

Katakana Star Samurai: A Mobile Tool to Support Learning of a basic Japanese Alphabet

Juvane Nunes Marciano, Jaime Bruno Cirne de Oliveira, Bruna Camila de Menezes, Leonardo Cunha de Miranda, Erica Esteves Cunha de Miranda

Department of Informatics and Applied Mathematics
Federal University of Rio Grande do Norte (UFRN)
Natal, RN, Brazil

juvane@ppgsc.ufrn.br, jaimecirne@gmail.com, brunacamilamenezes@gmail.com, leonardo@dimap.ufrn.br, erica@dimap.ufrn.br

Abstract— The growing use of mobile apps in our daily activities is noticed, even for work, leisure or educational purposes, in which the games have conquered considerable space. Also, in the current lifestyle of people in general, time is scarce, and these tools can be very helpful, for they are always available since the user has a mobile device. In the context of educational purposes, games have the advantages of being fun, and rather possible to play quick matches. This work presents Katakana Star Samurai, a game designed for smartphones and tablets, that supports the learning of Japanese language providing an environment for the student to practice their knowledge, focused on a basic Japanese alphabet called katakana. Also, we present a test with users that helped us define the next steps of this research.

Keywords—games; edutainment; Japanese; katakana.

I. INTRODUCTION

Nowadays the use of mobile devices as smartphones has become a daily experience, and with the development of devices increasingly more powerful, a high number of tasks can be accomplished through the phone. This has raised the development of apps, which are small applications directed to some activity, for example, to access a social network, to edit a photo, to chat and to play games. These applications are very useful, since they offer the possibility to do all these things in one device, some of them at the same time, and in almost everywhere.

Currently, the growth in the area of games, which are of various types, is remarkable. There are several games for different platforms – i.e. operating systems and devices – as personal computer games, web-based games to be played directly from a web browser, and also as apps for mobile devices. Environments and purposes of the games have also been expanded. Nowadays it is possible to observe the presence of games in educational environments to aid it. Several works point to the use of mobile devices for learning purposes [9], [11], [12]. Games specifically have been analyzed in the works of Davies et al. [2] and Martínez-Ortiz et al. [6]. The term for this type of use is edutainment, i.e. a mixture of education and entertainment, where students are

encouraged to use a game that is fun and effective at the same time, in their task of helping to learn content, supporting the learning process.

The use of computational tools to support the teaching of languages is known as Computer Assisted Language Learning (CALL), and within this topic, there is Mobile Assisted Language Learning (MALL), which includes tools designed for mobile devices. The usage of CALL methods is supported by the works of [1], [3], [4], [7], [8] and [10]. In this context, the digital games are included, which are tools that can also be used for the educational purpose.

In our research context, we already developed a CALL game to support Japanese language learning, called Karuchā Ships Invaders [5], with focus in the hiragana alphabet and basic Japanese cultural words. In this context, to follow the flow of content to be learned in Japanese language, the next theme is the other basic Japanese alphabet, called katakana. This alphabet is not addressed by our former application, so, in this work, the designed game aims to help the learning process of the katakana alphabet through the practice with roma-ji or hiragana, at player's choice.

The study of Japanese language itself is already a challenge, since it contains several particularities. This language uses three different writing systems, i.e. kanji, kana – hiragana and katakana (which is the focus of this work) – and roma-ji (Roman alphabet). Katakana is an alphabet used to adapt foreign words and proper names for the Japanese, as well as to emphasize a word or phrase. As said, the game presented in this paper assists the practice of katakana alphabet.

This paper is organized as follows: Section 2 presents the related games; Section 3 presents Katakana Star Samurai, the game developed in this work; Section 4 presents a test with users; Section 5 presents a discussion; and finally Section 6 concludes the paper.

II. RELATED GAME

In this section we present some games related to Katakana Star Samurai, in the Android and Windows Phone mobile OSs and in the Web. We searched for games that have the goal of

teaching katakana, though several of them have options for hiragana too.

In Android there is Katakana Colocar Lite¹ (hap Inc.), a game that presents a picture, for example, of an animal or fruit, a few spread katakana characters and empty spaces to be filled with the characters that form that word; this game requires some vocabulary knowledge of the player, and appears to be more suitable for Japanese kids. Kana Pop² (CatMoverApps) is a simple game that presents a kana (the player can choose to practice hiragana, katakana, or both) and four bubbles containing different roma-ji, the player has to touch in the bubble with the roma-ji corresponding to the presented kana.

