Learning Activities, Educational Games, and Tangibles: Arabic Language Learning in the ALADDIN project

Pantelis M. Papadopoulos
Carnegie Mellon Qatar
Education City, PO Box 24866
Doha, Qatar
pmpapad@cmu.edu

Andreas Karatsolis
Carnegie Mellon Qatar
Education City, PO Box 24866
Doha, Qatar
karatsolis@cmu.edu

Zeinab Ibrahim
Carnegie Mellon Qatar
Education City, PO Box 24866
Doha, Qatar
zeinab@qatar.cmu.edu

ABSTRACT
The paper presents ongoing work on the ALADDIN project, a 3-year endeavor that involves the re-conceptualization of the standard Arabic language learning curriculum for kindergarten students in Qatar, supported by a comprehensive technology-enhanced learning framework. The curriculum, scheduled for September '13, follows an adapted version of the traditional folk Aladdin story, divided into 22 episodes, presented over a 45-lesson series (9 weeks). During the second half of each lesson, instruction is based on educational technology. The learning goals of letter recognition and production are served through storyboarding, learning activities, and educational games, specifically designed for tabletop computers and situated in the contextual theme created by the story. The unique affordances of the underlying technology provide a highly collaborative and interactive environment, while the ability of tabletops to recognize tangibles via tags creates a more vivid experience for the students. The paper discusses: (a) the specific context of this work and the instructional goals, (b) the theoretical foundations of the new curriculum, (c) the unique characteristics of the technology used and the design issues raised, (d) preliminary data gathered by observing young children using the technology, and (e) examples of learning activities and games designed for the project.

Categories and Subject Descriptors
K.3.1 [**Computers and Education**]: Computer Uses in Education – *collaborative learning, computer-assisted instruction.*

General Terms
Design, Human Factors.

Keywords
Language learning, tabletop computers, educational games, collaborative learning.

PCI 2013, September 19 - 21 2013, Thessaloniki, Greece
 ACM 978-1-4503-1969-0/13/09…$15.00.
http://dx.doi.org/10.1145/2491845.2491852

1. INTRODUCTION
The main goal of the ALADDIN (Arabic LAnguage learning through Doing, Discovering, Inquiring, and iNteracting) project is to advance Arabic language teaching in Qatar. This research proposes a new design in the curriculum, focusing, in the current phase, on kindergarten students (i.e., 5-year olds) and the teaching of the alphabet. This new design is based on listening sessions, narratives, peer-interaction and collaboration, and educational games combined in a technology-enhanced learning environment (TELE) as an integral part of the curriculum. We are expecting that the use of a well-known story from the Arabic folklore as the background framework of our system and the use of game-like activities will help us capture students' attention and engage them deeper in the learning activity.

This research draws extensively upon the works of Ibrahim [1][2][3][4][5][6] 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.

Technology has a prominent place in the new design, as students' learning experience is deeply affected by the affordances of a unique and high-end system that supports multi-user and multi-touch activities. More specifically, the technology-enhanced learning part of the curriculum is based on the tabletop Samsung SUR40 with Microsoft® PixelSense™ system that can identify more than 50 simultaneous touch points and has the ability to recognize any real object through a set of 256 special tags, thus extending the learning experience, by including tangibles. Of course, designing educational material for such a system and for such a specific context poses special requirements that require the rethinking of basic design principles.

In this paper, we present (a) the context of our work, painting the picture of the educational system in Qatar and the language issue in the Arab world, (b) aspects related to the instructional method of Arabic language learning used, (c) the theoretical underpinnings of our approach, drawing from the collaborative learning and game-based learning paradigms, and (d) how the characteristics of tabletops can affect the learning experience. In addition, we provide preliminary insights regarding the use of the selected technology by young children (4-9 year old), based on data from observations.

Finally, we present the design of some of the learning activities and educational games that are now under development.

2. THE CONTEXT OF OUR WORK

2.1 The Dialectic Issue

Across the Arab world, Classical Arabic (CA), and its derived form, Modern Standard Arabic (MSA), are perceived as the "high" form of language whereas, the local mother tongues, or "dialects" are usually perceived negatively. However, nowadays, many voices are alerting that the Arabic language is in danger and especially from the English language. There is further concern from a language and identity perspective, particularly the present image of the Arabic language among Arabs and their view concerning the English language. For instance, Mejdell [7] refers to Diem's [8] claims that Egyptians do not master Modern Standard Arabic due to the "scholastic ways" or teaching methods which students resent, in addition to their perception of the contemporary Arab civilization as inferior.

All prior language research has shown that a negative attitude towards one's own mother tongue affects not only mastering another language but self image as well [9]. All sociolinguistic research in language and identity and on how to preserve a nation's language confirms that this should come from within the native speakers of the language who should be holding strong and positive beliefs about their own language. In other words, to preserve and maintain the identity of an Arab, the Arab has to hold firmly to his/her own language. Schools do not deal with diglossia till very last years in the Students' education (if ever dealt with). Therefore, these students are left unclear about the two varieties and their relationship. Thus, this research project also tries to smooth the transition from the dialect to MSA as all recent researches have proven this firm relationship.

