Learning Arabic Through Play Games on Tabletop Surface Computers in Early Childhood

Pantelis M. Papadopoulos[1(✉)], Zeinab Ibrahim[2], and Andreas Karatsolis[3]

[1] Aarhus University, Aarhus, Denmark
pmpapad@tdm.au.dk
[2] Carnegie Mellon University in Qatar, Doha, Qatar
zeinab@qatar.cmu.edu
[3] Massachusetts Institute of Technology, Cambridge, USA
karatsol@mit.edu

Abstract. This paper presents the use of educational games in the context of the "Arabiyyatii" research project, a three-year project funded through Qatar National Research Fund. The scope of the project is teaching Modern Standard Arabic (MSA) to kindergarten students (5-6 years old) that are native speakers of the Qatari dialect. Part of the new curriculum envisioned in the project includes the use of simple educational games, specifically designed and developed for tabletop surface computers. The paper presents a naturalistic study design, following the activities of 18 students for a period of 9 weeks in the project. The paper presents three of the most played games by the students, along with analysis on collected data, focusing on students' performance and attitudes towards the new curriculum. Results analysis provided an encouraging image, suggesting that the conducted activity was able to increase students' engagement in language learning, increase their exposure to MSA, and develop their vocabulary.

Keywords: Educational games · Tabletop surface computer · Language learning · Modern standard arabic · Early childhood

1 Introduction

The use of official and everyday forms of a language can create confusion to young students, as the borders between the two are not always visible. Across the Arab world, Classical Arabic (CA), and its derived form, Modern Standard Arabic (MSA), used in all formal contexts, is perceived as the "high" form of language whereas, the local mother tongues (or "dialects") are used in daily contexts and are usually perceived negatively [1]. As expected, the situation in Qatar is no exception, creating confusion to students (e.g., [2]). As all diglossic languages, the formal form, MSA is the language students learn in schools, while the informal form, the dialect, is the mother tongue spoken at home. As a consequence, the numbers of geographical dialects are various [3], if counted by all 22 Arab countries.

The main goal of our work on the "Advancing Arabic Language Learning in Qatar" project (formerly known as "ALADDIN" for Arabic LAnguage learning through Doing,

Discovering, Inquiring, and iNteracting, and recently renamed "Arabiyyatii", meaning "my Arabic") is the proposal of an updated comprehensive curriculum for the Arabic language that would integrate the use of innovative educational technology into current didactical methods. Tabletop surface computers have been selected as the innovative technology that would offer a series of new learning affordances and would allow the reconstruction of the traditional classroom in a new way. On the other hand, didactical methods stir away from the commonly used scholastic model, making use of communicative approaches, collaborative learning, and constructionism.

This research draws extensively upon the works of Ibrahim (e.g., [4–7]) pertaining to Arabs language attitudes, the relatedness of the MSA to the dialect and the native speakers awareness, lexical separation as a consequence of diglossia, the use of technologies in Arabic language learning, and language planning and education. For example, in summarizing the current situation of the Arabic language, Ibrahim [7] noted that there is conflict in Arabs towards their language. Native speakers do not know much about the relationship between the different varieties of Arabic (dialects) and the official MSA and they often have trouble identifying which version is needed from them in formal education. To make matters worse, the language teachers often do not receive appropriate education on how to approach this delicate issue. The end result, as Ibrahim puts it, is "a native speaker who is in a life time dilemma" (ibid., p. 360).

The curriculum proposed in Arabiyyatii addresses this issue by applying a holistic approach. The project offers a rich learning experience that includes listening, discussing, writing, storyboarding, and gaming activities. The backbone of the curriculum is Aladdin's folklore story, modified from the original version for content and learning requirements. The story provided the context of the curriculum and was presented to students through a series of 21 video episodes. Each episode lasted 5–7 min and was a sequence of still cartoon images with voice-overs.

For 9 weeks during the Fall semester 2013, we tested the new curriculum in the private Kindergarten of the Qatar Academy in Doha, Qatar. The instructional goal during this study period was to teach a class of 5–6 year-olds the Arabic alphabet and enrich their vocabulary in MSA. Although the project has a wide scope, aiming at a new curriculum, the present paper focuses specifically on the use of the educational games, specifically designed and developed for the project.