And Learn Japanese Katakana!³ (Makorino), which is similar to the first game presented; this game presents katakana characters with sound, and then brings pictures of animals with spread characters for the player to form the word; it also has a very childish interface, and, as the first, is more suitable for Japanese students, not foreign. Fig. 1, green area, shows screenshots of (a) Katakana Colocar Lite, (b) Learn Japanese Katakana! and (c) Kana Pop.



Fig. 1. Related games: green area for Android, purple area for Windows Phone and orange area for Web.

For Windows Phone, the related games are Learn Japanese with Jbubbles⁴ (pretty-coolgames.com), a game where there is a ship and some bubbles with kana, the player hears a letter or read a roma-ji and has to shoot (touch) the corresponding kana; the game has the idea similar to Katakana Star Samurai (our proposed game). Another game is Kana Shuffle⁵ (Max Nilsson), a simple game where a basic Japanese alphabet (hiragana or katakana, player’s choice) is presented jumbled; the player has to put it in alphabetical order, following the families (gyo). Guess That Kana⁶ (Seva Alekseyev) is a question and answer game that presents a kana and four options of roma-ji, for the player to choose the corresponding

one. Fig. 1, purple area, shows the screenshots for (d) Learn Japanese with Jbubbles, (e) Guess That Kana, and (f) Kana Shuffle.

In the Web, we have two examples: Learning Japanese: Katakana⁷ (UOL Games) is a tool that contains a memory game with katakana, a quiz and a game called “falling katakana”, in which katakana characters come down in the screen and the player has to type the corresponding roma-ji to destroy them. Another game available on the Web is Katakana Game Alphabet⁸ (www.learn-hiragana-katakana.com), in which are presented one ball at a time in katakana, and the whole alphabet in roma-ji in a corner; the player has to click on the roma-ji that corresponds to the katakana in the ball; it is also possible to see the stroke order of each character in the balls. Fig. 1, orange area, shows screenshots of (g) Learning Japanese: Katakana and (h) Katakana Game Alphabet. Table I presents the 8 related games, with respective icons, (P)latforms, and focus of learning.

Table 1. Related Games.

P	Icon	Game	Focus
Android		Katakana Colocar Lite	Vocabulary + Katakana reading and listening
		Kana Pop	Hiragana/Katakana reading
		Learn Japanese Katakana!	Vocabulary + Katakana reading and listening
Windows Phone		Learn Japanese with Jbubbles	Hiragana/Katakana/ Kanji reading and listening
		Kana Shuffle	Hiragana/Katakana reading and alphabetical order
		Guess That Kana	Hiragana/Katakana reading
Web		Learning Japanese: Katakana	Katakana reading
		Katakana Game Alphabet	Katakana reading and writing

III. KATAKANA STAR SAMURAI

Katakana Star Samurai is a game designed aiming to support Japanese language learning by offering an environment of practice of the katakana alphabet; but with the intention to mix educational with fun as much as possible, we try to make the simple fact of playing be the learning process, with game elements that avoid text tutorials or “classes” inside the game. Katakana Star Samurai mixes two game styles, i.e. space invaders and asteroid. The game development team is composed by an artistic designer, a game developer and three researchers in the field of educational technologies.

Katakana Star Samurai is designed to run in the current most popular mobile devices, i.e., tablets and smartphones. To check sizes of fonts and elements, and their arrangement in the

¹ https://play.google.com/store/apps/details?id=air.jp.ne.hap.knarabe.lite&hl=pt_PT

² <https://play.google.com/store/apps/details?id=com.catmover.kanagame>

³ https://play.google.com/store/apps/details?id=com.makorino.aiue_onigiri

⁴ <http://www.windowsphone.com/pt-br/store/app/learn-japanese-with-jbubbles/98f07238-a53e-4870-b245-9d3ba1895d61>

⁵ <http://apps.microsoft.com/windows/pt-br/app/kana-shuffle/a908df0d-5b88-4287-96aa-c0b484441515>

⁶ <http://www.windowsphone.com/pt-br/store/app/guess-that-kana/2755087a-5965-e011-81d2-78e7d1fa76f8>

⁷ http://jogosonline.uol.com.br/learning-japanese-katakana_22637.html#rml

⁸ <http://www.learn-hiragana-katakana.com/review-play-katakana-game/>

screen, we ran a prototype with the design on some devices with displays of 3.5", 5", 6" and 7", the first three are smartphones and the last one is a tablet (Fig. 2). We found out buttons and ships should be in a position in which the player can touch quickly one and another, once both will be clickable/touchable elements. The game is implemented using Unity, and is currently available to Android devices with at least version 2.3 and minimum resolution of 420x360. Also, the game is currently available in Brazilian Portuguese, English, Spanish and Japanese languages.

