Kyoto University
Design School

2014 Summer-term FBL/PBL

Foreign Language Education++
Final Report

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September 9, 2014

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1 Introduction

1.1 Problems in Japanese English Education I (Seongsu)

1.1.1 Lack of Emphasis on Practical Skills

Japanese English education is heavily focused on reading and grammar, and in particular it poses a serious weakness in practical skills such as speaking and listening. Among reasons for such imbalance are the fact that the college entrance exam mainly deals with reading and grammar skills and the lack of communicative language teaching (CLT) due to lack of teacher's ability and available resources for CLT [11].

1.1.2 Yakudoku and Long-Term Transitional Phase

In addition to less emphasis on practical skills, motivational issues and cultural influence are among other factors that act as barrier for enhancing conversational skills. However, we pay a particular interest to one of traditional Japanese English teaching methodology called *yakudoku* that is widely used during English course in Japan. Yakudoku is believed to be very effective in preparing for college entrance exam [5], and it is "a technique or a mental process for reading a foreign language word-by-word, and the resulting translation reordered to match Japanese word order as part of the process of reading comprehension" [8]. It can be easily witnessed that it comprises a major part in English lesson not limited to reading comprehension section but also other sections in English in Japan by personal experiences as well as academic literatures.

Here, a hypothesis is made that a practice of yakudoku is not only ineffective in acquiring practical skills in English but also even harmful in productive use of English. The main ground for the hypothesis is that English and Japanese are the languages at poles apart. For native speakers of English, Japanese language is classified as category 4 in foreign language difficulty metric, which means Japanese language is one of the most difficult languages to learn for English speakers, for their differences in structure, grammar, vocabulary, writing system, etc.[1] (Defense language institution) Simply because two languages are too different, it becomes very arduous and sometimes even impossible task to directly translate a Japanese sentence into English without losing details, and vice versa. However, as a result of a practice of yakudoku, it is assumed that students are trained to first come up with a Japanese sentence and then try to translate it into English whenever they try to express an idea or situation in English, and this places a significant challenge in communication in English with occurrence of an intermediate stage, namely long-term transitional phase.

[1] http://www.ausa.org/publications/ausanews/specialreports/2010/8/Pages/DLI%E2%80%99slanguageguidelines.aspx

Long-term transitional phase is coined in order to refer to a mental process where an idea to express is first described in one's mother tongue or primary language and then is translated in target language especially linguistic gap between two languages are significant. Once long-term transitional phase is adopted as main scheme for speaking in secondary language, it is as though any word or expression in one's secondary language merely represent corresponding word or expression existing in primary language.

1.2 Problems in Japanese English Education II (Ryunosuke)

In a current educational setting in Japan, Japanese students have merely used English in natural conversational setting. There are three reasons for this. First reason is about Japanese cultural context. Compared with other county, Japanese students have tendency to uniformity. Also, they are usually afraid of getting wrong. These culturally-oriented characteristic makes Japanese students English education difficult to offer English conversational setting.

Second reason is about student personal motivation for English use. Generally, English is viewed merely as a subject to pass university entrance examination. This might decrease students and teachers motivation for learning English in natural conversational setting — even though English is a strong tool for getting career or studying after graduating university.

Third reason is about conventional English teaching method. Even somehow these problems above will be solved, there are still problems for teacher. Because in many cases, teachers also do not have enough English speaking skills to teach for students. This reason might be the most serious problem in those I listed.

Here, our PBL tackled this third problem as a main problem for English learning in Japanese elementary education. Especially, we focused on improving real-time communication skills in English. Also, we valued learning by direct experience. Considering these two main concern, we made English Karuta game as a tool especially for solving teachers' problem in English teaching.

As we consider Karuta game as a complementary educational tool for English education, the contents of it must be designed in light of current problems of conventional Japanese English education. Therefore, first of all, current problems of conventional Japanese education are discussed and how each corresponding component of Karuta card will help learner to deal with the problem is presented subsequently.

1.3 General Idea of English Karuta Game (Ryunosuke)

English Karuta game is an English word learning tools which oriented communicational situation. Compared to current English textbook, using Karuta game has three advantages. First, *English Karuta game matches Japanese culture*. Karuta has long history in Japan and many Japanese has experienced this game. Even our Karuta game uses English, this cultural background makes Japanese student easy to understand the rule and participation. Also, even Japanese are not familiar with classics, the Hundred Poems by One Hundred Poets

(which is very famous Japanese classic tools using Karuta style) are generally learned in game. Therefore, English Karuta might work well in learning word and sentence effectively like the Hundred Poems by One Hundred Poets.

Second, *English Karuta game motivates situation based learning*. In our English Karuta game, we use natural picture and use natural English sentence for game. In this sense, English Karuta game is oriented to situation based learning compared to word-paired associate learning. Next, I explain what is the difference of these two way of learning.

Generally, when we use textbook, we learn English words largely relying on rote associative memorization between new words and their translations in Japanese. This is known as word-paired associate learning, a typical way of learning 2nd language vocabulary [17]. In contrast, in situation based learning, word learners have to extract the meaning of new words in many different contexts by observing and integrating multiple signals such as the actions and intentions of the speaker using them [9]. Situation based learning is very similar way of learning to infant 1st language acquisition [18]. In addition, although study of situation based 2nd language learning were less [20], one study denote that at least pattern of neural activity in human brain, situation based learning is very similar to that of learning their 1st language learning [18]. Even this study does not strongly support effectiveness of applying situation based learning in Japanese university student 2nd language learning, this approach may be promising for younger Japanese students.

Third, *English Karuta game is usable in two aspects*. For one thing, English Karuta game can generally be done with just a card set. This simple equipment need makes easy to implement in English class. For the other thing, English Karuta is compatible with technological application. As explained in later chapter, this advantage makes teacher burden. In sum, English Karuta game has suited to Japanese students English learning. In next section, we introduce how to implement

1.4 How the Project Proceeded (Hiroaki)

I think the most important purpose of final report of FBL/PBL is not to report what we did, but to report how we did. This is because that the purpose of the project is not to reach perfect goal, but to know the difficulty of teamwork. Therefore, I wrote this section.

Note that this part includes my (Hiroaki's) bias very much. Therefore, this part should not be included if this will become publication.

Before mid-term presentation First, we discussed and listed up problems around English education as second language learning. [2] Then, we have got some clarifications of problem. Here, I list up them. Details of some items will be appeared in general part.