2 Study Background

2.1 Arabic Language Characteristics

The Arabic alphabet consists of 28 consonants, 3 long vowels, and 3 short vowels. Short vowels are not written within the word, but either above or below the letter. To provide a clearer picture of the study, it is important to present some of the unique characteristics of the language. Arabic writing has four major characteristics that distinguish it from other languages:

- writing is from right to left
- most letters are connected in both print and handwriting

- letters have slightly different forms depending on where they occur in a word (isolated, initial, medial, and final form)
- Arabic script consists of two separate "layers" or writing: the first is the basic skeleton made up of consonants and long vowels, and the second is the short vowels and other pronunciation and grammatical markers.

As far as pronunciation is concerned, Arabic has one-to-one correspondence between sound and letter, while the writing system is regularly phonetic meaning that words are generally written as they are pronounced. This is crucial in the project, since slight difference in pronunciation of a word in dialect and MSA resulted in different writings.

In the context of the study, teaching the Arabic alphabet focused on two major outcomes: recognition and production of the letters. Production means that the students should be able to write and pronounce clearly the letters of the alphabet, while recognition means audio and visual recognition. The students should be able to recognize a specific letter in a spoken or written word. Production in the project was covered by writing activities and discussion sessions led by the school teacher (result analysis on the writing activities can be found in [8]). On the contrary, the educational games presented here were focused on recognition.

2.2   Computer Games in Education

A plethora of different types and forms of computer games have been used extensively in education. The topic has attracted the interest of many researchers resulting in a very rich literature. Kebritchi and Hirumi [9] provided an overview on the pedagogical foundations of modern educational computer games. The use of computer games has yielded encouraging results in several aspects related to learning. Study findings suggest that appropriate use of computer games could positively affect students' motivation, increase their engagement, enhance knowledge acquisition, support collaboration, and foster the development of problem-solving skills in primary (e.g., [10]), secondary (e.g., [11]), and tertiary education (e.g., [12]).

Although there are several studies focusing on younger ages (e.g., [13]), little can be found regarding the use of computer games at kindergarten. When looking even closer to the Arabic context of the project, the use of educational software or computer games in formal education is rare, if any.

2.3   Tabletop Surface Computers

Tabletop surface computers are a relatively recent achievement, offering learning new affordances that make them a lucrative and interesting choice in educational technology. Results reported in studies have been encouraging so far. Kerne et al. [14] discussed the roles for interactive systems enabled by touch screen devices in supporting creative processes and aiding in idea formation. Morris et al. [15] examined the educational benefits of using a digital table to facilitate foreign language learning. As documented in Piper [16], the use of multimodal tabletop displays, as a rich medium for facilitating cooperative learning scenarios, is just emerging.

The tabletop surface computers[1] we use in the project allowed us to design learning activities using touch technologies and shared interfaces. The system (also "table" for the rest) has a 40" touch screen that can recognize more than 50 simultaneous touch points. As such, the size of the screen is large enough to provide an ideal physical space for interaction and collaboration for 4 kindergarten students. This was essential in the project. Moving away from the traditional setting of a classroom (strictly defined by desks and whiteboards), the use of a table allows students to gather around in small groups and increases the opportunities for peer interaction and student participation.

Apart from the reconstruction of the physical space, the ability to support several simultaneous touch points and the ample screen space are essential in creating a shared interface. A typical computer has two main entry points, namely the keyboard and the mouse, while a tablet has a very limited number of simultaneous touch points (usually 4–5 depending on the system). On the contrary, a table makes all the items of the interface readily available to all participants, thus being ideal for collaboration.

While designing an application, or a game in our case, for a system such as this, the engineer has to take into account the specific affordances the system offers. A distinct example on how the system specifications affected the design of the games and the learning activity was the issue of the horizontal screen. Since students gather around the table, orientation of the interface and its components should be designed carefully. Similarly, learning design should take into account students' positions around the table. In the project, we applied three different approaches, according to the learning needs of each activity: single fixed orientation, multiple fixed orientation, and freely rotating interface items.

Regarding the technical skills of our target audience, the use of touch technology was essential, since kindergartners usually lack the ability to use a computer. On the contrary, the students had already been exposed to other touch systems, such as smartphones and tablets both at home (parents' devices) and at school (each student receives a tablet pc from the school in the beginning of the year).

3   Method

3.1   Participants

School administration assigned one of the classes enrolled in the "Arabic Studies" course to the study. The class had 18 Qatari enrolled students (9 boys and 9 girls), native speakers of the Qatari dialect. All students were between 5 and 6 years old. Although all students were native speakers of the dialect, they had not been taught MSA before and were novices. The learning goal of the course was to teach students fundamental linguistic skills in MSA such as vocabulary development, letter production and recognition, and proper pronunciation. As we mentioned earlier, there is a one to one connection between pronunciation and writing, and it was the first time during their school life that students had to make a distinction between dialect and MSA.