Unfortunately, very little research, if any, has reported on the state of the Arab children's vocabulary at the age of five when they start schooling. Saiegh has done few, but very crucial, studies on the effect of diglossia on children's' learning [10][11][12][13]. The "scholastic way," which does not go well with new millennium technologies and methods of teaching, actually makes the students feel far from their actual surroundings. An enquiry into the relevant research on technology-based language instruction is, therefore, important.

2.2 Education in Qatar

All Arabs, and not just Arab children, face three major linguistic dilemmas in their lives. First, diglossia leaves the Arab in a life time of confusion between the border lines and the continuum of the two varieties. The present scholastic situation starts dealing with this issue in the third grade and sometimes later, leaving the student in loss for several years. Second, technology has now become an integral part of their lives, driven by recent development in infrastructure and modernization; yet hardly any educational software is available in Arabic or for Arabic instruction online and for use in the classroom. Finally, the instance of viewing grammar as an end in itself rather than a means to improve language proficiency sets many barriers between the student and the Arabic language.

Children arrive at primary school speaking dialect, not recognizing the dialect/MSA kinship, and feeling that they are facing a new language (their native tongue and themselves inferior). This awkward situation continues for several grades, impeding educational progress for those children.

Students in Qatari schools get access to computers since day one in school, yet the lack of good Arabic software limits the use of the new technologies to a minimum. And preliminary studies indicate that this reality is most evident in the Arabic language classroom. For instance, many language teachers might be attracted by the new instructional technologies they can bring into the classroom but are often overwhelmed by the technological complexities and the high linguistic level demanded of their students. Deciding how to use and integrate those materials within a more traditional methodology demands an extra effort many full-time teachers cannot afford or are incapable of.

3. A NEW ARABIC CURRICULUM

3.1 Learning Goals and the Arabic Alphabet

During the current phase of the project, we are focusing on kindergarten students who, typically, are not taught to read and write. As such, the main goal of the project is to help K students (a) recognize, and (b) produce the letters of the Arabic alphabet.

The Arabic alphabet contains 28 letters, consisting of consonants and long vowels, and additional symbols that function as short vowels and pronunciation markers, or markers of certain grammatical functions. The alphabet and the writing system have four major characteristics that distinguish them from its European counterparts: (a) Arabic is written from right to left, (b) most letters are connected in both print and handwriting, (c) letters have slightly different forms depending on where they occur in a word, (d) Arabic script consists of two separate "layers" or writing, a basic skeleton made up of consonants and long vowels, and the short vowels and other pronunciation and grammatical markers.

Regarding (c), each letter in the alphabet can have different forms depending on whether it is written in isolation, or in the beginning, middle, or end of a word (i.e., isolated, initial, medial, final forms). Six letters (ا د ذ ر ز و) have only an isolated or final form, and force the following letter (if any) to take an initial or isolated form, as if there were a word break.

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.

Letter recognition refers to both visual and audio, meaning that the students at the end of the curriculum should be able to identify the form of a letter in a written word and also identify the pronunciation of the letter in a word. Although, our goal is to teach students the isolated form, it is expected that given enough exposure, the students will be able to recognize letters in several positions.

Production, on the other hand, refers to students' ability to write the letter or pronounce it correctly in a word. The assessment of correct pronunciation is left upon the teacher. The writing part, however, can be monitored and assessed with the use of technology. As in most languages, there is a certain preferred way of writing each letter in Arabic. Usually, students have to replicate the writing of a letter, by following arrows (and numbers, in cases where the letter is not a continuous line) in their textbooks.

3.2 Aladdin and the Magic Lamp

A basic definition, which captures the essential points of narrative, is due to Bruner [14], who claims: "(Narrative is) a unique sequence of events, mental states, happenings involving

human beings as characters or actors". Why is narrative so important as concerns TELEs? Narrative is recognized as a privileged form of thinking, which is present in children from early age [15]. Moreover, the use of narrative seems to have an influence on many high-level cognitive abilities, and hence be important for instruction. For instance, Luckin et al. [16] point out that narrative is a process involving both recognizing and giving structured meanings which can be shared and articulated, while Mott et al. [17] argue that it supports memory, by providing an organization structure for new experiences and knowledge, and claim that narrative-centered learning environments are engaging worlds in which students are actively involved in story-centric problem solving activities.

The main vehicle to deliver information to the students in the project is an adapted version of the famous and loved Arabic folklore story of "Aladdin and the Magic Lamp". 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 maintained all the aspects of Arabic heritage, along with short additions that would emphasize the pedagogical teachings of the narrative.