- personal motivation
- conventional teaching method

[2] I think it was bad to list most problems depending on only our discussion. In the class, we should have experienced or observed real education, or have an expert talk us problems. These would help us to make common understanding. We might also be able to use some kind of design method.

- cultural context
- Inherent linguistic perception
- Definition of effective communication

We also had lessons to experience many technology that we can use for implementation. Such as, immersive display, 3D programming environment, pressure pad, face or eye tracking device and software, motion capture device (Kinect), and device measuring physical index.

How Karuta game was born Among problem points listed by discussion, I thought following points are important, and tried to realize them.

- Thinking by English. (almost equal to Situation-based learning)
- Helping with motivation
- Making discussion among players. It will help us to be intent on the game and also raise motivation.
- Easiness to use. (Usable in usual classroom)
- Be usable repeatedly. Not losing interest.

After thinking several times with these requirements, I came up with Karuta game for second language learning. This fit almost all requirements shown above. Then, I proposed it with saying "if we use technology, we must make better solution than this"[3]. That is, I proposed it as an object that is used to compare with other new ideas.

How Karuta game was accepted I put texts about these ideas including rules of Karuta on shared web site (Panda). Of course, such documents tell us almost nothing. These raise no concrete images for us. Therefore, I conducted first demo in Japanese in class (, because most of other members are foreigners!). Details of the demo will appear in following section.

Before final presentation After we decided to use Karuta game, we divided into three teams as we hoped. Such as, implementation, advanced approaches, and technical immersion. I'm in implementation team, so in following sections will be about implementation.

As implementation team, we made two implementations. The reason to have made two kind of Karuta, is that we perceived there needs a certain kind of theme for card set (Arseny's suggestion). And also, the first one is too simple. Figure 1.1 shows how our implementation and experiment proceeded.

[3] Using technology was the first purpose of this project

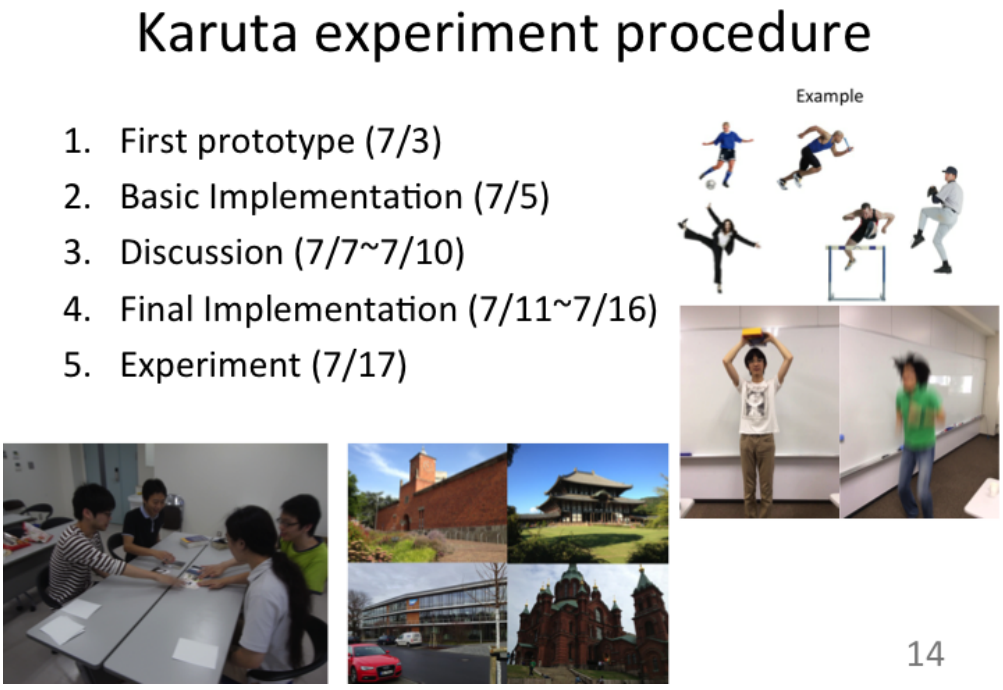

Figure 1.1: procedure of implementation and experiment

2 Prototype Implementation (Hiroaki)

We made some prototypes of Karuta game: first demo, basic implementation, and final implementation. In this section, we will show them.

2.1 First Demo

This is what is conducted for members of this projects, in order to introduce the idea of Karuta game.

Figure 2.1 and 2.2 are first demo. Here are sentences and rules for them.

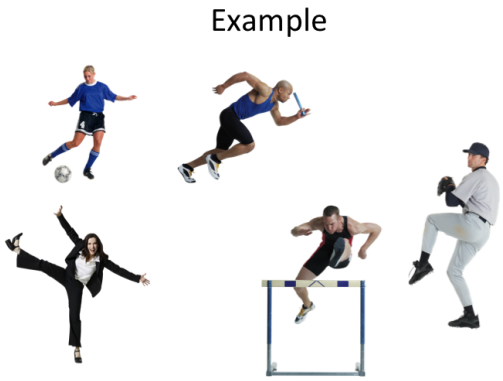

Figure 2.1: Karuta1

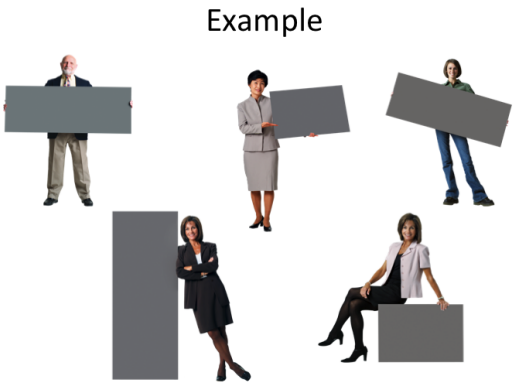

Figure 2.2: Karuta2

Sentences As we mentioned, they are written in Japanese.

Karuta1 {野球、ボールを投げようとしている人、走りながら飛んでいる人、地面に足の付いていない人}

Karuta2 {板に手を乗せている人、板を手にのせている人、板を持っている男の人、板に触っていない人}.