Fig. 3 presents other screens of Katakana Star Samurai, as home screen (Fig. 3a), mode choice screen (Fig. 3b), level choice screen (Fig. 3c) and a gameplay of level 1 with star dying (Fig. 3d).



Fig. 2. Design on different screen sizes: (a) 3.5" (b) 5" (c) 6" (d) 7".

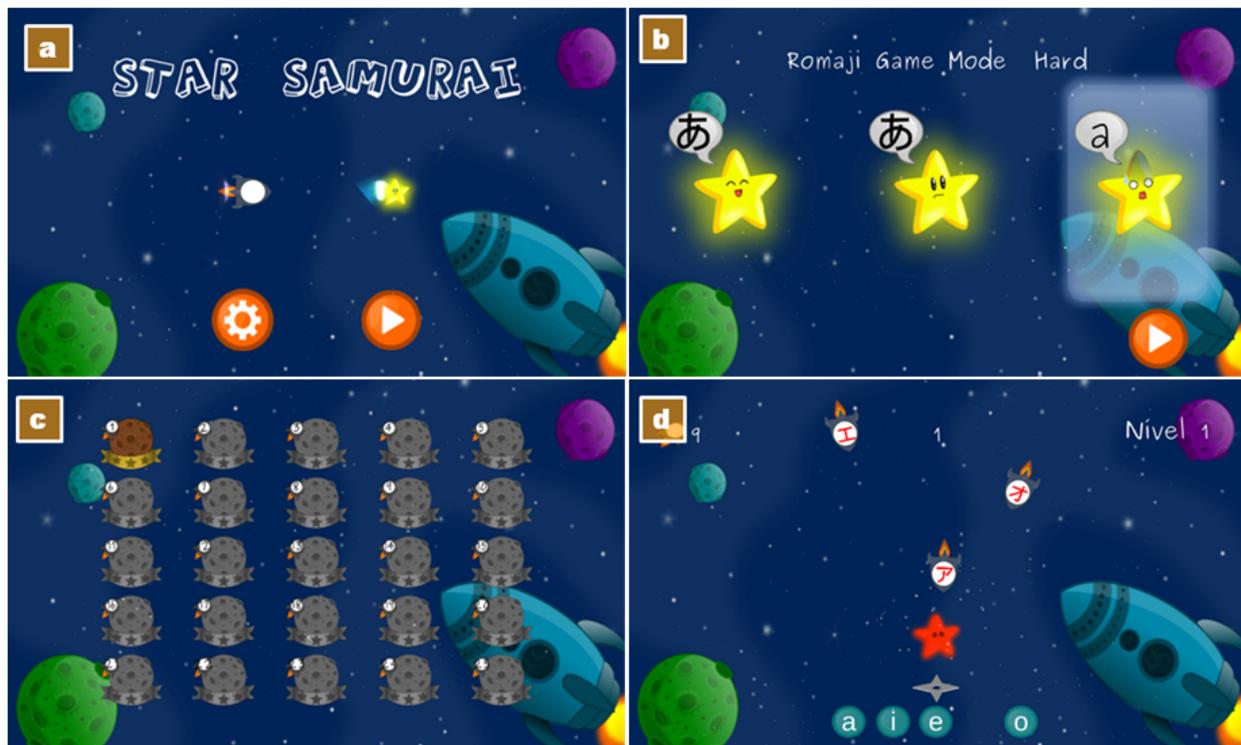


Fig. 3. Star Samurai (a) home (b) mode choice (c) level choice screens and (d) gameplay.

A. Plot and Gameplay

Katakana Star Samurai tells the story of a samurai warrior of a medieval future who tries to save a precious star from having its energy robbed by evil enemies moved by a Japanese power controlled through katakana alphabet. To do that, the

samurai uses an inherited old ship, called Katana, which shots special spatial shuriken to harm and destroy these enemies; the ship is also controlled by a Japanese power, but using hiragana and roma-ji alphabets to decode the location of the evil

katakana ships and load the shuriken shooter, guiding it to hit the ships.

It can be noticed the influence of the cultural aspects on the game design: the samurai – a warrior with honor and the mission to protect the star – possesses a ship called Katana, as a reference to the long sword the actual samurai should use. The samurai also needs Japanese language knowledge to accomplish the mission, as a reference to the literacy required from the actual warriors that inspire Katakana Star Samurai game. The use of shuriken also resembles a Japanese weapon of medieval ages.