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[1] http://www.samsung.com/uk/business/business-products/smart-signage/specialised-display/LH40SFWTGC/EN.

The total population of the class was available only 8 days during the course of 9 weeks for various reasons (e.g., illness). Usually, the actual number of students in the classroom ranged from 16 to 17.

3.2 Design

The design applied in the study followed a naturalistic study approach, following the activity of the 18 students in the new curriculum for a period of 9 weeks (September 29 – December 4). The instructional goal during that specific period was to teach students the isolated form of the first 12 Arabic letters (from [ﺍ] to [ﺯ], considering 'alif' and 'alif with hamza' as two different letters).

3.3 Material

The main instructional goal behind the design of the educational games was to support students in letter recognition. In this section, we describe the 3 most played games we used in the classroom, plus one game that was introduced near the end of the study. Several other games, along with their alternative versions (e.g., individual or collaborative play), have been developed in the Arabiyyatii project. However, not all games were introduced and used during the 9-week period during which we had access to the school. This was planned, since some of the games in the project focused on higher level of knowledge (e.g., identify words, instead of letters) and had to be introduced later during the school year.

Storytelling. As we mentioned Earlier, the New Curriculum Was Built around an adapted version of the famous and loved Arabic folklore story of "Aladdin and the Magic Lamp". Although watching the video episodes of the story was not a game per se, we present the storytelling activity here, because is provided the context and set the tone of the gaming activities that followed.

Although the story is known through many variations, it is very often enriched with additional episodes and characters that fit different contexts. Our version, based on the original story, excluded parts that would be too violent for the students and not suited for their age, while maintaining all the aspects of Arabic heritage, along with short additions that would emphasize the pedagogical teachings of the narrative (e.g., Aladdin has to work in order to get help from the genie).

Special effort was given to include in the narration words and sounds that would be useful for teaching. As such, the language used was MSA and the linguistic expression was simple enough for students to comprehend. Thus, we took out some of the classical words that would be too difficult for students to understand.

The use of appealing images and capturing voices can capture students' interest, while the presentation of familiar heroes using the MSA can bring students closer to the language. Short episodes can be perceived as learning packages focusing on specific goals (e.g., learning colors, fruits, tenses etc.). The story served as the continuum of the instructional method as it provided the theme for the learning activities and the educational games on the tables.

Aladdin's story was divided into 21 episodes, each one starting from where the previous part finished. The episodes were approximately of the same length, lasting around 5-7 min each. Each episode was a sequence of static images (Fig. 1), along with an audio track, in which dialog and narration were included. Actors played the roles appearing in the story, to have accurate pronunciation of the different letters according to MSA.

Fig. 1. A screen caption of an episode of the storytelling activity.

Soundboard. The soundboard belonged to the gaming activities of the new curriculum, although it is not strictly speaking a game. It is a transfer of the well-known soundboard toy for children and its purpose was to help students understand how words are pronounced in MSA and assist them in building their vocabulary. The application had three main parts: (a) the letter bar, showing all the letters of the Arabic alphabet, (b) the gallery, showing 15 different images of objects that start with the letter selected in the letter bar, and (c) the lastly touched object, showing the image the students touch last in the gallery. The activity is simple. First the students have to select a letter in the letter bar. After selecting a letter, the system selects a random set of 15 different objects that start with the selected letter. These images are retrieved from a larger pool of images. The reason for a random gallery was to cover more images and keep students' interest high: the more a student is using the application, the higher the chance to eventually see more/new images. Of course, the number of available images in the pools of each letter could differ a lot. This means that for some letters a few random galleries could cover the entire pool of images, while for others, this goal was harder to reach, and students had to keep using the application in order to see all the available images.

Next, the student has to select an image in the gallery, by touching it. Upon touching, the system plays a pre-recorded audio file representing the correct pronunciation of the word in MSA. To ensure that the pronunciation was the correct one, professional actors were hired to record the words in MSA. These were the same

actors we used in the project to do voice-over of the episodes showing Aladdin's story. In general, the Aladdin's folklore story provided a continuum in the project. Most of the words used in the Soundboard activity were also in the story. In addition, we expected that having the voice of the main protagonists of the story pronouncing the words would be interesting for the students and would further enhance their engagement in this activity. Furthermore, there were many connections between the activities included in the curriculum. The images used in Soundboard were also used in other games. Thus, spending time in the Soundboard allowed students to get familiar with the vocabulary and the images they were going to see in the games to follow.

