their second language. Tiziana [26], for example, discovered that AR technology was able to keep learners engaged in learning activities for a longer period of time.

In the course of this project, gamification and AR technology were designed and utilized to help students to overcome their language anxiety in speaking English in higher education. This project has been conducted in close cooperation between Swedish Royal Institute of Technology (KTH) and Self-Access Learning Center (SALC) at Kanda University of International Studies (KUIS) in Japan. The ultimate target group is Japanese language students who study English as their second language (for more, see Section 3).

This thesis aims to understand how we can employ AR technology and gamification to support Japanese second language students in overcoming their barrier of daring to speak English. This study aims to answer the following research questions:

1. *How can gamification and augmented reality be effectively designed and used to support second language students in overcoming their barrier of daring to speak English?*
2. *What are students' perceived attitudes towards the designed technology-supported solution to assist them in overcoming their language anxiety and their barrier of speaking English?*

## 2. Background

### 2.1 Language Anxiety in Foreign Language Learning

Since the mid-1960s, researchers have realized that anxiety occurs during second language learning and practicing [25]. The anxiety comes from the difference between people's expectation and their actual performance. People often consider themselves fully capable when they speak their mother language. But when they speak some other language, their performance may not be good enough to be fully understood or accepted by others. This psychological gap is the main reason of anxiety, which influences students' further performance and second language achievement (usually shown as grades) [19].

Language anxiety influences learners' performance. Horwitz [21] for example, found that students who suffered from language anxiety tended to avoid difficult and personal communications in their target language. Also, anxious learners were identified to prefer descriptive messages, instead of interpretive ones, which means they prefer more concrete sentences and shorter compositions [17, 21]. Moreover, Jeong [22] showed that learners' anxiety restrained their neural responses during conversations.

Apart from students, teachers also experience various degrees of anxiety. Machida [20] pointed out that since English became a mandatory course in elementary schools in Japan in 2011, English teachers have been suffering from the anxiety when speaking English. The anxiety mainly results from the lack of their English proficiency and the insufficient training on how to teach English, which jeopardizes their teaching performance. Such anxiety can then be passed on to the students by reducing their chance of acquiring English skills and ultimately influenced students' confidence in speaking English.

### 2.2 Learning through Games

Earlier research has concluded that games have the potential to improve students' academic performance [13]. For example, Sandberg et al. [7] examined the use of mobile technology for second language learning. In their experiment (to learn English words), a mobile game during and after a zoo visit was offered to second language learners. The results showed that learners who kept using this application for two weeks scored higher than the ones who only used it in the zoo. Kennewell [8] compared the performance between students with traditional learning media (e.g., the ordinary black/whiteboard, the textbook, the worksheet) and advanced media tools (e.g., interactive whiteboards and computers) for gamified learning process. The study's results showed that the students equipped with advanced technology tended to have a higher level of motivation, a more intense engagement with the activity and a greater willingness to explore ideas and to persevere in the face of challenge compared to those with traditional learning media.

## 2.3 AR in Second Language Acquisition

Augmented reality (AR) is a mix of virtual elements and real-life authentic world objects and environments. Recently AR technology has also entered the field of education. For example, Perry [9] developed an application with gamification elements and AR for French second language learners and found that the use of AR-supported game-based mechanics facilitated learners' second language acquisition. Holden et al. [28] developed a maker-oriented AR and place-based method for language learning. The game's goal was to solve a murder, in which players interacted with non-playing characters and actual inhabitants so that they could learn through the use of the target language. The results showed that the engagement mechanisms offered in the AR environment indeed enhanced the experience of learning languages, allowing students to learn language "in an innovative and fun way" [26, p.57]

There are also applications that encourage learners to speak a foreign language with others and/or practice oral language skills in daily life. In one study, Tiziana [26] developed an application (called *Imparapp*) that aimed to facilitate students to learn Italian in daily life. The game started with a treasure hunt. During the game, students needed to collaborate with each other in Italian and navigated through the city. Positive feedbacks from the participants indicate that learners perceived interactive activities to be more engaging than traditional methods such as books and courses.

## 2.4 Japanese Culture

People's perceptions towards technologies-in-use and their design may vary due to different cultural backgrounds [38]. Therefore, for the purposes of this thesis, it is important to consider specific aspects of the Japanese culture in order to tailor the design of the GOAT app to Japanese students' needs and requirements.