The gameplay is simple, as shown in Fig. 4. At the top, Fig. 4a shows the number of enemies left to destroy in the current level, Fig. 4b shows the current score, Fig 4c shown an enemy that comes from above of off screen heading to the star, and Fig. 4d shows the current level. In the bottom of the screen there are the shot buttons (Fig. 4e) and the shuriken gun (Fig. 4g). Fig 4h shows a selected button. Right above, (Fig. 4f) is the star to be protected. Each shot button contains hiragana or roma-ji characters (according to mode choice) – corresponding to the katakana carried by the enemies, or some other characters to puzzle the choice of the button. The player has to touch the button, and following, touch the enemy with the katakana that matches the hiragana or roma-ji touched, destroying the evil ship. If an evil ship is not destroyed it reaches the star and steals some of its energy, and if the star loses all its energy, it dies and the level is failed.

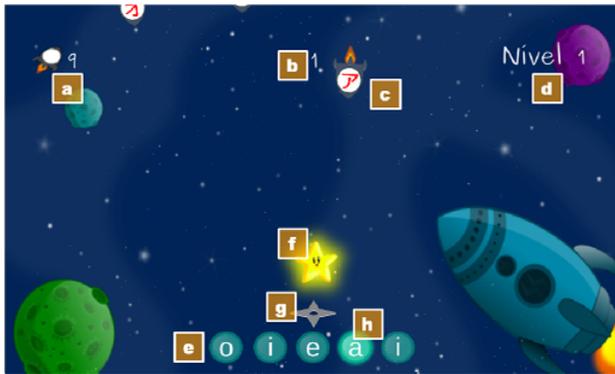


Fig. 4. Katakana Star Samurai level screen: (a) enemies left (b) score (c) enemy (d) level (e) buttons area (f) star (g) shooter in the shape of a shuriken (h) a selected button.

The fact that the player can choose whether they want to practice from katakana to roma-ji or katakana to hiragana provides more learning strategies that can fit more students. A player who wants to learn one alphabet at a time will probably know hiragana first, and then use this knowledge to learn katakana while practicing the hiragana learned before; to do that, the player can choose the buttons to have hiragana. But it is possible that a student wants to learn hiragana and katakana in parallel, or even prefer to use roma-ji if they think it is

easier to associate the pronounce with their native alphabet, so they can choose the buttons to have roma-ji. The enemies will always be katakana, once teaching this syllabary is the main goal of the game.

For each level, there is a specific number of enemies to be destroyed without letting the star die, and also a number of total buttons that will be displayed at once, and this number enhances as the levels increase. For each level, there are also new symbols that are displayed, starting in level one with five katakana symbols, which belong to the first family of the alphabet, the “a gyo”. These numbers are all described in the next subsection. Once the game is based on destroying a specific number of katakana per level, there is no determined time for the player to accomplish a level; the goal is that they can be able to destroy all the enemies without letting them drain all the energy of the star (i.e., without dying).

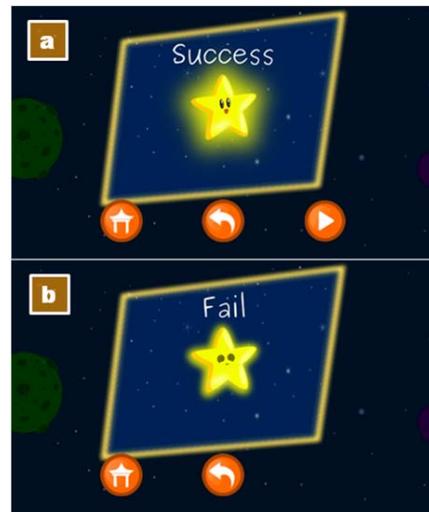


Fig. 5. End of level screens (a) "level cleared" (b) "level failed".



Fig. 6. The five status of the star.



Fig. 7. Enemy ships of Katakana Star Samurai.

Fig. 5 shows the screens for level cleared – success – and level failed – fail. While the energy of the star is stolen, it

begins to change its appearance, from happy to worried, sad, crying and exhausted. Fig. 6 shows these changes, presenting the five possible status of the star. Fig. 7 shows in detail the two kinds of enemy ships of Katakana Star Samurai: the ordinary ships with only one katakana inside, and the boss ship, with five katakana inside.