The earlier version of the Soundboard was designed to be used by 4 players at the time. For this reason, the table screen was split into four areas, with two students sitting in each long side of the table. However, the number of simultaneous images touched and the fact that the classroom provided by the school was proved to be small for the number of tables used in the project, created an incoherent noise. Because of this, a new version was developed with only one player per table (Fig. 2). To make sure that the sound would be clear for all students to hear, we added an additional set of speakers. In the end, the activity was used only on one table operated by the teacher. The students were surrounding the table, while the teacher was standing in front of it leading the first few rounds. After that, the students were taking turns in touching images and hearing the pronunciation in MSA.

Fig. 2. Soundboard game. 1: Letter bar; 2: Gallery; 3: Current image.

Although the earlier version use multiple fixed orientations, the sound issue made it necessary to eliminate simultaneous touches and use a design approach that would allow for better control for the teacher.

Bingo. Bingo was the most played game in the study. The reason for this was that it was the first game introduced to the students and they preferred it over the other games we introduced later. The idea of the game is based on the well-known bingo game, modified, of course, for content and instructional goals. In the game, two teams of students (typically two dyads) sit on the opposite short sides of the table and play against each other trying to finish first, in order to win. In the beginning of the game, a person chooses the range of letters that are going to appear in the game, along with the duration of each round and the number of allowed mistakes per round (Fig. 3). Although students could do this on their own, we decided that it would be better for the study control, if the teacher was the one that would made these choices. This way all students in the classroom would play on the same level and on the same letters.
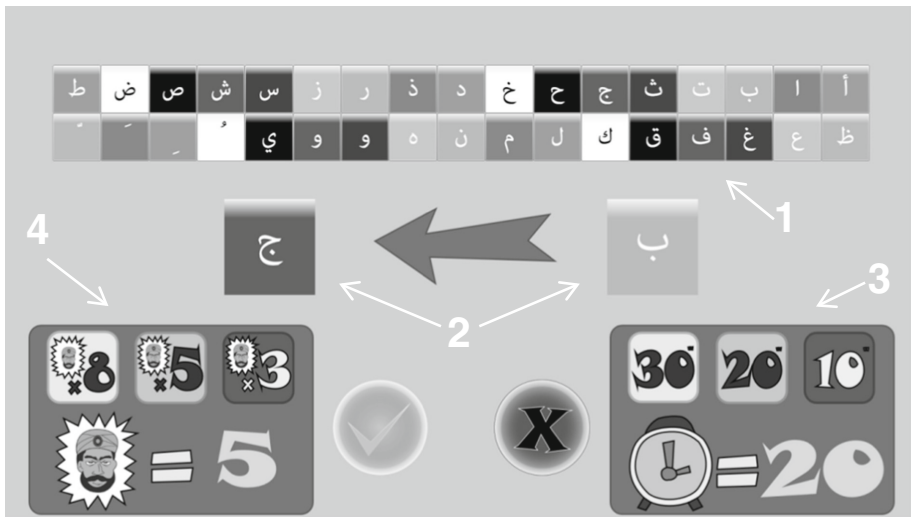

Fig. 3. Bingo game start page. 1: Letter bar; 2: Selected range of letters; 3: Seconds per round; 4: Allowed mistakes per round.