Japan has an interdependent (or socio-centric) culture, meaning that individuals tend to imitate others [12]. In an interdependent culture, collectivism is important, meaning that Japanese people tend to put "we" before "me" [3]. Such an interdependent culture becomes more evident in the Global Leadership and Organizational Behavior Effectiveness Project (GLOBE) [5], where Japan scores far above average on Institutional Collectivism, i.e., a degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action. According to the GLOBE studies (2004), Japan is also a country that scores higher than average on performance orientation and much lower than average on assertiveness. In other words, Japanese culture rewards people who succeed in different fronts, and punishes failing in a more passive manner, rather than aggressively and confrontationally, which can be corroborated by the low score on

assertiveness [5]. These unique cultural traits contribute to the current dilemma of English education in Japan.

## 2.5 Current English Education in Japan

To popularize English, the Japanese government has taken proactive measures, such as the introduction of compulsory English courses in elementary school since 2011 [20]. Unfortunately, the results fall short of expectations. Findings of a relevant study [6] showed that in 2016, the Japanese government set a goal that 50 percent of the Japanese third-year junior high school students should achieve Grade 3 or higher out of 5 in Eiken English proficiency test<sup>1</sup>. Students with Grade 3 were "expected to be able to understand and use language concerning familiar, everyday topics, such as likes and dislikes, and basic personal and family information" [6]. In reality, only 36,1 percent of them achieved this level of English proficiency in 2017.

## 3. Case Background

This study was conducted in collaboration between KTH and the Self-Access Learning Center (SALC) at Kanda University of International Studies (KUIS) in Japan. SALC is a learning center that helps second language students develop their self-regulated learning habit that is essential to their successful acquisition of the target second language. Most students at KUIS learn English as their second language. One of the common problems these students encounter is the fear of speaking English [33]. At KUIS and SALC, second language students are provided with and encouraged to use tablets as their main tool of learning second language. However, most learning and teaching activities offered by the center are still paper-based. This creates a gap between the initiative of using tablets and the teaching and learning activities offered.

Currently, SALC mainly offers traditional teaching and learning activities to help students practice their oral English skills, e.g., group discussions and board games. In SALC, an area called 'Yellow Sofas' (Image 1) has been set up, where students are encouraged to talk with each other, but only in English (i.e., they are not allowed to use their mother tongue), often when playing board games.



Image 1. Yellow Sofas at SALC

<sup>1</sup> <https://www.eiken.or.jp/eiken/en/eiken-tests/>

## 4. Method

In order to find an answer to the research questions (see Section 1.3), the research process followed the Design Science Research Process (DSR) methodology [32] (Figure 1a). In DSR, design is used as a research method or technique in an effort to shed light on new knowledge [36]. The whole process contains five parts: Awareness of Problem, Suggestion, Development, Evaluation and Conclusion. The project follows the DSR model in the following steps (Figure 1b).

Firstly, the problem addressed in this work was identified through a series of workshops and interviews, which were carried out by the KTH researchers in June 2018 (*Problem Awareness*, see Section 5). Secondly, as a preliminary solution to the stated problem, a low-fidelity prototype (called Prototype 1) was developed, which was designed in the scope of the Advanced Project course in Autumn 2018. Preliminary user tests of the prototype were performed in January and February 2019 within the frames of this thesis. Relevant feedbacks were gathered from chosen Japanese, Swedish, and Chinese students (*Suggestion*, see Section 6). Based on the feedbacks, the prototype was further developed. A high-fidelity prototype, the GOAT (Gamified cOmmunication Tool) app was developed (*Development*, see Section 7). To evaluate the application, new user tests were conducted, including i) a 30-minute game session, where study participants used the GOAT app to complete several designated tasks, ii) questionnaires before and after the test, and iii) focus group interviews. To have a better understanding, a time line is shown in Figure 2, including all steps of the entire work.