B. Level Division For Learning

The level division in Katakana Star Samurai was created to introduce new content gradually, aiming to provide a learning pace that most users will be able to follow. Basically, for each new level, a new family (gyo) of the alphabet is presented; in general, gyos have five characters each, but some gyos have less. This rhythm is slightly accelerated from level 18 on, in which are presented composed characters, whose gyos are smaller (three composed symbols per gyo). Also, there are six

game modes: easy, medium and hard, each one with choice for hiragana or roma-ji.

Each level has as enemies the new katakana of the level plus the katakana from all of the previous levels. The percentage of characters corresponding to the list of new characters in the current level is determined by the difficulty mode, i.e., easy (50%), medium (33%) or hard (totally random). For example, level 3 has as new characters the symbols of “sa gyo”, but also can show symbols from “ka” and “a” gyo (level 2 and 1). Also, in each level, there is a determined number of enemies to be defeated without letting the star die, which starts in 10 at level 1 and increases in an arithmetic progression of ratio 3. Still, for each level, there is a number of buttons that appear with different symbols for the user to load the Katana; this number also increases with the levels, starting in 5, and follows the same formula as the number of enemies to be defeated.

Table 2. Level division of Katakana Star Samurai.

Level	Gyo	#	Katakana	Hiragana	Roma-ji	Enemies/Buttons
1	a	5	アイウエオ	あいいうえお	a i u e o	10/5
2	ka	5	カキクケコ	かきくけこ	ka ki ku ke ko	10/5
3	sa	5	サシスセソ	さしすせそ	sa shi su se so	12/5
4	ta	5	タチツテト	たちつてと	ta chi tsu te to	12/6
5	na	5	ナニヌネノ	なにぬねの	na ni nu ne no	12/6
6	ha	5	ハヒフヘホ	はひふへほ	ha hi fu he ho	15/6
7	ma	5	マミムメモ	まみむめも	ma mi mu me mo	15/7
8	ya	3	ヤユヨ	やゆよ	ya yu yo	15/7
9	ra	5	ラリルレロ	らりるれろ	ra ri ru re ro	18/7
10	wa/n	3	ワヲン	わをん	wa wo n	18/8
11	ga	5	ガギグゲゴ	がぎぐげご	ga gi gu ge go	18/8
12	za	5	ザジズゼゾ	ざじずぜぞ	za ji zu ze zo	21/8
13	da	5	ダヂヅデド	だぢづでど	da dji dzu de do	21/9
14	ba	5	バビブベボ	ばびぶべぼ	ba bi bu be bo	21/9
15	pa	5	パピプペポ	ぱぴぷぺぽ	pa pi pu pe po	24/9
16	fa	4	ファフエフォ	- - - -	fa fi fe fo	24/10
17	va	5	ヴァヴィヴヴェヴォ	- - - -	va vi vu ve vo	24/10
18	kya/gya	6	キキキギギキ ヤユヨヤユヨ	きききぎぎき やゆよやゆよ	kya ky ky gya gy gy u o u o	27/10
19	sha/ja	6	シシシジジシ ヤユヨヤユヨ	しししじじし やゆよやゆよ	sha shu sho ja ju jo	27/11
20	cha/dya	6	チチチヂヂチ ヤユヨヤユヨ	ちちちぢぢち やゆよやゆよ	cha chu chodya dy dy u o u o	27/11
21	nya/mya	6	ニニニミミニ ヤユヨヤユヨ	にににみみに やゆよやゆよ	nya ny ny my my my u o a u o	30/11
22	rya	3	リャリュリョ	りゃりゅりょ	rya ryu ryo	30/12
23	-	-	-	-	-	5/12
24	-	-	-	-	-	10/12
25	-	-	-	-	-	15/12

The bosses of the game are big ships who bring not one, but five katakana inside, and to defeat them, the player has to load the Katana with all five correctly. These ships can be very strong, some of them will not be destroyed with only one shot; in this case, when the first shot hits, five new characters appear in the ship, and the player has to load the Katana again with the new corresponding hiragana/roma-ji, and this goes on until the ship is destroyed. Bosses appear at the end of level 10, containing only katakana presented until this level; at the end of level 20, following the same rule as the first; and levels 23, 24 and 25 are special levels where only bosses will appear. That is why the number of enemies to be destroyed decreases from level 22 to 23, and increases again in levels 24 and 25.