Special effort was given to include in the narration words and sounds that would be useful for teaching. As such, the language used is MSA and the linguistic expression is simple enough for students to comprehend. The use of appealing images, themed music, 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 serves as the continuum of the instructional method as it provides the theme for the learning activities and the educational games on tabletops.

3.3 Lesson and Curriculum Structure

The curriculum spans across 9 weeks (45 lessons). During the first four days of each week, the students are taught new letters (one per lesson), while on the fifth day there a weekly review lesson focusing on all the last four letters. Near the end of the curriculum, review lessons increase in number and cover more material.

Aladdin's story is divided into 22 episodes, each one starting from where the previous part finished. The story progresses and new episodes are presented during listening sessions to the students only on the first and third day of the week. On the second and fourth day of a week only parts of the episodes presented the day before are used, while during the review lesson on the fifth day the last to episodes are presented together (see Figure 1).

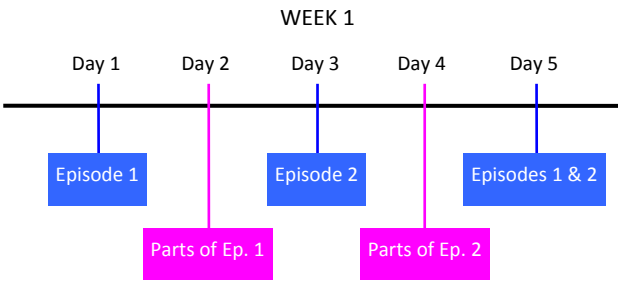

Figure 1. Episode organization across the week.

The episodes (audio track with static image sequence) are approximately of the same length, lasting around 2-3 minutes each. Actors will play the roles appearing in the story, to have accurate pronunciation of the different letters according to MSA. Narration is modified so that each episode will include several words and sounds with the letters in focus. We expect that the division of the story into several episodes and the repetition on the last day of the week will keep students' attention high throughout the curriculum.

We differentiate the instructional part that occurs with tabletops in two categories, namely learning activities and educational games. There are several types of both for each lesson to provide students with interesting alternative and keep their engagement level high.

Learning activities come first. They can be both closed and open-ended and they are usually short and straightforward. We aim at to increasing students' exposure (audio and visual) to the letter in focus by allowing them to perform drill and practice, trial and error, and exploratory learning. As we mentioned earlier, the major learning goals of the project is to support students in recognition and production of the letters in the Arabic alphabet. The learning activities must cover both these goals.

The educational games, on the other hand, take place during the last part of each lesson and are more open-ended as they focus more on the fun factor. In following sections, we present the theoretical background of our approach in designing the activities and the games, and we also provide examples of them that are under development.

4. COLLABORATIVE, AND GAME-BASED LEARNING

4.1 Social Aspects of Learning

Computer-Supported Collaborative Learning (CSCL) builds on the idea that peer interaction is a highly potent learning mechanism and can be realized and even enhanced by appropriately designed computer-based tools and scaffolds [18]. Research has shown that student interaction can indeed increase group performance and individual learning outcomes (e.g., [19][20]). However, collaborating students often fail to engage in fruitful interactions when left without instructional support (e.g., [21][22][23]). One cannot expect students to know how to work collectively just because they were assigned to a group and various studies have identified patterns of suboptimal collaboration in free (non-supported) collaboration conditions (e.g., [24][25][26]). To increase the probability that team partners will collaborate efficiently it has been suggested to guide the activity using "collaboration scripts". Collaboration scripts are teacher-led didactical scenarios defining roles, tasks, phases, and phase sequencing to engage students in meaningful (knowledge-generating) interactions (e.g., [27][28]).

The affordances of tabletops and the instructional method of Arabic language learning in general drive the design of the activities in the ALADDIN project towards peer interaction. However, we also have to acknowledge the special characteristics of our context. Every so often, research on collaborative learning is based on clearly defined groups and the motivation and metacognition of the group members, in the sense that collaboration is an acquired skill that has to be taught and developed. In our case, it is expected that the kindergarten students will not be able to collaborate effectively on their own,

while the different types of learning activities and educational games along with the classroom organization favor the creation of ad hoc groups.

Support will have to come by both the system and the teacher. Especially for system scaffolding, students' inability to read and the use of several tabletops in a classroom limit our choices on instruction delivery modes: text is not even an option, while the extensive use of audio instructions could be problematic, because of the number of speakers we are going to have in the classroom. As such, the main method for delivering instructions will be visual (short animations, explanatory images, and signs). Thus, the teacher will have an active role in monitoring and supporting students' activities.

Regarding group formation, although it could be easy for the students to understand and internalize a collaborative pattern dictated by a script, it would be difficult to have the same groups throughout the curriculum, or even a lesson. Kindergarten is the first community students belong to outside of their families and it is the context where they further develop their social skills. As such, it is preferable to increase students' interaction with their peers. The formation of stable groups is to the opposite direction. In addition, as we will explain next, the various distribution patterns of students around the table also prohibits the formation of stable groups.