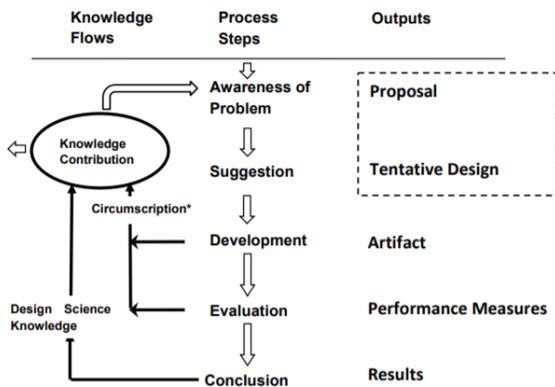


Figure 1a. Design Science Research Process Model

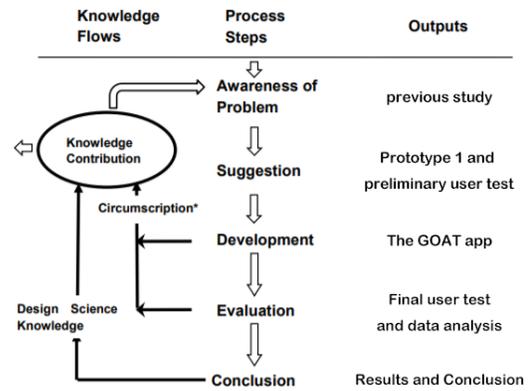


Figure 1b. Adapted version of DSR

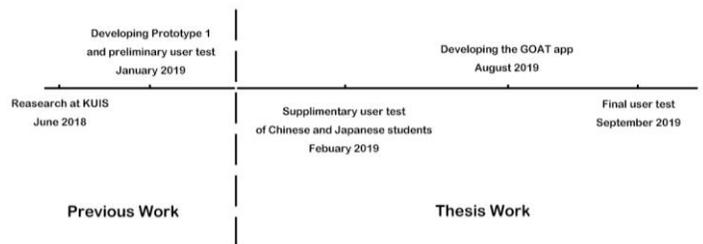


Figure 2. Timeline of the entire project

### 4.1 Data Collection

To evaluate the tool, we have conducted user tests that comprise of three parts: 1. a 30-minute game section/user test. 2. Questionnaires before and after the test. 3. Focus group interviews.

The form of user tests was inspired by the method suggested in Bernadette’s paper [9], i.e. the questionnaire and focus groups were used as the method to evaluate a prototype. Questionnaires were used for the purpose of collecting quantitative data, which can show participants’ attitude towards the prototype. The questions were in the form of a 5-point Likert scale (5 indicates ‘totally agree’ whereas 1 indicates ‘totally disagree’).

As a supplement to the questionnaires, focus group interviews were conducted after the participants answered the survey questions in an attempt to gather more specific and qualitative feedback on the GOAT app and the user test.

### 4.2 Data Analysis

After the user test, the data were analyzed by means of descriptive statistics, which is a common method to investigate the relationship between variables. For the questions with the 5-point Likert scale, means were calculated, which could lend insights on participants’ opinion towards the prototype. The questionnaires included the same questions for both before and after the test (See Appendix 1). The comparison could demonstrate the difference in students’ self-perception before and after the test. In other words, the results can indicate whether participants are more willing to speak English after using the prototype. Moreover, the

survey data were compared between the preliminary user tests and the final user tests.

Thematic analysis was used to analyze interview data from focus group interviews. Thematic analysis translates the interview results into identifiable themes and patterns [35]. The themes provide the most important and relevant data that can help to answer the research questions [32]. The feedback from participants illustrated their perceptions towards the GOAT app, which serves to supplement the statistics.

### 4.3 Ethics

The participation in this research study was offered on a voluntary basis. Before the test, participants were informed on the purpose and the process of the research project in words. All the data were kept confidential and anonymous. Following the Global Data Protection Regulations (GDPR), participants were given the choice to withdraw from the research study at any time during the course of the experiment.

## 5. Problem Awareness

To understand Japanese students' needs and preferences in how to overcome their barriers to speak English, we devised our preliminary study approach, which includes three workshops (two hours each) and interviews with students and learning advisors that were conducted (by the KTH researchers) at Kanda University in Japan in 2018, out of scope for this project [33]. During the studies, the Japanese students and the learning advisors expressed their ideas on how to utilize modern technology in the learning and teaching process. As a result of these activities, a technology-enabled potential solution was suggested: to introduce the concepts of learning games, Virtual Reality (VR) and AR into language education. Also, in relation to the game concept, students pointed out a specific physical place at SALC, i.e., the yellow sofas, where they play learning games on a regular basis to improve their English communication skills.

Considering that the aim of this study is to encourage English speaking in the real world instead of the virtual environment, VR technology – which segregates people from the reality using specialized devices (usually VR glasses) - does not fit well into the purpose. Because VR devices will hinder conversations in an interpersonal setting (i.e., when wearing VR glasses, participants can hardly communicate with each other through body language or eye contact). To the contrary, AR technology, which enhances user's immersion into the real world through elevated interpersonal interactions (see Section 2), was added to the game concept.

## 6. Suggestion and Initial Development

### 6.1 Prototype 1

As a possible solution to the aforementioned problem, a low fidelity prototype in a form of an Escape Room game (i.e., a popular Japanese game) was developed within the frame of the Advanced Project Course at KTH in 2018 (Image 2). In this game,

players are commonly locked together in the same room, in which they have to collaborate to gather clues and solve puzzles in an attempt to unlock the door and eventually escape the room within limited timeframe.

In contrast to the overall game idea stated above, Prototype 1 is a game, in which three players are locked in different rooms, not in the same room. Being locked in different rooms was thought to encourage communications among the players because they could not see the surroundings (such as furniture and decorations) in other rooms. They can only see the objects in their own room. However, the clues in different rooms need to be pieced together in order to solve the puzzle. Participants are “forced” to rely on each other to describe the clues placed in their rooms and strategize with each other verbally in order to “liberate” themselves. It is as if we deployed a jigsaw whose fragments were spread out in different rooms. Impelled by the urge to escape the room and intrigued by the desire to solve a puzzle, the participants can cast off the fear of embarrassment and focus more on communicating with each other, thus facilitating the form of a habit to converse in English more intuitively.