In the beginning of the game, the table screen is split in two playing areas, each one having a gallery with 40 images (Fig. 4). The galleries are populated randomly by the system that retrieves images from the pools of the selected range of letters. The randomization algorithm tries to have the same number of images for each letter. In the middle of the screen, there is a common area where the letter round and the remaining time are shown. During each round, the application picks one random letter within the selected range and displays it in the middle area. At the same time, remaining time for the round starts decreasing. The students have to touch the images in their gallery that start with the round letter. If a touched image is correct, it is replaced with Aladdin's face and remains like that for the rest of the game. In case of a mistake, the face of the Magician (i.e., Aladdin's nemesis) appears, and the object image reappears in the next round. A round ends, either when time runs out, or when both teams reach the allowed number of mistakes. The game ends, when one of the teams fills the gallery with Aladdin's face.
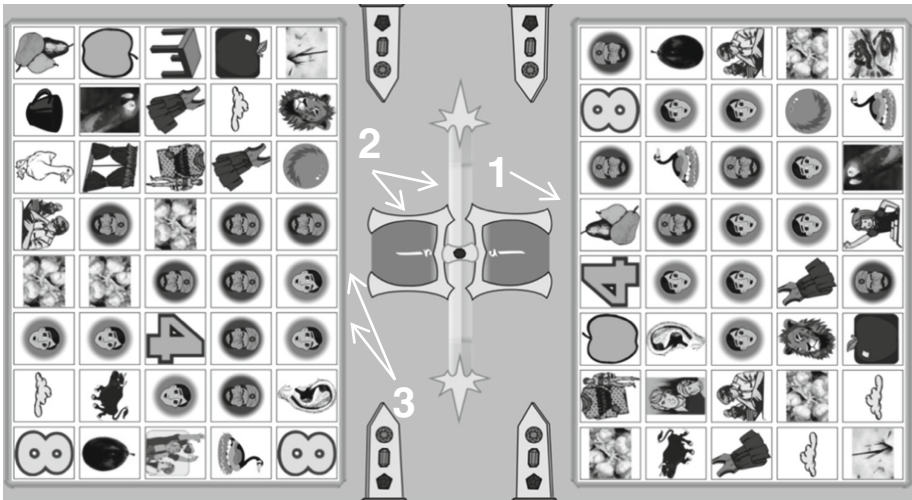
Fig. 4. Bingo game. 1: Gallery; 2: Remaining time and round letter; 3: Aladdin's and Magician's faces.

Regarding learning goals and cognitive activity, the students are expected to act in three steps. First, they need to identify the objects depicted in their galleries. Second, think or pronounce out loud the respective word in MSA, and third, decide whether the word begins with the same sound represented by the letter. Students' collaboration in teams and the factor of competition were expected to increase interaction and engagement.

At the end of each round, the system was recording the timestamp, the number of total and correct touches made, and the round letter for each team in log files.

Get3. This game is a variation of Bingo described above. The main differences between the two games are that Get3 is played individually, and there is no pressure from time limit or competitiveness. We designed this game to complement the data we were expecting from Bingo.

In Bingo, it is not possible to differentiate between the performances of each player, since it is not possible to identify each touch. In addition, the time limit in each round makes the game harder for students. Get3, on the other hand, allows the monitoring of individual performances and gives the opportunity to weaker or introvert students to take control of the game and play following their own pace. Furthermore, making the game an individual one eliminates competition, and this also lifts some of the pressure the students might feel while playing.

In terms of pedagogy, however, both games follow the same principle. The students have to match the starting sound of a word to the depicted letter. By combining the two games we were able to better understand student performance in a group and in an individual setting.

The teacher is, once again, responsible to adjust game settings and select the letter range and the goal score in the beginning of the game. Goal score is the total number of

correct answers the student needs to win the game. In other words, it is a limit of how long the game will go on.

The table screen is split in four playing areas covering all available space (Fig. 5). In each area there is a small gallery of 6 images, a round letter, and indications (number and bar) showing the current score. These four areas function completely independent from each other. The gallery has always 3 correct and 3 wrong images and it is refreshed in each round.

Fig. 5. Get3 game. 1: Gallery; 2: Round letter; 3: Total score and score bar.

In case of a correct touch, the image is replaced by a diamond, while, in case of a wrong answer, the image is replaced by an "X". After three images are touched, the round ends and the gallery and the selected letter are refreshed by the system. This means that in each round, the success rate of a student could vary from "0 out of 3" to "3 out of 3". The game ends for a player (but not for the whole table) when the goal score of correct answers is reached. After that, the game for the winner player starts over with the same range of letters.

The system monitors students' activity individually and records the timestamp, the round letter, and the success rate for each round. Both Bingo and Get3 were designed to play sounds on each touch (pronunciation of the words in MSA). However, because of the noise issues noted earlier in Soundboard, the sound was muted.

Pairs. This game was introduced last to the students (during the 7th week of the study), as it is the most difficult one. This is because the system does not ask for a specific letter, but students have to figure out the letters behind every image. In the Pairs application, the students have to pair images in on set to images of another set. A correct pairing refers to images that depict items that start with the same letter. So, once again, the

students have to identify the items in the images and think of how these items are pronounced in MSA.