4.2 Educational Games

Although video games have been around for over 30 years, it has not been until recently that their use has been problematized as tools to support literacy practices. The work of Gee [29][30] has been often cited for its analyses of video games and his consequent attempt at developing a set of principles which can be found in the design of good video games. However, what most references to Gee's work fail to acknowledge is that his real concern is not to argue that kids should be playing games from early on, say three-years-old, but rather that we have to understand the new literacy practices, the new "work order," [31]. Literacy (or language learning for that matter) is not an end in itself. Instead, literacy is only meaningful if understood in relation to social practices, allowing people to participate in larger practices, especially ones to which texts are an integral part.

Digital narratives, especially ones motivated by folklore stories can be easily combined with game-like activities. However, usability, likeability, distractions, etc. are important issues to be considered [32]. The profile of our users demands special design approach. This means that when dealing with young children the instructional designer should be careful to capture their interest and make them engage into the learning activity.

In contrast to learning activities, the educational games in ALADDIN will be more open-ended with more available options in each step for the students and focused on entertainment. Different types of games will serve different learning goals and the teachers will be able to choose the games the students should play. Game difficulty will adapt to students' progress in language learning. Competition among students could be a motivational drive, although additional attention is needed as high levels of competition could have detrimental effects on social aspects and consequentially on learning outcomes.

5. TECHNOLOGY CHARACTERISTICS

5.1 Selecting the Technology

Drawing on the previous sections, we can identify certain requirements that could be used as a guide in selecting the right technology for ALADDIN. First, we need to acknowledge our users' profile. Kindergarten students usually lack the ability to use easily a computer. Although the ability to use a mouse is easily acquired, it is still an issue to have students in the same class starting at different levels of competence. Hence, we would prefer a system that it would be easy to use for every student. Second, we need a solution that promotes peer-interaction and collaboration. The typical row organization of a computer lab is not suitable for this project. Instead, we believe that ALADDIN should be a meeting point inside the classroom for students working together. Ideally, we would like to have a shared interface for each student team. Finally, as anyone would expect for a technological solution, we need a system that is easily used and controlled by the teacher, having in mind that K teachers are not always technology savvy.

Based on the above, we decided to develop ALADDIN on tabletop computers with touch sensitive displays. A tabletop computer meets all the aforementioned needs, as it has a very intuitive interface that any student can readily learn to use, is ergonomically suitable for K students, supports physical group formation inside the classroom, by providing a shared multitouch interface, and is just as easy to use for the teacher, as a typical desktop computer. The obvious drawback is the cost of this solution. However, one should also consider the fact that this type of technology is gaining ground and it is expected to reach a wider audience and that could also mean a drop in prices. In addition, the ability to transfer part of the material or even have future versions of the project suitable for student-owned tablet computers could also provide argumentation for such a costly solution.

Tabletop computers are comparably a new approach in learning environments. However, research so far reports encouraging results. Kerne et al., [33] discusses the roles for interactive systems enabled by touch screen devices in supporting creative processes and aiding in idea formation. The touch screen devices facilitate the collection and manipulation of images, texts, and voice annotations in a composition space. In simple words, students can write on these devices, thus in our case helping build MSA vocabulary. As documented in Piper [34], the use of multimodal tabletop displays, as a rich medium for facilitating cooperative learning scenarios, is just emerging. The horizontal form factor of a multitouch tabletop surface allows multiple people to simultaneously interact with the same representation. The benefits of multimodal tabletop displays for educational applications seem endless; however, few studies have specifically examined the cognitive and pedagogical benefits of multimodal tabletop displays. La Mesa de Clasificación (LMC) is a project that examined the educational benefits of using a digital table to facilitate foreign language learning [35]. The application allowed four language learners to sit at the tabletop display and cooperatively categorize facts about various Spanish speaking countries.

5.2 Affordances and Design Issues

As we mentioned in introduction, we chose Samsung SUR40 with Microsoft® PixelSense™ for the project. The specific affordances

of the system defined largely the design of the activities and games we are currently developing.

The first issue a designer has to address on a tabletop system is the orientation. In a vertical screen, there is only one position for a user to be and that is in front of the screen. As such, there is only one correct orientation. Things change though in case of a horizontal screen, where users can stand in all four sides. The typical design would make three of the users frustrated as the material would appear to them on a wrong angle. There are three approaches that we use in our design: bird-eye, mirrored, and orientation-independent design. In activities and games where we used bird-eye design the background simulates a view from above making the orientation appropriate for all the users around the table. Mirrored design means that the interface is duplicated appropriately for each user. Finally, orientation-independent design means that the activity/game is not affected by orientation. This is usually the case of games based on tangibles placed on the table. Figure 2 presents how the screen is organized according to basic design styles and how the students are distributed around the table.