Due to the fact that Prototype 1 was only initially developed in a form of a low fidelity prototype, with several missing functions and visual decorations, a paper-based version of this prototype was offered for preliminary testing to the participants in Autumn 2018. The screenshots of the entire house (see Images 2a & 2b) were printed and given to the participants to run the user test.



**Image 2a.** Screenshot of the low-fi prototype: Overview (Prototype 1)



**Image 2b.** Screenshot of the low-fi prototype: Living Room (Prototype 1)

## 6.2 Evaluation of Prototype 1

Preliminary user test of Prototype 1 was conducted in order to understand if the users were willing to use such gamified application for their acquisition of verbal language skills.

The testing of the paper prototype was impossible to carry out with the Japanese students in Japan due to time limitations of this project. Instead, a user test was conducted with nine KTH students in Autumn 2018. Similar to Japanese, Swedish do not speak English as their native language. Students use English as their second language. Even though Swedish students generally perform very well in speaking English, it is still valid to investigate if the developed prototype can indeed encourage second language students to speak English. Also, we wanted to understand students' attitudes towards the gamification elements of the software. Nine participants participated in the user test. To fit into the design of the game, they were divided into three groups. During the test, there was an observer who watched and recorded the participants' behavior, i.e. the level of participants' engagement.

After the test, participants were interviewed through focus group discussions. The interview questions included such questions as, *Do you think the game encourages you to speak English with others?* or *How do you feel about the difficulty level of the puzzles?*

## 6.3 Supplementary User Test of Prototype 1

Since nine participants was not a sufficient sample size for user testing, a supplementary user test with six more participants was conducted within the course of this thesis work in February 2019. The same version of the prototype was offered to the 6 additional participants, i.e., the Chinese second language learners. Since Chinese students – who share similar cultural background as the Japanese students – sometimes display the same language anxiety issue as the Japanese students [17, 27], their feedback can be highly valuable to the research.

Nonetheless, the feedback from the target group for this study, i.e., Japanese English language students, was of paramount importance, especially in understanding the cultural aspect of the designed solution. Since it was impossible to conduct a user test with these students due to the time and distance limitations, a pre-recorded video file that featured Prototype 1 was shared with 18 Japanese students at SALC (KUIS) in February 2019. Relevant questions were also sent to these students in order to gauge the students' opinions towards the suggested game concept and the design of the entire prototype, especially its artistic style. The students' responses to the questions were received in the form of short video recordings (3-5 min). Each recording contained responses from two Japanese students.

## 6.4 Results of the User Testing (Prototype 1)

All in all, 15 Swedish and Chinese students, as well as 18 Japanese students participated in the user testing for the paper-based prototype where they were offered to play the room-escape

game and finish several tasks. The results showed that out of five groups (with three students in each group) who tested the prototype one group successfully escaped from the room. Four groups managed to enter the final room with a few hints offered by the experimenters.

Some participants expressed that the game offered during the testing was *“interesting”* and *“good for practicing English”* for their language learning purposes (Respondent: R1, R2, R7). Others, who have tried some other Escape Room game before stressed that the design of the game offered *“a good environment for practicing oral skills”* (R12).

According to the participants, the difficulty level of the puzzles in the game was acceptable. Two groups thought the puzzles were well-balanced except for an equation puzzle. More importantly, one group (Rs 7-9) pointed out that *“the arrangement of the puzzle [was] not reasonable”*. They explained that *“the person in the closet needed to wait for a long time (approximately 5 minutes) for the other two to ‘save’ him/her”*. This long period of separation might cause the feeling of isolation and detachment from the game.

Overall, all groups stressed that the game encouraged collaboration since the puzzles could not be solved by a single person. However, two groups (Rs 1-3, R13-15) pointed out that *“the encouragement of speaking English was obscure”*. Since the game was based on graphics, all the puzzles could be discussed in Swedish or other languages that participants knew better. One group (R7~9) also indicated that they spoke English only because they were told to do it. Otherwise, they would bring other languages into this game.

Based on the observational data analysis, the results showed that all groups were active during the collaboration. What is more interesting was that two groups showed that when they could not solve the puzzle during the game, one person tended to stand out as a 'leader', trying to guide the team through the collection and analysis of all the clues.