As in the previous games, the teacher has to select the range of letters and the winning score. The screen is divided into 4 areas (Fig. 6) and each student plays individually. In case of a correct pairing, the image of the respective letter appears at the bottom of the playing area, just under the paired image of the bottom set. Otherwise, an "X" appears. There is no time limit for creating the pairs and a new round starts right after all the images are correctly paired. This goes on, until the goal score is reached. Because an image cannot be paired to two images at the same time, students' success rate in each round could be "0 out of 4", "1 out of 4", "2 out of 4", and "4 out of 4" (i.e., "3 out of 4" is not possible).
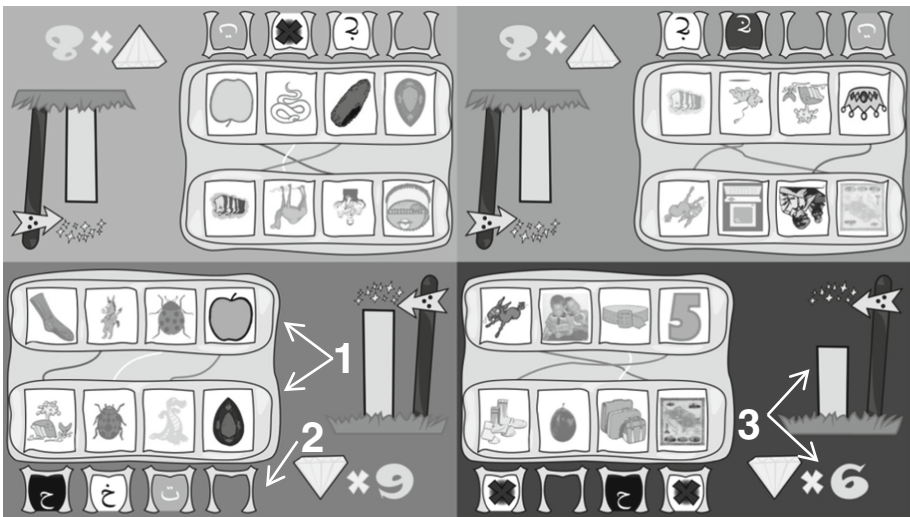

Fig. 6. Pairs game. 1: Image sets; 2: Right/wrong indicator; 3: Total score and score bar.

The system monitors the letter range, the datetime, and the number of tries per round. No individual data are recorded that would link a specific student to the recording metrics. Figure 6 shows the interface of the Pairs application.

Initially, the students did not like playing this game, because, as they said, it was hard for them. However, by the end of the 9 weeks, the students were already comfortable with the game and asked the teacher to play it. Despite this, the Pairs game is not part of the study analysis, because it was introduced late and the volume of collected data from the tables during the study period was not enough for meaningful statistical analysis. The game is presented here, in order to provide a better picture of student activity during the 9 weeks.

3.4 Procedure

Students have the Arabic Language class 4 days per week, at different hours. The class typically lasts 40 min, however, because students have to switch classrooms and since there is not always a break between classes, the actual duration of the class is usually 30–35 min.

Usually, a new letter was introduced by the teacher during the listening and discussion sessions, followed by writing activities. The games were used at the end of the class repeatedly, in order to (a) keep students' engagement and enthusiasm high, and (b) enhance retention.

Gaming sessions were usually lasting about 10 min, although, there were also sessions covering the whole class. Students played some of the games a few times per week. The class was controlled by the school teacher, with the principal investigator of the project also in the classroom to observe and take notes. The teacher was advised before class on the requirements of the new curriculum and on the planned activities to maximize the impact of the new approach. Although the principal investigator was present during the class, she was not allowed to intervene, since her role was only to observe student behavior and performance on the new curriculum.

The students were distributed to the 5 available tables in the classroom by the teacher. Although organizing students into groups of 3–4 students per table was mostly done randomly, factors such as gender, interpersonal relationships, and general student performance were often taken into account by the teacher, in order to have a balanced distribution. Group formation and students' spots were changing randomly in each class. Also, although it was not encouraged, students changing spots during a class was not forbidden either. It is important to note that students' identities were not part of the data collected by the tables or the researchers of the study.

While the number of allowed mistakes (5) and the duration of each round (20'') remained the same for most Bingo games played, the number of letters selected varied significantly to accommodate instructional needs in each class during the study period. For example, if the teacher had concerns about students' level of understanding for a specific letter, this letter might be repeated in the next lesson. This changed the schedule of the study and affected the data analysis that followed, but it was necessary, since the study had to follow a naturalistic approach.

A higher number of letters in Bingo means that, respectively, a lower number of images will appear for each letter in the gallery in the beginning of the game. This makes the game more difficult as students have fewer chances to find a correct image. On the other hand, as students proceed successfully, finding correct images and getting the number of remaining available images in the gallery (i.e., not covered by Aladdin's face) much lower, the game gets easier (up to the last round, where the only available image is also a correct one).