Rules

1. The speaker say some sentence
2. Players look for and choose a card that suits the sentence well.

3. Only one player can get a card. So, you (a player) should do as long as quickly.
4. The other players can suspect whether the card is correct. There may be a more suitable answer card. Also, if you think there is no correct answer, you can declare that. Then, players, and even the speaker should check whether the card is true answer. (This process would make discussion.) They can also rely on their teacher.
5. If the card is regarded correct, the player get the card. Else, the player get some penalty.
6. loop..

2.2 Basic Implementation

This is first implementation of implementation team (Ryunosuke and Hiroaki). We took many pictures about a very simple movement or statement of objects and people.

Figure 2.3: Putting up an umbrella

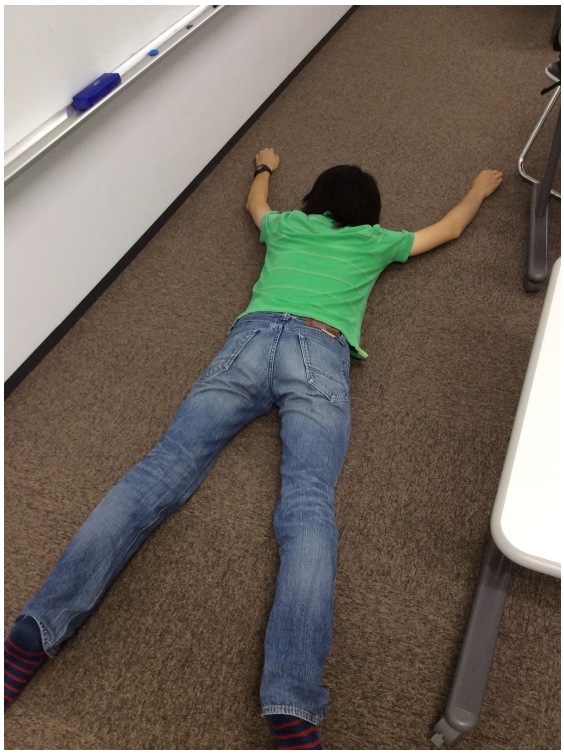

Figure 2.4: Lying down

Though they look too simple, please note that we can make Karuta game freely and easily as we did.

2.3 Final Prototype

This is second implementation. This Karuta game consists of set of card-set. One card-set includes four cards and they obey one common theme like “people who are studying”. Figure 2.5 and 2.6 are examples, and these captions are themes.

Figure 2.5: deer

Figure 2.6: pavement

Sentences For deer set.

- The deer is eating grass.
- The deer is sitting on the ground and looking at us.
- A group of deer are looking at some people.
- A deer is wading in a lake.

For pavement set.

- The path is along a cutting. (切り通し)
- Two paths branch from either side of this trail into the forest.
- The path in the forest is rough.
- Two paths branch from either side of this trail into the park.

Rules Almost same as the first demo. However, in experiment using this implementation, discussion part is apparently omitted for simplicity.

3 Preliminary Experiment: Results and Discussion (Ryunosuke)

In the previous section, we have introduced how we implemented English Karuta game. In this section, we show results of this implementation. In preliminary experiment, we asked some question after participants took experiment. Questions included two kinds; choice question and free answer question. In choice question, we asked participant "How do you feel about English Karuta game" . In free answer question, we asked participant "What is strong points and weak points of this Karuta" game in terms of game-structure and learning tool.

Table 3.2 [1] is a summary of contents and value of choice question. Although we did not take any control group and could not make any statistical test, result showed mostly participant agreed in English Karuta game advantage. Especially in label "Interest", participant shows stably high score. Also, in label "Interaction", "Continuation", "Listening", and "Word learning", English Karuta game shows high score. However, in terms of label "Grammar" and "Speaking", English Karuta game was seen as not good tool. We supposed these low score might reflect current versions problem.

To analyze free answer question, two of PBL members independently categorize each participant answers into "strong point", "weak point", and "other". Table 3.1 is a summary of strong point and weak point in terms of card game. In eight strong points of English Karuta as a card game, number 2 and 6 indicated English Karuta game motivated participants to learn English. Also, number 3 and 5 indicated Karuta itself supported participants' images of read sentences. Even number 3 seemed contradicted with the result of choice question (Order 3), this can interpret as English Karuta game only motivates participants motivation in terms of card game, not as a learning tool. For a weak points, there were some problems of non-native speakers (number 2 and 3). These problems might solve through using native English speaker as a speaker of English Karuta game or using voice text reading systems.

We also analyzed the strong point and weak point of English Karuta game in terms of English learning tool. Table 3.3 is a summary of this results. For strong points, all answer indicate English Karuta game motivated learner. This result was generally consistent with previous result in Table 3.1. However, for a weak points, English Karuta game was viewed as not good tool for grammar learning (number 2). This result was consistent with result of choice question (Order 8).

In sum, preliminary experiment worked well and English Karuta motivated participants

[1] We ask participant "How well does each question fit to English Karuta game? Please answer", "1: Definitely not fit", "2: Not fit", "3: Can not say", "4: Fit", and "5: Definitely fit". Therefore, high value means Karuta game is good in question aspect.

Table 3.1: Contents and value of choice question (N=7)

Order	Label	Content	Value (M)	Value (SD)
1	Interest	English Karuta game is interesting	4.43	0.73
2	Usefulness	English Karuta game is useful for English learning	3.71	0.70
3	Motivate	English Karuta game motivates me to learn English	2.86	1.25
4	Interaction	English Karuta game improve communication with other participants	4.00	1.31
5	Continuation	English Karuta game motivate me to retry this game	3.50	0.96
6	Listening	Compared to other listening materials, English Karuta game is superior	3.43	0.90
7	Word learning	Compared to other English word learning materials, English Karuta game is superior	3.57	0.73
8	Grammer	Compared to other English grammar learning materials, English Karuta game is superior	2.00	0.53
9	Speaking	Compared to other English speaking class in high school, English Karuta game is superior.	2.57	1.50

to learn English. However, as a grammar learning tool, current version is not sufficient. This problem will be solved using incremental Karuta in the future. Also, in this preliminary experiment, we did not set any control condition. In the future, we have to carefully set control condition and try to compare whether our speculative result here is valid or not. Finally, we have not tested whether our English Karuta game actually improved participant English use. In the future, we set pre/post design experiment using this Karuta game and try to confirm effectiveness of English Karuta game.