The results of the data analysis based on the feedback from the Japanese students show the following. The majority of the students ( $n=15$ ) stressed the game concept was *“attracting”* and *“exciting”* (R3, R7, R8). One of the respondents (R14) said: *“The game is interesting, and I am willing to speak English when using this prototype. And it can encourage shy students who often hesitate to go to the Yellow Sofas. During the cooperation, we can practice our English skills, such as describing objects”*.

Four students indicated that Japanese people love playing games in daily life. Moreover, three groups expressed that Japanese people love competition. A competition mechanism could be introduced into the prototype to share scores and compete with each other. This mechanism would also promote students' motivation and enthusiasm. In the meantime, the need for a reward system was also emphasized. Japanese people get motivated in competition and strive to get rewarded for excellent performance because of the culture pattern. At last, one group also

indicated that Japanese students prefer group activities (i.e. more than two students) than one-to-one activities, because Japanese people are in general perceived to be shy [39]. This also relates to the problem that the Japanese are reluctant to speak English in public [39].

The most frequently mentioned problem with the offered tool was the style of the house; Japanese society has a totally different lifestyle than the Western culture. For example, the respondents expressed that Japanese use chopsticks instead of knife and fork. To meet these requirements, the decoration and layout of the house need to be re-designed.

Apart from this, the Japanese students also provided suggestions on the use of AR technology. The AR technology could elevate the interest and provide a more novel and captivating experience. However, the technology could also bring negative impacts on the health of the students. One participant (R14) pointed out that *“Using AR for a long time may harm the eyes. Even worse, simulator sickness could happen because of the frequent rotation of the camera”*.

To summarize, based on the feedback from the user tests, further improvements to the prototype need to focus on three main aspects: i) the aesthetic style of the entire house, ii) puzzle design, and iii) interaction design.

## 7. Further Development

In this section, we present a further development of the designed solution (Prototype 1), which is a part of the developmental phase of the DSR model (Figure 1). Based on the results of user testing from all three groups of students (i.e., Swedish, Japanese and Chinese), the low-fi prototype was further developed into the high-fi prototype, called the GOAT app.

### 7.1 Remodeling: Aesthetic Design

One of the key areas of improvement is based on the most mentioned problem among the Japanese respondents, i.e., they wanted a Japanese-style house instead of the European-style one offered in Prototype 1. After referring to relevant literature about Japanese home decorations and interior design, most of the models in the house (e.g., furniture and puzzles) were re-designed. The style of the house was changed from cartoonish to realistic. For example, the wall was changed from red wall paint to wood texture, which meets commonly perceptions of Japanese home style (See Image 3a). In Japanese culture, wood decorations are widely used. It is deemed as a natural and simple material [34]. The floor was also changed into Tatami, which is also a typical feature in Japanese homes.

To adapt to the Japanese aesthetics, the furniture in the house was remodeled to match the style of the house. Compared with the previous prototype, more wood and cotton furniture were used in the new house. Furthermore, for decorative purposes, Ukiyo-e (a kind of Japanese art) were used as texture. All the models were

built with software Maya<sup>2</sup>. The improved art style is presented in Images 3a and 3b. Overall, the “house” in GOAT app looks closer to a real-life Japanese family house.



Image 3a. Overall scene of the GOAT app



Image 3b. Living Room in the GOAT app

### 7.2 Interaction Design

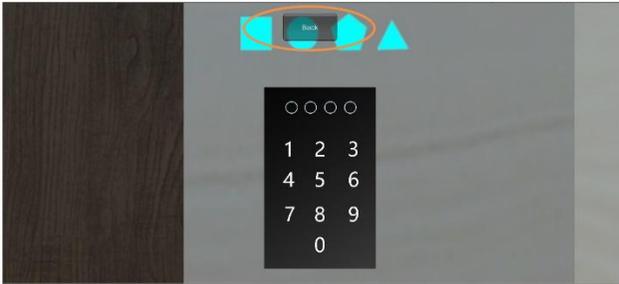
The second part focused on the improvement of the tool’s interaction design. The previous test was only conducted with paper models. But in reality, the game needs more interactions to run on a smartphone. Based on the feedback from the user tests, several interactions were added to the house to ensure a better user experience during the game. In the GOAT app, the participants can see and navigate in the house with the designed buttons (Image 4a). The main drawback of the previous design was that when players rotated the smartphone to look around; they may lose the sight of the fiducial marker, which could cause the disappearance of the entire house. The previous method of navigation was hard to maintain during the whole test.

In the GOAT app, the navigation technique was changed. Instead of rotating the smartphone, users can press buttons on the screen to turn around and navigate in the house. Correspondingly, the camera position was changed to fit the interaction. Now the camera was set in the center of the room. Players could take a close look on the items in the room by clicking them on the screen. Then the camera will zoom in and focus on the item to show more details (See Image 4b). When the door was unlocked, users could click on the door to enter the next room. This function facilitates the users to interact with their surroundings.