Table 2 presents the levels of the game, with the new katakana included, corresponding hiragana and roma-ji for each one; number of enemies to be defeated and buttons, for each of the 25 levels of the game. Levels 23, 24 and 25 are special levels which do not contain new katakana characters, but super enemy ships which contain combinations of them. Some of the katakana do not have corresponding hiragana, in these cases, roma-ji will appear, since it is the only “translation” the katakana has. In Table 2, the column “Katakana” contains the new elements to be practiced in each level, and the columns “Hiragana” and “Roma-ji” have the correspondent symbols to each katakana. For example: ア = あ = a, corresponding to the first square of each symbol column for level 1.

IV. TEST WITH USERS

In this Section we describe a test made with end users of Katakana Star Samurai to find out about several aspects of the game.

A. Scenario and Methodology

The test was accomplished with a total of 8 users, with ages from 9 to 26. There were users in four levels of katakana knowledge: (i) no knowledge, (ii) beginner – knows the difference between hiragana and katakana, (iii) intermediate – knows all katakana symbols, and (iv) advanced – can read katakana fluently. The test took place in different environments, as a study room, a bedroom and a street. The purpose for that is we wanted to evaluate the tool in real usage scenarios, which can be almost everywhere a person can use a smartphone or tablet.

For the test, the users were asked to play the game for up to one hour, and they were able to choose from two different screen size devices. After the playing moment, the users were asked to answer to an interview that was recorded in audio. The users could answer to the questions together with other users which participated at the same time. Table III presents the questions of the interview.

Table 3. Question of the interview for the test with users.

#	Question
1	Did you like to play Katakana Star Samurai?
2	What’s your opinion about this playability?
3	What’s your opinion about the graphical design of the game?
4	What’s your opinion about the music and sound effects?
5	What’s your opinion about studying katakana this way?
6	Do you think it is possible to learn katakana with Katakana Star Samurai?
7	Did you feel some difficulty at some point of the test?
8	What screen size did you like the most to play Katakana Star Samurai?
9	Do you have interest of downloading Katakana Star Samurai?
10	Do you have any suggestions for the game?

B. Results

There were accomplished three sessions of experience: the first with two advanced students; the second with one intermediate student and two users with no knowledge of katakana; and the third with a beginner and two with no knowledge. Fig. 8 shows some moments of the users playing Katakana Star Samurai. In Fig. 8a two different moments of the same user are shown: succeeding and failing in a level. Fig. 8b shows two users playing simultaneously, with the same screen size, Fig. 8c and Fig. 8d show users playing with different screen sizes.



Fig. 8. Users playing Katakana Star Samurai.

This test with users provided qualitative results through the interviews made after the users played the game for up to an hour. From now on we present the most relevant answers for each of the ten questions made to the participants. About Question 1: all users said they liked to play the game. Question 2: most users found the playability interesting, while one user said he would prefer to click and drag the button instead of performing two clicks. A user of beginner level found it very interesting to practice katakana in this “frantic” way, claiming that it naturally enhances the fluency to read the symbols. Question 3: the graphical design of the game was appreciated by all of the users, being described with terms as “motivating”, “beautiful” and “eye catching”. Question 4: the music of the game was described by some users as “the icing on the cake”, and in general, the users liked it very much. The only

complaint is that some soundtracks were very low, so the volume had to be turned loud to hear it well.

About Question 5: according to the users, even those with no knowledge of Japanese, the game brings a dynamic way to study, memorizing, remembering and practicing katakana, and once the playability is quick and fast, it stimulates the student to be more fluent in the reading of the alphabet. A user with advanced knowledge reported he was able to remember some symbols he had forgotten, only with the playing time of the test. He commented katakana is the less used Japanese alphabet, being easier to forget some symbols, and for that, to have a tool to practice like this is very useful. Question 6: regarding the learning of katakana, the most relevant answers were from the users with no knowledge, which were divided; two of them believe they could learn katakana through the game, and even were able to memorize some symbols during the brief test; one said that as levels advance, it may be very difficult to learn the entire alphabet just by playing; the other said that this tool is great for practicing content that was previously learned, but to learn with the game only seemed unlikely.

In Question 7 some users reported difficulties related to screen size on the 3.5" , in which the buttons were difficult to click – mainly for the users with bigger hands – and some letters were too small, in addition to have less time to think while the enemy ship can reach the star. Also, some users with no knowledge of katakana said that it was difficult to play because there was no tutorial or hints. Question 8 brought interesting points about the screen size related to the playability of Katakana Star Samurai: the smallest screen on the test was 3.5" , which was said before as too small for some elements to see and touch; 5" and 6" screens were considered the best in terms of visibility and playability, but 7" screen caused different opinions. Some users liked it because they were able to play better with the device on a surface (a table or the legs) and use all the fingers more easily to touch the buttons and the ships. Other players said it is difficult to use such a big screen to play using the thumbs while holding the device.