Table 3.2: English Karuta Strong and Weak points as a card game

Strong	1	Easy to define win or lose
	2	Competition increases the motivation to English learning
	3	Karuta picture support semantic images of English words
	4	Easy to understand the rule
	5	Deepen the understanding of words meaning
	6	Game structure motivates the Karuta game itself
	7	Idea can be expanded to other language
	8	Game structure affects motivation and interest
Weak	1	Sitting place affects the score of Karuta Game
	2	Ambiguous sentences are difficult to answer
	3	Non-native speakers are not appropriate for this game
	4	Loser might feel inferiority complex
	5	Knowledge of grammar is needed to do this game
	6	Cannot understand why "Karuta Game"
	7	Karuta game does not support grammar learning
	8	It is boring

Table 3.3: English Karutas' strong/weak point as a English learning tool

Strong	1	Motivate understanding sentence pronunciation and meaning
	2	Team setting might improve discussion
	3	English Karuta motivates first English learners
	4	Karuta is useful for a starting point to motivate learner
Weak	1	Player's English skills affects the game interest
	2	Karuta cannot support all aspects of English learning (e.g. grammar)
	3	The relationship between Karuta learning and its effectiveness is unclear
	4	Cannot understand why English Karuta
	5	At least some English background is needed to this Karuta game
Other	1	Cannot understand the importance of Karuta game other than culturally easy to understand
	2	Too simple to enjoy this game
	3	Grammar learning is needed without English Karuta game

4 Design of Karuta Contents Reflecting Problems in English Education (Seongsu)

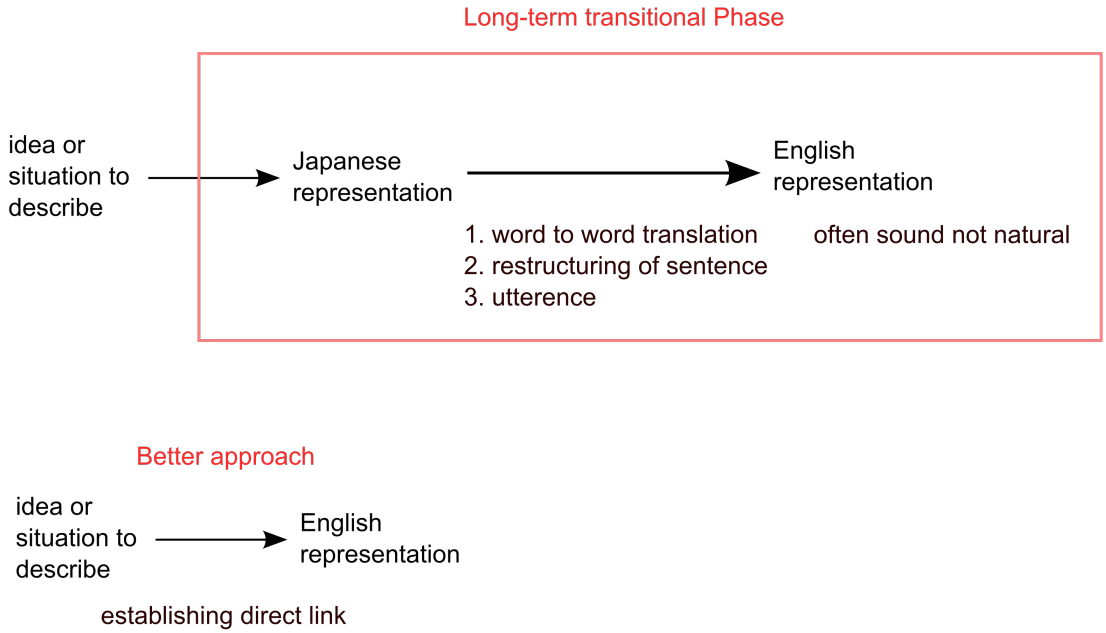

Figure 4.1: Long term transitional strategy

We suppose we can do much better when secondary language is utilized somewhat independently of one's primary language, with a word or expression in it becoming simply a mirror image of actual object or idea it represent. We show this idea in fig. 4.1. Therefore, Karuta Game itself must become a practice of communication in English, helping participants to be able to establish and solidify a direct link between an object or idea and a corresponding English word or sentence for effective English communication.

Because most parts of communication are exchanged in the form of sentence, it is better to set the contents of Karuta card as a complete sentence rather than a single word or phrase. Also, even though of course a design of contents of Karuta cards involves graphical or auditory representation of such sentences and such design is never negligible, utmost importance lies in design of answer sentences, and we present two main schemes, namely *incremental Karuta* and *combinatory Karuta* to generate answer sentences systematically.

4.1 Incremental Karuta

Incremental Karuta is a series of Karuta game to help learner to quickly structure an English sentence. In incremental Karuta, a corresponding English sentence is getting complex each time. For example, an answer sentence of first game can be “a dog is walking”. In turn, “A dog is sitting in front of a dog house”, “A dog is lying before his house, napping”, and “A dog is sitting before his house, barking at stranger, at night” would be answer sentences consecutively. By doing so, a learner is expected to develop a skill to structure different components of an idea into one succinct sentence quickly.

4.2 Combinatory Karuta

The goal of combinatory Karuta is to teach a learner a variety of words in single category. Here, a part of sentence is replaced by another word in a specific category of words. For example, “a dog is barking in the morning”, “a dog is barking at dawn”, “a dog is barking at night” can be a set of answer sentences.

With incremental Karuta and combinatory Karuta, a learner is expected to develop an ability to structure a sentence using abundant vocabulary to achieve fluency in English communication.

4.3 Direct Experience

As to card representations of answer sentences, enough visual and auditory assist must be given in order to let participants have enough direct experience and build strong link between an idea/situation with appropriate English words or sentences. To serve the purpose, Karuta cards may feature motion picture and native speaker’s pronunciation using relevant technologies.

5 Automatic Card Generation (Arseny)

5.1 Introduction

Automatic card generation is very important for the Karuta game, because otherwise it's very difficult to realize incremental and combinatory card content strategies by manual card creation. Because there are thousands different nouns, adjectives and verbs, the combination of them creates an exponential explosion. Of course, not every combination is valid in a linguistic sense, but even enumerating valid language sequences would not decrease the order of the total number of resulting sentences.

As a side remark, I would like to note that when I have visited ACL2014 conference, there was a keynote talk by Zoran Popovic[1] about automated algebra problem generation for school students. He made a very interesting point about task *themes*. Theme could be anything that is interesting for students: Fantasy, Science Fiction, basically, as long at it is interesting — really anything. If theme is interesting, students want to solve more and more tasks, and theme helps to be a natural motivation source.