<sup>2</sup> <https://www.autodesk.com/products/maya/overview>



**Image 4a.** Navigation in the house (Buttons are highlighted)

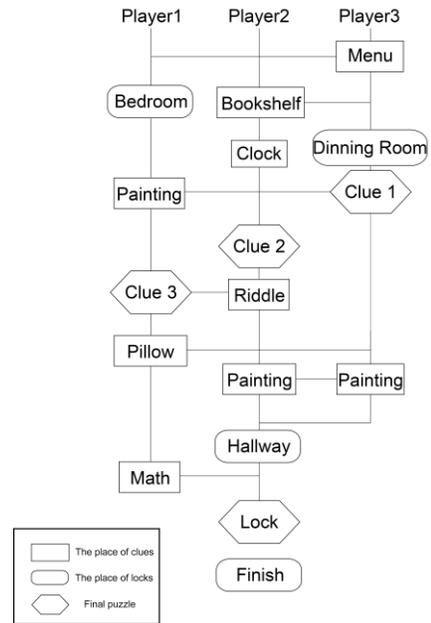


**Image 4b.** Focus on the detail (Button is highlighted)

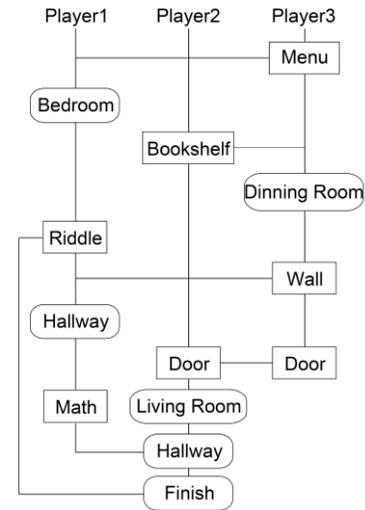
In the GOAT app, instead of staying in the physical house, players can use AR (via their smartphone cameras) to navigate around the house which will appear in the virtual world by using a special marker called fiducial. A fiducial marker consists of a unique sequence of black and white patterns, similar to a QR-code. Since AR cannot build the model in the air, fiducial markers are used as the basis for the model. The game can only be played with the presence of fiducial markers.

### 7.3 Puzzles Design

The design of the puzzles was also re-considered. First, the number of puzzles was reduced from eight to six (See Figure 3a). Since the tool was designed for a 30 minutes' game, too many puzzles would cause difficulties for players to succeed. Moreover, the order of puzzles was also altered and the flow of puzzles was rearranged (See Figure 3b). Compared with Prototype 1, in this new model the player in the closet would leave the bedroom faster instead of having to wait for an unreasonable long period of time. This would improve the user experience and guarantee that players are actively engaged during the entire course of the game.



**Figure 3a.** Flow of the previous puzzle



**Figure 3b.** Flow of the new puzzle

## 8. Evaluation

### 8.1 Final user test

A final user test was conducted to better understand students' views towards the GOAT app in assisting them to overcome their language anxiety. The participants were recruited from KTH language Café in October 2019. Six Japanese students (3 males and 3 females) participated in the user test. They were divided into two groups (three each) to play the game.

Before the test, the participants were required to answer several questions about their background. Earlier experience of Escape Room game and AR technology could influence participants'

performance in the test. So the purpose of background questions is to reduce the bias brought by earlier experience.

After answering the aforementioned questions, the participants first received a short instruction on how to play the game. They were also informed that only the use of the English language was accepted during the test. The tasks given to them included: 1. To find clues in their rooms 2. To meet with each other, and 3. To escape from the house. During the test, everyone needed a smartphone with the AR camera to interact with the house. The participants could ask for hints from the experimenter when they were stuck on a puzzle for over five minutes.

After the test, another round of questionnaire and focus group interviews were given to the participants. The questions can be found in the Appendix 1. All the questions solicit response on a 5-point Likert scale. The interview was based on the participants' answers to the questions above, to get a deeper understanding of the given answers (i.e., participants needed to explain their answers).

## 8.2 Results

Overall the students showed positive attitudes towards the GOAT app. Over 60% of the participants agreed that the gamified AR-aided tool is a good solution to overcome their barrier of speaking English. One participant (R5) expressed that Japanese second language students indeed need more chance to practice English. Most participants (R1, R2, R3, R5, R6) wanted to play the game more in the future.

### 8.2.1 Participants

The background questions were about the participants' level of self-confidence in speaking English and their level of verbal English language proficiency (Q1 and Q2). The average score of 2.17 (Table 1) means less confidence compared with the scores of Swedish students (1.56 on average from the preliminary user test). The results showed that the Japanese students indeed needed to become more confident in speaking English.