Question 9 found that all users had even a little interest in downloading Katakana Star Samurai, and four of them – two advanced, one intermediate and one beginner – asked directly for the .apk or link to install it in their own devices. About the suggestions asked in Question 10, there were many. One suggestion made by almost all users was to have power-ups and rewards according to player's performance. It was also suggested to have a tutorial to teach how to play, once the playability was described as "different from most current games". A content tutorial was also suggested, to teach the katakana alphabet, mainly for the users with no katakana knowledge, as well as hints in game to, at least, the lower difficulty levels. About the mode choice screen, the users said it was not clear how to switch from hiragana to roma-ji mode. The soundtracks were described as good but very low and difficult to hear in normal volume, and it was also suggested an option to turn off music and sound effects separately. Still about sounds, a user suggested sounds with the pronunciation of each syllable to be available and played while the ship is hit.

V. DISCUSSION

Katakana Star Samurai presents, subtly, influence of cultural aspects from Japan. This game just supports the learning of katakana, an alphabet used mainly to write foreign words in Japanese; but at the same time, the game offers an environment with Japanese elements, which can improve the user experience and the fun of the game, providing additional motivation for the player to keep playing, and thence, learning katakana. Once samurai warriors are widely known in most parts of the world, including Brazil, as being aspects that resemble Japan specifically, the learning environment becomes contextualized and more fun.

The design of the game elements was made carefully to provide i) a good learning, by making sure the Japanese characters were in a readable size, considering the screen sizes on the currently most popular Android mobile devices; and ii) an interesting gameplay, with harmonic elements that make the player enjoy the game screens, what can also add motivation in a different view.

The learning feature of the game is the game itself. There is no explanation with long texts teaching symbols, or an introduction to content in traditional course schemes. The game intends to offer, in the first level, a tutorial of "how to play", which is common to mobile games nowadays, and the learning of the Japanese characters is reached by just playing the game once and again. The levels were designed to present few new content, for the player to have the opportunity of practicing in a level until they feel secure to go forward.

There are noticeable differences from the related games to Katakana Star Samurai. Most of the cited games do not concern about a good design of the elements, making them very simple or not harmonic. The design of Katakana Star Samurai has each and every element carefully planned to match each other and the context of the game, in learning and fun perspectives. Also, the games usually have no levels, and the content is presented randomly, assuming that the player already knows the content, or expecting them to learn by trial and error between a large amount of new information they receive every time they play. Katakana Star Samurai has an intelligent division of levels, which presents content gradually, in an order similar to what Japanese natives learn; and with the possibility of the player to practice the same level as much as needed.

The related games are, generally, monotonous. They provide a task that never changes, the challenge is not improved as the game advances, i.e., apparently there are no elements to hold the attention and interest of the player to keep using the game. Some of them present an application as a game, but that fits more as an evident educational exercise. For example, "Guess that Kana" is basically a multiple choice exercise, while "Learning Japanese: Katakana" has a more dynamic gameplay, but also do not present clear levels or

difficulty increase. Katakana Star Samurai has the concerning of being a game in the first place, which is able to support learning without becoming an obligation to the player. The proposed levels of Katakana Star Samurai, and bosses, who increase difficulty, as the quick gameplay together with an attractive design, compose a strong tool that can keep the interest and motivation of the student of Japanese language.

The test with users raised very interesting questions, mainly the agreement in educational aspects of the game, by users of all levels of knowledge in katakana that participated the test. Regarding the screen sizes, it was interesting to see that not only a smaller screen but also a bigger one can bring difficulty to some players, as in the case of a 7" screen, which was not good to play Katakana Star Samurai for some users. The fact that a user with advanced knowledge commented about the usefulness of the game is very interesting, it was possible to realize that katakana is an alphabet that can be more easily forgotten by foreign Japanese students and that really needs support tools that help them practice this alphabet. To provide this support through a game that can be played quickly in almost everywhere can raise more motivation in the practice of katakana – as also said by another user.

Even being part of a suite of games to support Japanese language learning, Katakana Star Samurai is a complete game in its proposal, which is, support the learning and practice of the katakana characters and their readings, for roma-ji or hiragana, at player's choice, offering an entertaining way of learning and practicing the katakana alphabet. Katakana Star Samurai is implemented using the Unity game engine. With this engine, we can distribute the game to several platforms, though our primary goal is mobile, with the current version running in Android.