5.2 Generation

Before discussing a procedure for the generating cards, it is necessary to define input and output of card generator. Input can be a seed sentence, user learning history, card set difficulty and theme. For example, input can be something like "human +tears a piece of paper", medium difficulty. Here a plus before a word means that this word should be changed to a different one, leaving most of the sentence intact, however some arguments can be changed to create a natural sentence. The example output of the system could be a list of cards describing sentences similar to

- human *tears* a piece of paper
- human *cracks* a glass
- human *crushes* a box
- human *punches* a hole in a paper
- human *breaks* a wooden stick

[1] `http://scholar.google.co.jp/citations?sortby=pubdate&hl=en&user=0Qr2IGwAAAAJ&view_op=list_works`

Task difficulty consists of two main components: *inherit* difficulty and *set-specific* difficulty. Inherit difficulty is the grammatical and lexical difficulty of the sentences that will make up the cards. It is independent of the card set and can be inferred from the learning history and checked by some kind of tests in a controlled classroom learning scenario. This kind of difficulty probably should be automatically inferred from the learning history and test data and not being set directly. Depending on this difficulty it is possible to infer a set of constraints that will hint on which words and grammar constructions can be used in the sentences for the cards and which cannot. Set-specific difficulty is mostly a measure of semantic similarity defined on the set of cards. If the cards have more different target word, then it is harder to distinguish them from each other and if the cards are more different, then it's the opposite. The only problem is to define this similarity measure, which is a bit tricky.

Basic scheme for the card generation can be described in 5 steps:

1. Analyzing and creating internal representation of input with possibly performing syntactic and semantic parsing
2. Creating a set of restrictions on the possible hypothesis, limiting topic of words and sentences that will be used in the candidates and using history data to limit inherit difficulty of the resulting cards
3. Creating a set of hypothesis using that restrictions
4. Making a selection of a result subset using a global subset similarity measure as a task-specific difficulty measure
5. Generate finite images based on the selected subset of hypotheses

The list of resulting sentences consists of seed one plus several similar ones. Teacher can be presented with a larger list and make selections from that list afterwards to filter out unsatisfactory system output. Analysis of proposed solution in the terms of implementability is described below.

5.2.1 Proposed Solution Analysis

Because of the structure, there are two parts of analysis, a Natural Language Processing (NLP) side and an image synthesis side. The output of a first part is an input for the second part, so it is natural to discuss each part separately.

Natural Language Processing Side

There are several developments in the modern NLP that can be helpful for this task. In measuring similarity, there are works on compositional similarity like [19]. In this task it is required to somehow compute similarity between phrases or the whole sentences. For example, the phrase "well done" should be similar to the phrase "great work", however

they have completely no word overlap. Usually it is done by creating a vector representations for words and computing similarity as a cosine similarity between those vectors. There are two types of approaches for creating this types of vectors.

The first one is based on counting term vectors for documents in large corpus and computing some kind of matrix decomposition. A classic example for this method is called Latent Semantic Indexing [7]. It applies PCA to the term-document matrix usually weighted by td.idf scheme. The resulting vectors somehow capture semantic similarity between words if to project them in the resulting subspace. A more recent counting approaches like [16] use the principle that context defines the word meaning and count words that appear near the target word.

The second type of approaches is more recent and is based on neural networks to learn the representation. It had started from the work [2] on the neural network language models. Expanded by the work [13], ultimately it produced works [14, 15] that focus on semantic word representations. Using a neural networks, for each word in a corpus, it learns a vector word representation $vec(word)$ that have very interesting linguistic regularities. For example, $vec(king) - vec(man) + vec(woman) \approx vec(queen)$.

Recently, there were works [12, 1] that was comparing both approaches for measuring similarity. These kind of measures are usable for computing task-specific difficulty, however exact methods and values would be implementation specific.

For the generation of hypotheses it is possible to use collocation databases, either in their raw format, or more structured case frames [6, 10]. Using that collocations, it would be possible to create candidates and select common arguments for phrases.

Image Generation Side

In the generation side, there are two kinds of approaches that could be taken: collecting and annotating images, for example from the web, or generating images. Annotation can be done using computer vision.

In the case of collecting, it is necessary to get really huge database of pictures. Getting them annotated by humans is possible by the means of crowd-sourcing, although it will take time. Automatic annotation or mixed approach will be better, because there would be a need to remove "garbage" images that would be automatically collected. In any case, even if object and object properties identification is more easily doable and it will yield a source of images suitable for training nouns and adjectives, the action identification is much more difficult – but it is needed in order to train verb usage.

Generating approach would not have those problems, but generating images that represent similar words in a way so the images will be distinct enough is a challenging task and an open research question. In the present there are works on a 3D scene generation from natural language text [4, 3], but they still mostly focus on static scenes. Representing verbs like "break" would be much more difficult in a static image, however in the case if the media for the cards should not necessary paper, it is possible to generate short video clips, easily capturing actions. The question whether it is going to be more distracting is open to discussion though.

6 E-Karuta System (Ampere)

In this chapter, we would like to introduce an architecture of Karuta game on technology platforms.

6.1 Objective

There can be various obstacles in order to include Karuta game into the classroom activity. For example, teacher needs to put more effort for the preparation of Karuta cards and questions.

Electronic Karuta(E-Karuta) can also deal with personalization of game, (semi)-automatic card generation. It can also cope with non-native pronunciation of the speaker, usually the non-native teacher. More over, for E-Karuta, it is possible to be extend in many interesting way, for instance, supporting distance playing, adding motion graphic on the cards. Evaluation and feedback are also easier to be done and to collected with this system. The information collected from evaluation and feedback is also useful for further analysis.

6.2 Possible Platform

With technologies, Karuta can be played on various platform and interface. It also can be easily and flexibly transform to other platform in the future, so the player will not be bored of the same game. Here, we would like to introduce three possible platforms.

First, the platform that allows users to play E-Karuta on a common area with a projector and a sensor, i.e. Microsoft Kinect sensor. For us, this appears to be the most feasible method to apply in a real classroom. In many schools, a classroom is already equipped with a PC and a projector. Adding just a sensor to the existing system does not cost much.