The questions about their earlier experience of Escape Rooms games and AR technology (Q3 and Q4) showed their baseline understanding of the game elements and the AR technology. Out of six participants, five admitted that they used to play Escape Room game with their friends. Such experience helped them during the test because they were familiar with the general rules. Meanwhile, the results indicated that only two students had the relevant knowledge of using AR technology. The score of 3.83 showed that although applications with AR technology (such as Pokémon Go) are popular, students still need more knowledge on how to manipulate AR technology in applications. Only one participant believed that he had a full understanding of the AR elements in the application. Most participants only have heard about it before and/or tried once. But they did not know how it works nor how to use it.

Question	Average	Minimum	Maximum
Q1	2.17	1	3
Q2	2.17	1	4
Q3	2.83	1	5
Q4	3.83	2	5

**Table 1.** Participants' background

### 8.2.2 Comparison before and after the test

The same questions (Qs1-2 and Qs5-6) were asked both before and after the test. The score could reflect if the GOAT app encouraged participants to communicate and increased their confidence in speaking English. The score rose slightly from 2.17/2.17 to 2/1.83 (See Table 2), which suggests that the app has the potential to help the participants overcome the barrier of conversing in English. Paired-sample T test was used to examine the statistical significance. Results show that the data is not statistically significant. During the interview, one of the respondents (R2) stated: "*Though the increase of confidence is a long-term goal (which is hard to change in a short time), I like this prototype and think it is a good start to practice English.*" Moreover, R2 and R6 pointed out that compared with day-to-day conversations, it was easier to communicate with strangers in game setting. They explained that "*The game created a relaxed atmosphere in which mistakes could be tolerated*". So during the test, they could communicate without the fear of failure and embarrassment.

When	Question	Average	Minimum	Maximum
Before test	Q1	2.17	1	3
	Q2	2.17	1	4
After test	Q5	2	1	4
	Q6	1.83	1	3

**Table 2.** The answer to the same questions before and after the test (Q1 and Q5 are the same, Q2 and Q6 are the same)

However, there exists a counter-example. R4 experienced a drop in his confidence in speaking English (Table 3). The score changed from 3 to 4. He explained that he never tried Escape Room or AR technology before. So during the game, he found it difficult to find the clues. Moreover, some clues (such as shapes like diamond and trapezoid) were hard to describe. So he had trouble in expressing his ideas to his teammates, which impeded the process of solving puzzles.

R4	Question	Q1	Q2	Q3	Q4	Q5	Q6
	Answer	3	4	4	5	4	3

**Table 3.** R4's confidence dropped after using the application

### 8.2.3 Gamification and AR technology

The results showed that with the use of gamification and AR technology, the GOAT app in fact encouraged participants to communicate in English. (See Table 4) more confidently. Also, they showed less stress and embarrassment during the test compared with normal conversations with strangers.

Question	Average	Minimum	Maximum
Q7	2	1	4
Q8	1.83	1	2
Q9	2.83	2	4
Q10	1.67	1	2

**Table 4.** Feedback about gamification and AR technology

The question on whether participants were motivated to speak English during the test (Q10) proved that the participants had positive attitudes towards the gamification concept. One student pointed out that when she talked with strangers in the language Café at KTH, it was hard to find a proper topic. The lack of topic aggravated the obstacle and language anxiety, which made her reluctant to practice her verbal English skills. But when playing the game, participants share one goal, helping them to find a common topic to warm up. Consequently, the gamification concept removes the barrier and improves students' motivation to speak English.

The answers to the question on whether the use of AR technology can encourage students to speak English (Q9) require further examination. The overall score of 2.83 suggests that the evidence was not strong enough to confirm a positive relationship between AR technology and the improved willingness to speak English. Four participants (R1, R2, R4, R6) perceived AR technology to be an interesting feature that could attract students to try this application. On the other hand, one participant (R1) pointed out that *"It is difficult to learn (how to use AR technology) in such a short time for those who are not familiar with AR"*.

#### 8.2.4 Suggestions on further development

Moreover, suggestions on the tool's further development were also gathered from the participants. For example, the introduction of a leaderboard was mentioned. Timer can also be added to the game so that students can compete with each other on more fronts; it will help students focus on finding the most effective way to communicate with each other in order to solve the puzzle faster. Another example is that, the puzzle can be automatically generated to ensure that the students who have played the game several times are not bored. The puzzle will change every time the game starts. So students can play the game repeatedly without compromising their level of interest in the game.