In contrast, the number of selected letters did not affect the difficulty level in the Get3, since the number of correct images in the gallery in each round remained constant (3 out of 6).

3.5 Data Analysis

Study findings were based on three sources: (a) on the data logs recorded by the tables during gaming activities, (b) observations made by the principal investigator in class during the lessons, and (c) on statements made by the teacher, the students', and students' parents during and after the study period in open unstructured discussions.

As mentioned earlier, each game recorded a different set of data that would allow us to understand students' behavior and performance. The study did not follow the individual progress of each student, but focused on the progress of the class as a whole. Apart from the methodological difficulties and the permissions required (by the school and parents) to follow each student separately in a naturalistic study design, another important reason for looking at the entire class was that it was impossible to match a touch on a table to a specific student, especially since, in many occasions, students changed positions during a lesson.

Regarding the observations made by the principal investigator, no audio/video recording was used, as this was not allowed in the classroom. Instead, the principal investigator attended each lesson and took notes in writing.

Finally, throughout the study, the principal investigator had several opportunities to discuss the new curriculum with the teacher, the students, and the students' parents and record their opinions.

4 Results

Students' performance analysis is based on the data gathered in the Bingo and Get3 games. Using the tabletop surface computers was easy for the students. The time for familiarization with the games was also short, since students were soon able to use the system on their own.

Table 1 shows the results from the Bingo log files, for each of the 12 total days the game was played. Students' performance varied significantly according to (a) the number of selected letters, (b) the number of letters that were new and had not been played before, and (c) their familiarization with the images of each letter through other games. As we mentioned earlier, there were in-game factors that could affect the success percentage. For example, in the beginning of a game a letter might correspond to 10 correct images in the 40-image gallery, thus giving students a 25 % chance of success. In this case, the selection of a correct image by the students might indicate that the students were indeed aware of the correct answer. As the game progresses, both the number of available correct images and the number of remaining available images in the gallery change randomly (e.g., the sequence in which the system selects the letters and the number of correct responses from the students in each round cannot be predicted). As such, the values presented in Table 1 cannot be analyzed as absolute values (in which case a 40 % success rate would mean a mediocre performance), but only by comparing them to each other.

Table 1. Bingo success percentages/per letter/per day.

Day	Alif \w h	Alif	Baa	Ta	Thaa	Jiim	Ha	Khaa	Daal	Dhaal	Raa	Zaay	Total
8/10	49.59	41.73	49.54										46.95
23/10	36.90	45.92	43.49	40.63									41.73
30/10	37.86	32.08	32.90	40.83	38.12								36.36
5/11	40.62	31.44	31.04	36.97	35.28	43.58							36.49
6/11					65.91	64.54							65.22
11/11						46.63	43.57	40.57					43.59
13/11						46.39	48.05	50.58	48.96				48.50
18/11							42.49	43.24	46.95	44.69			44.34
25/11								48.45	51.25	50.71	51.41		50.46
2/12	30.23	30.25	48.65	36.08	36.21	47.46	50.16	41.83	32.36	43.91	45.53	47.98	40.89
3/12	42.33	24.74	52.18	42.58	27.74	55.02	69.69	40.56	33.03	21.53	29.45	33.75	39.38
4/12	28.31	32.20	43.92	42.90	31.62	40.53	43.92	27.43	35.66	37.74	56.96	51.39	39.38
Avg. %	37.98	34.05	43.10	40.00	39.15	49.16	49.65	41.81	41.37	39.72	45.84	44.37	42.18
Touches	984	1001	831	754	1156	1547	928	1356	1138	786	495	156	11132
Images	362	341	327	269	580	771	391	582	491	334	224	56	4728

One characteristic example of how the number of selected letters affected students' performance is provided on the statistics on 6/11 (marked grey in the table). When we decided to use only two letters in the gallery, students' scores peaked, exceeding 65 % - much more than the total average (42 %). Regarding familiarization with the images, it seems that students had trouble differentiate between the letters "Alif with hamza" and "Alif", making more mistakes when "Alif" was selected.

Get3 was played sporadically a little after we introduced Bingo. In the beginning, not all students wanted to switch from Bingo to Get3, because they enjoyed more the collaborative nature of the first one. We asked the teacher to organize a few gaming sessions during the last week of the study, having all students playing the game. During these sessions, we gathered data for the first 8 letters (Fig. 7).