VI. CONCLUSION

In this paper, we presented Katakana Star Samurai, an educational mobile game to support Japanese language learning, focused on the katakana alphabet. The game was described in detail, presenting the educational content as well as the playability and game screens. Also, we presented a test with end users that allowed us to bring several topics of discussion about design and the learning support the game offers to katanaka.

As future work, we intend to attend the users' suggestions for Katakana Star Samurai and to correct possible bugs in the game. We point the accomplishment of a wider experiment with more users, and using much more time, in order to obtain more feedback to improve the game and be able to test all the levels of the game. Also, we intend to apply a further improved version of Katakana Star Samurai in a beginner Japanese class to evaluate the learning power of the game.

ACKNOWLEDGMENT

This work was partially supported by the Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES), and by the Physical Artifacts of Interaction Research Group (PAIRG) at Federal University of Rio Grande do Norte (UFRN), Brazil.

REFERENCES

- [1] Berns, A., Palomo-Duarte, M., Doderer, J.M., Valero-Franco, C.: Using a 3D Online Game to Assess Students' Foreign Language Acquisition and Communicative Competence. In: Proceedings of 8th European Conference on Technology Enhanced Learning, EC-TEL. Springer, 19–31 (2013).
- [2] Davies, R., Krizova, R., Weiss, D.: eMaps.com: Games and Mobile Technology in Learning. In: Proceedings of the First European Conference on Technology Enhanced Learning, EC-TEL. Springer, 103–110 (2006).
- [3] Han, L., Liu, D. & Liu, Y. "Implementation of CALL-Based Online Japanese Learning System". In Proceedings of the International Conference on Internet of Things and 4th International Conference on Cyber, Physical and Social Computing, IEEE, 2011, pp. 585–588.
- [4] Lam, J., Cheung, K.S., Ng, J., Yau, J., Seto, W. And Im, T.: Students' needs of e-courses as complement to traditional learning: a Japanese studies e-course case. In: Proceedings of the IEEE International Symposium on IT in Medicine and Education. IEEE, 876–880 (2008).
- [5] Marciano, J.N., Ferreira, A.L.S., Correia, A.C.C., Miranda, L.C. And Miranda, E.E.C.: Karuchā Ships Invaders: cultural issues on the design/development of a Japanese CALL game made by/to Brazilians. In: Anais do XII Simpósio Brasileiro de Jogos e Entretenimento Digital. SBC, 172–180 (2013).
- [6] Martínez-Ortiz, I., Moreno-Ger, P., Sierra, J.L., Fernández-Manjón, B.: Production and Deployment of Educational Videogames as Assessable Learning Objects. In: Proceedings of the First European Conference on Technology Enhanced Learning, EC-TEL. Springer, 316–330 (2006).
- [7] McLoughlin, C., Hutchinson, H. And Koplin, M.: Different media for language learning: does technology add quality?. In: Proceedings of the International Conference on Computers in Education. IEEE, 681–684 (2002).
- [8] A.B.C. Pereira, G.N. Souza Junior, D.C. Monteiro, E.S. Barros, H.P. Costa, P.A.A. Nascimento, L.B. Marques, D.G. Souza, F.M. Salgado, and R.Q. Bessa, "A AIED game to help children with learning disabilities in literacy in the Portuguese language," in Anais do XI Simpósio Brasileiro de Jogos e Entretenimento Digital (SBGames'12), SBC, 2012, pp. 134–143.
- [9] F. Tian, F. Lv, J. Wang, H. Wang, W. Luo, M. Kam, V. Setlur, G. Dai, and J. Canny, "Let's play chinese characters: mobile learning approaches via culturally inspired group games," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI'10), ACM, 2010, pp. 1603–1612, doi: 10.1145/1753326.1753565.
- [10] Tiwari, S., Khandelwal, S. & Roy, S.S. "e-Learning Tool for Japanese Language Learning through English, Hindi and Tamil: A Computer Assisted Language Learning (CALL) Based Approach". In Proceedings of the 3rd International Conference on Advanced Computing. 2011, pp. 52–55.
- [11] L.-H. Wong, C.-K. Chin, C.-L. Tan, M. Liu, C. Gong, "Students' meaning making in a mobile assisted Chinese idiom learning environment," in Proceedings of the 9th International Conference of the Learning Sciences (ICLS'10), ACM, 2010, pp. 349–356.
- [12] Zervas, P., Sampson, D.G., 2010. "Enhancing educational metadata with mobile assisted language learning information," in ICALT'10, 10th IEEE International Conference on Advanced Learning Technologies. IEEE. p. 269–273.