Another issue is the touch types used. The selected system is able to recognize fingers, blobs (undefined shapes), and tags. Tags are unique tags encoded as a byte. Figure 3 presents four examples of tags. The highest order bit (bit 7) is at the 1 o'clock position when you look at the printed side of the tag. Less significant bits are then read counter-clockwise from the 12 o'clock position.

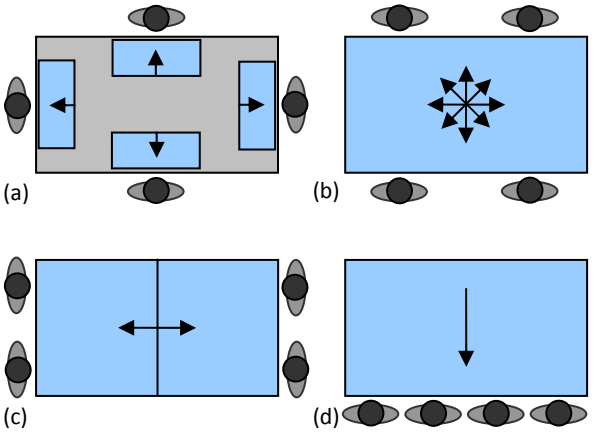

Figure 2. Basic interface design: (a) interface replicated for each student; appropriate for individual interaction, (b) orientation-independent interface; for collaborative or individual activities, (c) mirrored interface; for collaborative activities between groups, and (d) single-oriented interface; for listening sessions.

Tags can be placed underneath tangibles. That way the system is able to extend the learning experience to the real world. This is a huge advantage for us, as the use of tiles, cards, cubes, and figurines can be used in the learning activities and the educational games. Such tangibles are already connected with games and leisure time in students' minds and they can help us in making the fun factor of the project more obvious for the students.

As we mentioned earlier, the system identifies more the 50 touch points simultaneously. This unique feature allows us to design real-time collaboration activities with many students or groups of students.

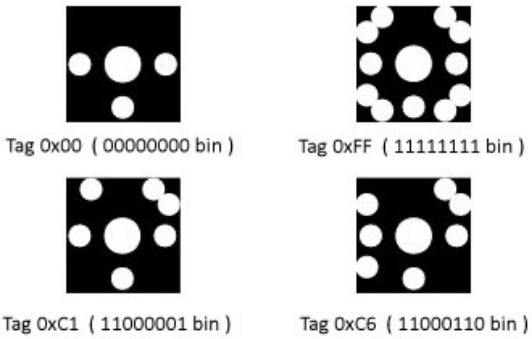

Figure 3. Samples of special byte-tags that can be recognized by the surface computer.

Finally, the system has embedded speakers and also is able to connect to additional sound systems. However, the use of several tabletops in one classroom raises issues regarding the use of sound. It is certain that sound is going to be used during the listening sessions, where the story episodes are going to be presented. For this, only one tabletop, connected with a central sound system, is going to be used. For the rest of the activities/games, sound will be strategically used to limit the chances of creating an incoherent noise.

6. PRELIMINARY DATA

Early in the project, we conducted two usability evaluations with the participation of family members of people working on the project to estimate children's interaction with the system. The goal of the first evaluation was to observe interactions among children and between children and the system in a group setting. For this reason, in the first group we had four children (2 male: 4yo, 9yo; 2 female: 5yo, 7yo), covering a range of user profiles. Of all the children, only the 9yo was technology savvy and familiar with touch screen technology. The 7yo and 9yo were already in elementary school and able to read, although text was not used in the activities.

The children were invited to our lab and we introduced the system to them. Next, we presented a short demonstration of how to use and interact with the system. After that, we used the built-in games the system had, to assess children's interactions. The first type of games was based on hotspots asking students to touch the right items on the screen according to visual aids. The second one required the students to drag and drop items to appropriate areas. Finally, the third one allowed children to paint freely on the screen using touch. The activities had an orientation-independent design and we distributed users around the tabletop. The whole process lasted about an hour, during which we were observing children's behaviour and taking notes.

All children were very enthusiastic about the tabletop and it was even hard at times for the facilitator to control them. It was a very positive reaction, but at the same time it raised our attention on the degree of coerciveness and structure we could embed in our collaborative activities. Over-excited students may face difficulties in focusing and working efficiently in the activities.

Children's learning curve in using the system was very steep. Even the ones that did not have prior experience with touch screen systems were able to perform tasks successfully. This was also an encouraging observation, since it suggests that the

selected system will be appropriate for kindergarten students. However, what we also observed was that the older kids were a bit faster than the two younger ones and they quickly assumed a dominating role. As a result, the two younger participants started disengaging, until they fully became observers. Just before the whole session ended, we asked individually the two younger children to play the same games on their own and it was obvious that they could use the system, albeit on a slower pace than the older ones. This suggests that they were able to learn how to play a game by watching others. Although this is a positive outcome, our goal is to have all participants active. Of course, the age difference and the prior experience with touch screen systems constitute a very different user profile and we do not expect the same difference in user profiles during the actual study. What is expected though is to have some students performing a little better than their peers. Breaking up the activities to require a certain level of participation from all students and having the teacher monitoring students' experience could be one way to prevent advanced students taking control over the others.