## 9. Discussion and Conclusions

This work aimed to help Japanese students overcome the barrier of language anxiety and to encourage them to speak English with the help of gamification and AR technology. The GOAT app was developed, in an attempt to respond to the first research question:

*1. How can augmented reality and gamification be effectively designed and used to support second language students in overcoming their barrier of daring to speak English?*

The results from the user tests provided the answers to the second research question:

*2. What are students' perceived attitudes towards the designed technology-supported solution to assist them in overcoming their language anxiety and their barrier of speaking English?*

## 9.1 The Use of gamification

### 9.1.1 Increase of motivation and engagement

The results showed that the use of gamification could enhance language learners' motivation to speak English. This corroborates the result of previous research from Kennewell [8], which showed that gamification could improve users' engagement, encouraging them to be more active during the verbal English practice. The gamification concept also fits into the Japanese culture. According to the feedback from preliminary tests and final user tests, Japanese people tend to be drawn to games and competitions. As a result, Japanese students can easily accept gamified learning methods. Compared with traditional learning methods, the designed technology-supported learning solution has a high potential to enhance students' interest and motivation in practicing English speaking. The game elements, i.e., competition, can attract Japanese students to try the prototype and compete with each other. This is similar to the previous research [13], which emphasized that the use of games indeed enhances the experience of second language learning.

### 9.1.2 Increase of confidence in speaking English

The findings also indicated that gamification improved students' confidence when speaking English. The use of gamification creates a casual environment in which participants could no longer be obsessed with the fear of making mistakes. Also, the GOAT app was seen to be a good starting point for conversation with new people, since students do not need to think about a specific topic to start a conversation. Consequently, gamification improves their confidence in speaking English.

## 9.2 The use of AR

According to the test results, the AR technology can attract more students to try the prototype. But the effect of promoting students' confidence in speaking English and reducing their language anxiety is not obvious based the results of this study. The main reasons are as follows. First, due to time limitation, the AR system in the prototype is still in its preliminary stage of development (See Section 7.2). The AR system only supports the appearance of the house. But solving puzzles, which is the main tasks of the GOAT app, does not benefit from AR technology in its present form. Secondly, even though AR technology is gaining more and more popularity in recent years, students participated in the study did not have enough knowledge of it. This suggests that when using such tools, participants need time to learn how to use AR technology. Consequently, a further development and a relevant examination are needed to be able to understand if and how the use of AR technology can influence students' confidence and performance in SLA.

### 9.3 Students' Acceptance

The results suggest that students hold positive perceptions towards the technology-supported solution being designed. Most participants expressed that the GOAT app could add more fun elements to the English-speaking exercise, which made it more attractive compared with traditional learning methods. The use of technology also meets the initiative from SALC that encourages students to use tablets for language learning.

### 9.4 Limitation and Further Research

The GOAT app employs modern technology (i.e., mobile technology, gamification and AR technology) to help Japanese students overcome language anxiety in practicing their verbal English skills. The findings show that the tool has a potential to help second language students to overcome their language anxiety and to encourage them to practice speaking English. However, several design implications should be considered to improve the usability of the GOAT app or similar tools. They include:

- Tutorial for beginners and user documentations;
- Further development of AR functions in gameplay;
- Timer and leaderboard for competition element;
- Random puzzle generator for repeated players
- Different levels of difficulty.

The results of this study prove that gamification is an effective approach for second language learning process. A future study should focus on the examination of the long-term use of such technology in application. Furthermore, the counter-example should not be ignored (see Section 8.2.2). This example indicates that the effects of the prototype might not be universal to all participants. Students with more experience in gameplay might perform better in the test. In contrast, students with no earlier experience may find it difficult to play. Further studies need to be conducted to evaluate any potential negative effects of similar technology-supported applications. Moreover, the statistically significance can be attributed to the lack of participants. Further study should include more participants to test the statistically significance.

In conclusion, the results show that the designed gamified AR-aided tool has a positive effect on i) overcoming students' language anxiety, ii) boosting their self-confidence and iii) improving their motivation and engagement, which ultimately encourages Japanese second language students to speak English.

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- Q8. I feel this game encourages me to speak English with other students.
- Q9. I think AR technology encourages me to speak English compared with traditional learning media (like whiteboard and textbook).
- Q10. I am motivated to speak English when using this gamified learning method.
- Q11. This game can be a good activity in SALC and I am happy if I can use them in the future.
- Q12. I like the Japanese-style decoration in the house. It looks vivid and natural.

## Appendix 1

Questionnaire of the final user test

### Before the test

- Q1. I am confident about my oral English level.
- Q2. I don't feel embarrassed when speaking English with strangers.
- Q3. I used to play Escape Room before and I am familiar with the rules.
- Q4. I knew and tried AR technology before.

### After the test

- Q5. After the test, I am confident about my oral English level.
- Q6. After the test, I don't feel embarrassed when speaking English with strangers.
- Q7. During the game, I don't feel nervous when speaking English.

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