Second, playing E-Karuta on a big tablet or smart board with touch screen is another choice. However, we need to consider how to identify each student touch from the others. In the future, better technology may help use identifying them using their fingerprint just on tablet. Third, playing E-Karuta on the linked tablets enables distance playing. Even though communication between player would be limited, social networking and voice over the internet are still possible to keep players connected.

6.3 Architecture

We decided to develop the architecture design of the first platform we introduced above, since is the most feasible for a classroom. As shown on fig. 6.1, we need a projector, a

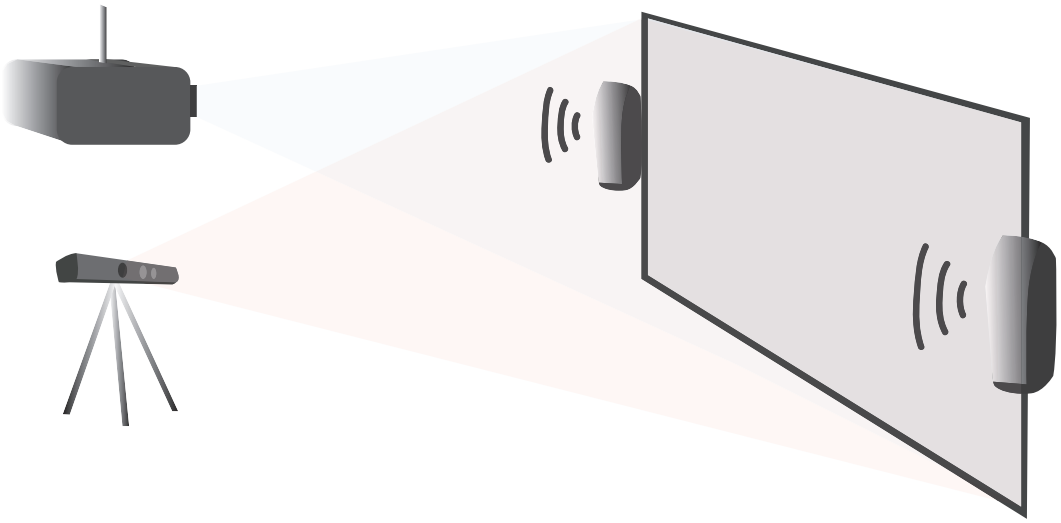

Figure 6.1: System components

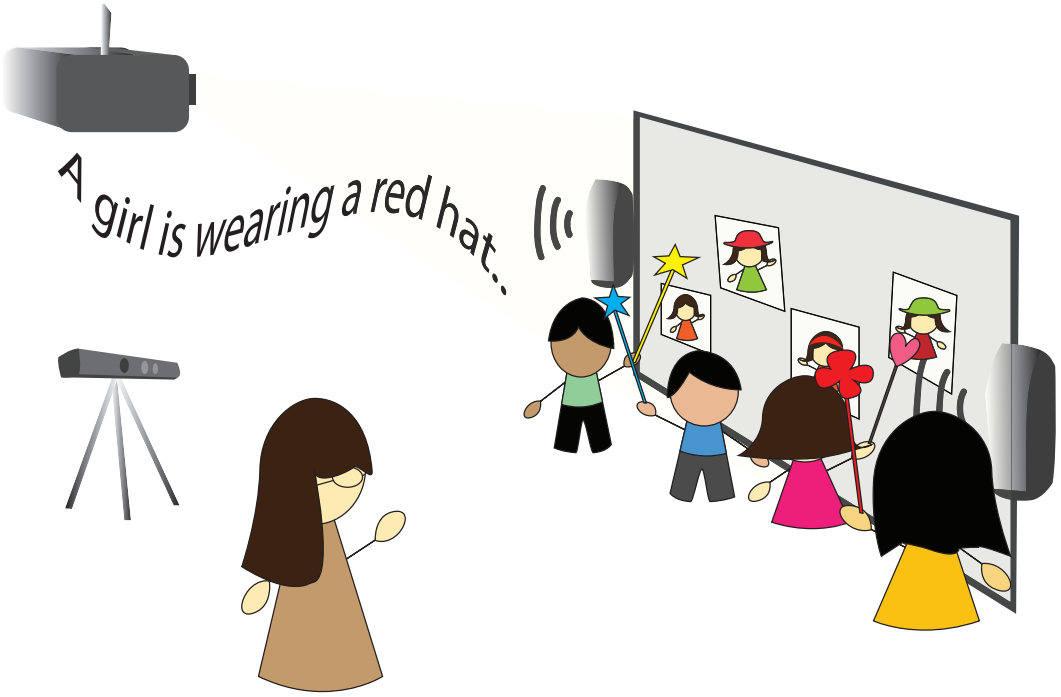

Figure 6.2: Example usage

motion sensor (Kinect), and speakers linked to a computer and installed in the classroom.

An example use of this system is displayed on fig. 6.2. The players which are elementary school pupils make their own wand then add their wand and user data to the system via the Kinect. When the game start, the projector projects all the cards on the screen, and when the pupils hear a phrase or a sentence from the speaker, they need to point out the right card by their wand as soon as possible. The sensor will collect the answer, then the system will calculate the score.