When reading the statistics, one has to have in mind the expected percentage in each occasion. As we mentioned earlier, several factors affect students' performance. Therefore, numbers in the two games should not be directly compared, but correlated. Results showed that students were able to recognize all the letters adequately, scoring once again lower in the letter "Alif" and corroborating the finding we had from analyzing Bingo data.

One more important note regarding the results is that the games used a pool of 600+ clip art images, and these images appeared thousands of times over the course of 9 weeks (e.g., 4728 just in Bingo). This extensive exposure to images and words is very important, especially if we take into account that students considered learning through these games as a reward for successfully completing other tasks, such us writing and discussion.

Regarding students' attitudes towards the new curriculum, the positive feedback we received was evident in many forms. For example, many students asked us to develop versions of the games for their tablet computers, "so that they could play at home" as they stated. The students were rushing to the "Arabic Studies" classroom, contrary to what typically happens for other classes, where students are escorted to a classroom following behind a teacher in a single-file line. Parents, teachers, and students of other classes (both from kindergarten and the co-located primary school) expressed a vivid interest in participating in similar activities, while the activities of the project recently attracted attention from Media in the region (e.g., [17, 18]).
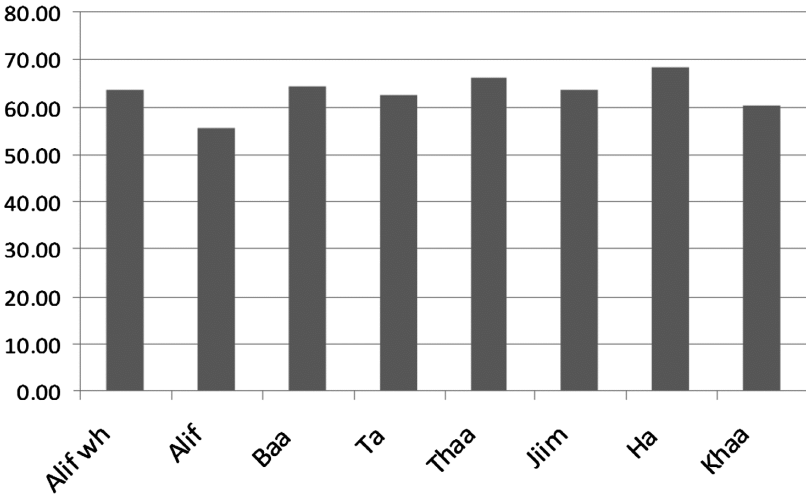

Fig. 7. Students' success percentage in Get3 game.

On the down side, some of the images used in the games were causing confusion to the students regarding the words they were depicting. The use of sound would be enough to clear this issue for the students, however, as we mentioned earlier, sounds had to be muted to avoid noise in the classroom. Finally, the number of the students in the study was easily accommodated by the number of available tables. In case of a larger group, more tables would be necessary to keep every student active. After observing students' activity during 9 weeks, be believe that it would be challenging for the teacher to manage a class in which some of the students need to wait for their turn in the tables.

5   Conclusions

The papers presented the initial analysis of the data gathered in some of the gaming activities of the Arabiyyatii project. Results showed that acceptance and engagement was very high and that there are strong indications for the effectiveness of the approach. However, improvements are also in order. First and foremost, due to the size of the classroom and the characteristics of the tables, most of the activities were lacking audio

feedback. A larger space would allow us to have a better control of the sound. Second, the pool of images (and the words they depict) had to be revised and expanded – this task is now completed and the trial feedback we received is already positive on the changes made. Results showed that the students saw each image numerous times. Using more images would make the games even more interesting and would enhance students' vocabulary.

Indeed, several other games and alternative versions of the ones presented here have already been developed in the project, although they have not all tested in the classroom as part of the new curriculum. The additional games expand our initial learning goals and include recognition and production of word and small sentences. It is important to note once again, that the games are just a part of the new curriculum for MSA designed in the project. Additional multimedia and applications have also been developed and aligned to the games. A series of video episodes depicting Aladdin's folklore story in MSA, writing activities on paper and on the tables, structured and unstructured story-boarding activities, and games for cognitive tasks of higher levels (e.g., match an image to a description) are parts of the new curriculum.

Finally, it is already in our intentions to develop tablet versions of the activities. It would be interesting to see whether this approach would increase students' engagement with the material and whether the lack of a shared interface would affect students' performance and attitudes. However, it is certain that the tablet versions would allow for project deliverables to be better disseminated into society.

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