On a similar note, in a more demanding game, only the 9yo was able to perform well, while the rest had trouble completing the game. Thus, after a while, the others abandoned completely the game and gathered around the 9yo to have a better view of his playing, thus deconstructing the initial distribution around the table (see Figure 4).

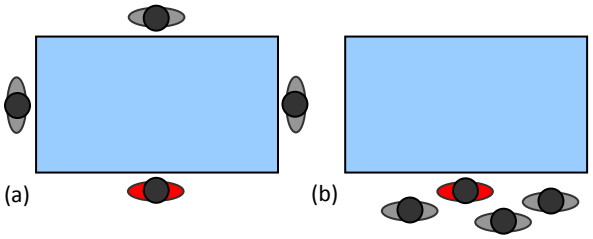

Figure 4. (a) the initial distribution of children around the tabletop, and (b) the final one. The 9yo is marked in red.

The second evaluation study had only one child (6yo male) that was very familiar with touch screen technology and tablet computers. The goal of the second evaluation was to check how the tabletop fits the needs of a child near the target age and how the particular touch-screen system compares to others from a 6yo perspective.

In terms of performance, the tabletop system is more powerful than any tablet computer or an average desktop. However, since it is based on light sensors to understand touch, it may lag when movement of objects is needed. Although lagging is small, it got the attention of the technology savvy 6yo.

Another issue is the height of the system that may be tall for most of the K students. Shorter legs (or an adjustable system for height) are needed. However, we do not want the system to be too low, since this would allow student to lean on to it and unintentionally add irrelevant touch points while using the system.

Finally, the 40 inches screen of the system proved to be quite big for just one 6yo, meaning that it was very hard for him to reach across the whole screen. This makes our design effort easier, since it allows us to divide the screen area in several parts and have students working on theirs, while it also serves our goal for collaborative activities, since no student will be able to complete a task alone, if the active areas are distributed on screen.

7. ACTIVITIES AND GAMES

The theme of the whole project is the folklore story of Aladdin and the Magic Lamp. Next, we are going to present two examples of the activities and two of the games we are currently developing, explaining also how they serve the learning goals of the project.

7.1 Learning Activities

7.1.1 Storyboarding

During the first and third days of the week, the students will have a listening session where a new episode of the story will be presented. Segments of these episodes will be used in the listening sessions of the second and fourth days of the week. The listening session of each new episode consists of (a) an audio track that includes the voices of a narrator and the main characters of the story, and (b) a sequence of 5-6 still scenes depicting important parts of the episode, presented on screen and transitioning alongside the audio track.

During the fifth day of the week, the students will have a review lesson covering the material of the last four days and especially the last four letters taught. The listening session will be the last two episodes put together. This means that the students will also see 10-12 scenes as one sequence. The first learning activity during the review lesson for the students will be to recreate the story of the two episodes by appropriately arranging the scenes on the screen. Each scene is connected with a specific segment of the story that can be heard by touching the scene. The students will be able to test different arrangements and hear the resulting story, until they manage to recreate what they heard during the listening.

The goal of the activity is to exercise and test students' comprehension of the story narrated in MSA. The activity is based on collaboration, since all students are allowed to perform the same task of dragging and dropping scenes onto a timeline. The students will all assume the same role, and they need to discuss on the right order. Initially, the scenes will be scattered on the screen, inviting all the students to start manipulate and arrange them on a timeline in the top of the screen. Since the scenes will have an orientation, the listening sessions and the storyboarding activity will also have the same orientation. Figure 5 depicts a mock-up of the interface of the storyboarding activity.

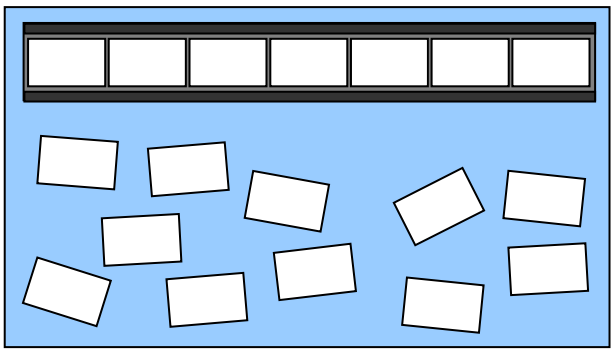

Figure 5. Mock-up interface of the storyboarding activity.