6.3.1 Interaction

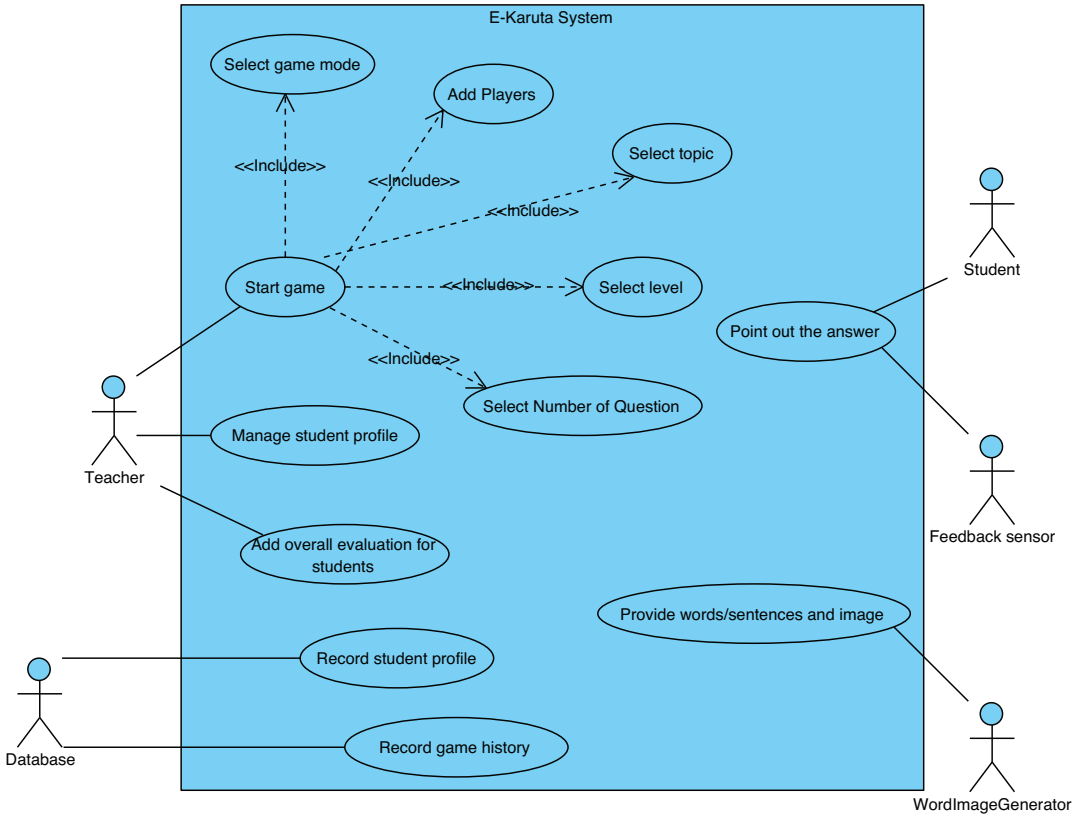

Figure 6.3: Use case

The use case diagram, displayed on fig. 6.3, shows the interaction between each actor and our system. Teacher do 3 mains action: start game, manage student profile, and add overall evaluation for student. To start the game, the teacher selects game mode, adds players, selects topic, selects level, and selects number of question. Students only need to point out the right answer which detected by feedback sensor or Kinect. In our system, database records game history and student profile but the cards database is not included here. All the cards and sentences are provided by the actor word and Image generator

6.3.2 Activity

How the system works in illustrated on fig. 6.4 as an activity diagram. Teacher starts the game by configuring the parameters, then our system send the history which acquired from player added and the game play history to the word and image generator. The generator sends the proper set of cards and words back then E-Karuta system projects the cards on the screen. They system plays the recored or generated speech and wait for the answer. When the player points out the card, sensor identify the student who points at the card and the selected card and send information back to the system. If the selected card is the right answer the system record the information and show the new score and result. If the answer is wrong the system also records the information and informs that the answer is wrong and wait for anther answer. The process continue until all the generated card is played then score and summary is calculated and shown. After that, game play history saved to the database.

6.4 Student Model Creation

Since we have game play history information stored in our database, it is possible to make use of it by creating a model to support teacher and her/his teaching.

6.4.1 Creating a Model

We shows the activity of model creation on Figure 6.5. When the teacher requests to start building the model, he/she needs to input students' grade and dropout information after the semester finished. The student information modeling system will send a request for the game history for each student to the database. Our modeling system contracts a decision tree to find a pattern of student with bad grades or problems and saves the tree.

6.4.2 Using the Model

According to the activity diagram on Figure 6.6. To use this generated model, E-Karuta system request for the prediction by sending the current student list. With the play history in the database and the generated tree, the modeling system can predict student who with problems then E-Karuta system informs the teacher, so he/she can try to fix or adapt the lesson as early as possible.

6.5 Limitation

E-Karuta is only a practice tool to be used in the classroom to enhance language learning. Other techniques and activities is still needed. This system may lessen the discussion between players, since the system tells check the answer immediately after the card is chosen. However, we can develop an E-Reverse Karuta to enhance discussion directly in the future.