7.1.2 Connecting Letters

As we explained earlier, our main focus during this phase of the project in the teaching of the isolated forms of all the letters in the Arabic alphabet. However, as students progress in the curriculum

and exposed to words and phrases, it is expected that they will recognize additional forms of the letters (especially, medial, and final). For this reason, one of the activities (that we will introduce later in the curriculum) will focus on how different letters are connected in words.

The activity is based on inquiry learning and allows the students to choose whether they are going to work individually or collaboratively. The goal is to familiarize students to the different letter forms. The activity uses tangibles (tiles or cubes with tags) with printed letters. When a tangible is placed on the screen, a small gallery of objects that contain the letter (and the sound, since Arabic has one-to-one correspondence between sound and letter) will appear next to the tangible. Putting two tangibles together will result in a box showing how the two letters are written together. Additional tangibles may be placed together and produce longer combinations (with the far right letter in the initial form, the far left in the final form, and the rest in the medial form). Figure 6 depicts a mock-up interface of the connecting letters activity.

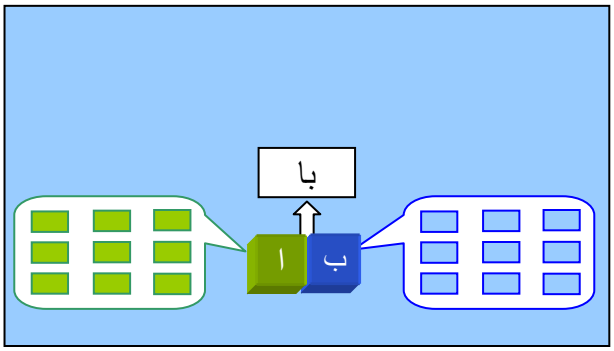

Figure 6. Mock-up interface of the connecting letters activity.

7.2 Educational Games

7.2.1 Audio Recognition

One of the main goals of the project is to support students in recognizing the sounds of the letters. A game focused on audio recognition will involve segments of the available listening sessions and buzzer-like buttons with letters on top appearing on the table.

A random segment of a past listening session will start playing and students need to touch the buzzers each time a word with the respective letter is heard. For every correct answer, additional points will be added to student's score, while wrong answers will result in point deduction. The game can be played by a single student or a group of students, especially in the case of a higher level with several buzzers available and more complex listening segments. The winner will be defined by the sum of points at the end of the game

We expect that the randomness in selecting the listening segment out of many and the many random combinations target-letters will retain students' interest throughout the curriculum. In addition, the nature of the game will make students to pay more attention to the listening parts and the proper pronunciation of words and phrases in MSA. Figure 7 depicts a mock-up interface of the audio recognition game.

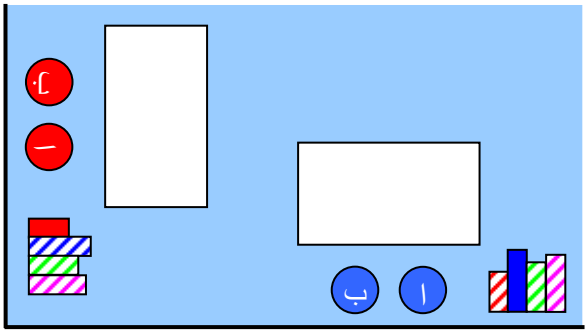

Figure 7. Partial mock-up interface of the audio recognition game.

7.2.2 Letter Bingo

The goal of this game will be, once again, to assist students in recognizing (via audio and visual) the letters of the Arabic alphabet. Much like the well-known game of Bingo, each student around the tabletop will be presented with a gallery of different objects. In the center of the screen a letter, accompanied by its sound, will appear and students will have to touch all the objects in their gallery that contain the letter, before the next letter appears.

A correct touch will result in removing the object from the gallery, while a wrong touch will result in missing a turn and waiting for the next letter. The winner is the one that empties his/her gallery first. Later in the curriculum, some of the objects may be replaced by written words in a gallery, thus supporting visual letter recognition in different forms.

8. CONCLUSIONS

This paper presented the context, current state, and the preliminary results in the ALADDIN project. The design issues emerged during these first phases on the project could provide useful insights to instructors and designers on using tabletop systems in education. The affordances of the technology, and the context of our project demand in several occasions a complete new approach to the, otherwise proven, principles of instructional and interaction design.

9. ACKNOWLEDGMENTS

This work has been funded by a grant from QNRF (Qatar National Research Fund), NPRP Project 4-1074-5-164 entitled "Advancing Arabic Language learning in Qatar".

10. REFERENCES

[1] Ibrahim, Z. (2000). "Myths About Arabic Revisited." Al-Arabiyya 33, 13-27.

[2] Ibrahim, Z. (2006). Borrowing in Modern Standard Arabic, Innovation and Continuity in Language and Communication of Different Language Cultures, ed. Rudolf Muhr, 235, Frankfurt: Peter Lang.