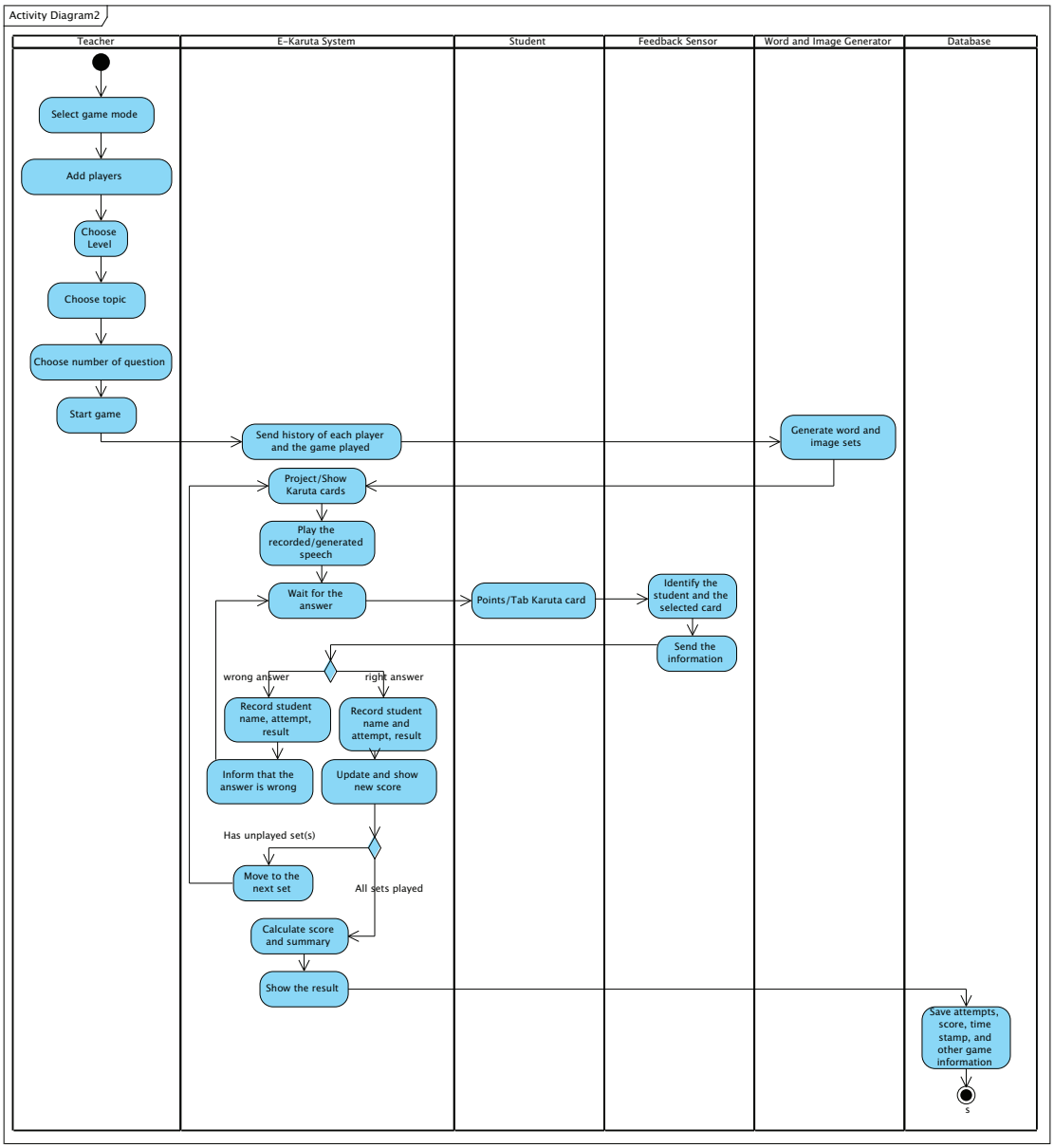

Figure 6.4: System workflow

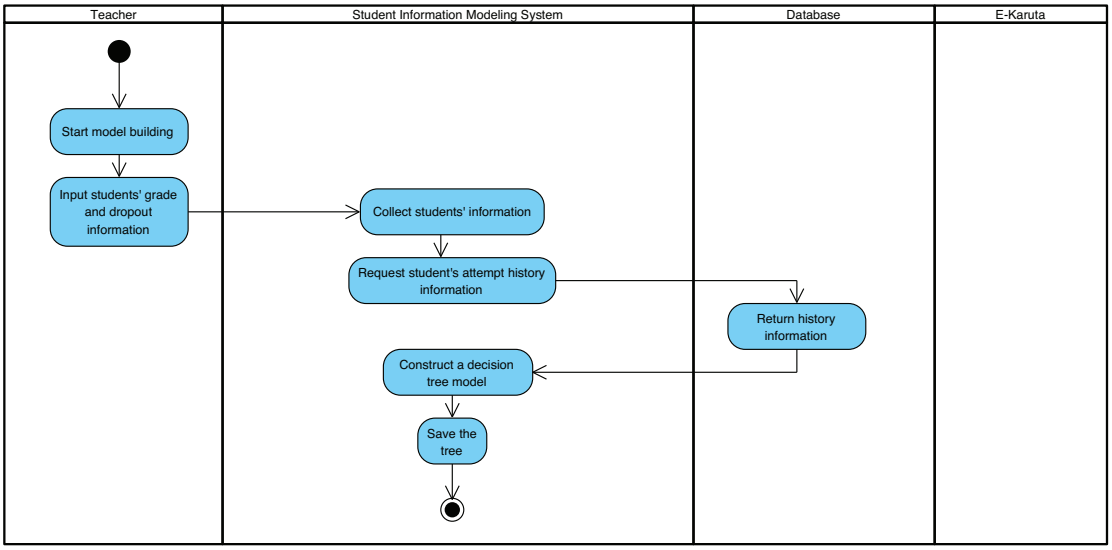

Figure 6.5: Model creation

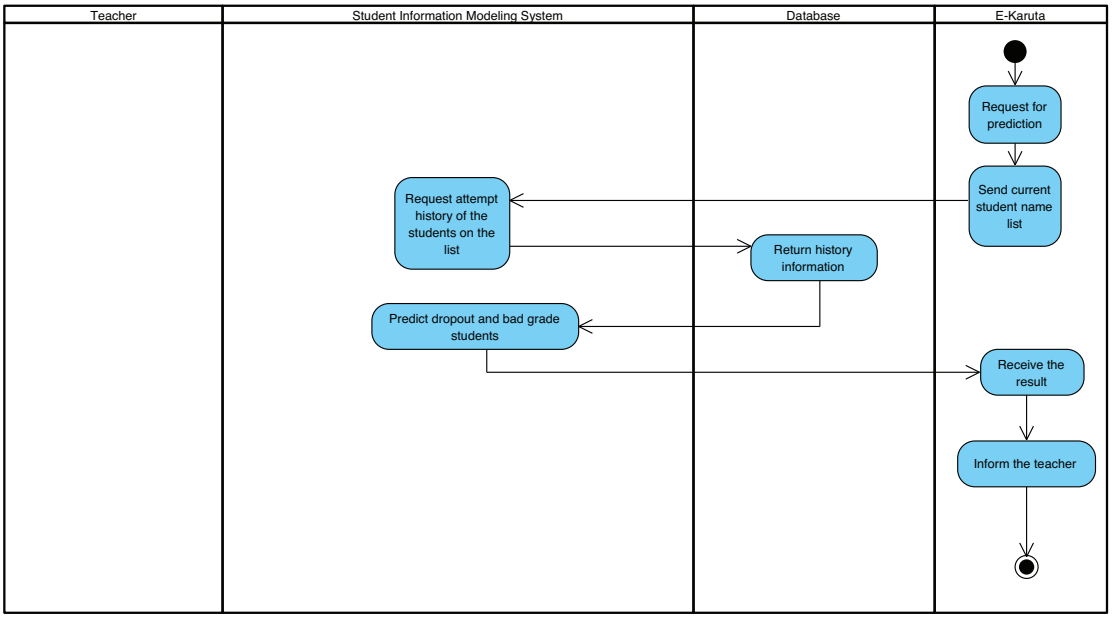

Figure 6.6: Activity diagram

6.6 Future Technology

In the future, there can be various technologies that can be applied to language class. For example, virtual world can also be developed for better experience of learning languages in different environment, or even make Karuta looks real for the player by adding augmented reality and holographic techniques.

When artificial intelligence become mature, we could also add an artificial intelligent agent to act as a player, a facilitator, or even a teacher.

Face tracking and motion sensor can also be applied to the game that is similar to Karuta called Simon Says game. Instead of using cards, players can do or express some action or facial emotion responding to the game system.

To fix the limitation about discussion, with better speech recognition for non-native speaker in the future, Reverse Karuta is an interesting way to develop speaking skill for the players.

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