[3] Ibrahim, Z. (2008). Lexical Separation: A Consequence of Diglossia, Cambridge University Symposium, Cambridge.

[4] Ibrahim, Z. (2008). Language Teaching and Technology, in Linguistics in an Age of Globalization, editors, Zeinab Ibrahim, Sanaa A. M. Makhlouf. Cairo:AUCPress, 1-16.

[5] Ibrahim, Z. (2009). Beyond Lexical Variation in Modern Standard Arabic. London: Cambridge Scholars Publishing.

[6] Ibrahim, Z. & Mohab, A. (2010). "Egyptian Native Speakers' Awareness on the Relatedness of Varieties: The Case of Arabic." in Language and Knowledge in Middle Eastern Societies. London: Cambridge Scholars Publishing.

[7] Mejdell, G. (2006). Mixed Styles in Spoken Arabic in Egypt, Leiden: Brill.

[8] Diem, W. (1974). Hochsprache und Dialekt im Arabischen. Wiesbaden: Steiner.

[9] Muhr, R., (2004). Language Attitudes and Language Conceptions in Non-Dominating Varieties of Pluricentric Languages, Standardvariationen und Sprachauffassungen in verschiedene Sprachkulturen/ Standard Variations and Conceptions of Language In Various Language Cultures.

[10] Saiegh-Haddad, E. (2003). Linguistic distance and initial reading Acquisition: The case of Arabic diglossia. Applied Psycholinguistics, 24, 431-451.

[11] Saiegh-Haddad, E. (2004). The impact of phonemic and lexical distance on the phonological analysis of words and pseudowords in a diglossic context. Applied Psycholinguistics, 25, 495-512.

[12] Saiegh-Haddad, E. (2005). Correlates of reading fluency in Arabic: Diglossic and orthographic factors. Reading and Writing: An Interdisciplinary Journal: An Interdisciplinary Journal, 18, 559-582.

[13] Saiegh-Haddad, E. (2007). Linguistic constraints on children's ability to isolate phonemes in Arabic. Applied Psycholinguistics, 28, 605-625.

[14] Bruner, J. (1990). Acts of meaning. Harvard University Press.

[15] Sugiyama, S. M. (2001) Food, forages and folklore: the role of narrative in human subsistence, Evolution and Human Behaviour 22, 221-240.

[16] Luckin R., Plowman L., Laurillard D., Stratford M., Taylor J., & Corben S. (2001). Narrative evolution: learning from students' talk about species variation. International Journal of Artificial Intelligence in Education, 12, 100-123.

[17] Mott, B.W., Callaway, C.B., Zettlemoyer, L.S., Lee, S.Y., & Lester, J.C. (1999). Towards Narrative-Centered Learning Environments. Proceedings of AAAI Fall symposium on Narrative Intelligence.

[18] Dillenbourg P. (1999). What do you mean by collaborative learning? In P. Dillenbourg (ed.), Collaborative-learning: Cognitive and Computational Approaches, 1–19. Oxford: Elsevier.

[19] Sandoval, W. A., & Millwood, K. A. (2005). The quality of students' use of evidence in written scientific explanations. Cognition and Instruction, 23(1), 23-55.

[20] Teasley, S., Fischer, F., Dillenbourg, P., Kapur, M., Chi, M., Weinberger, A., & N., N. (2008). Cognitive Convergence in Collaborative Learning. Paper presented at the International Perspectives in the Learning Sciences: Cre8ing a Learning World. Proceedings of the Eighth International Conference for the Learning Sciences - ICLS 2008.

[21] Hewitt, J. (2005). Toward an understanding of how threads die in asynchronous computer conferences. Journal of the Learning Sciences, 14(4), 567-589.

[22] Lou, Y. P., Abrami, P. C., & Spence, J. C. (2000). Effects of within-class grouping on student achievement: An exploratory model. Journal of Educational Research, 94(2), 101-112.

[23] Papadopoulos, P. M., Demetriadis, S. N., & Weinberger, A. (2013). "Make It Explicit!": Improving Collaboration through Increase of Script Coercion. Journal of Computer Assisted Learning. Wiley. (in press)

[24] Barron, B. (2003). When smart groups fail. Journal of the Learning Sciences, 12(3), 307–359.

[25] Liu, C., & Tsai, C. (2008). An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity. Computers & Education, 50, 627–639.

[26] Papadopoulos, P. M., Demetriadis, S. N., & Stamelos, I. G. (2009). Analyzing the Role of Students' Self-Organization in Scripted Collaboration: A Case Study. Proceedings of the 8th International Conference on Computer Supported Collaborative Learning – CSCL 2009, 487-496, Rhodes, Greece.

[27] Fischer, F., Kollar, I., Mandl, H., & Haake, J. (Eds.). (2007). Scripting computer-supported communication of knowledge. Cognitive, computational and educational perspectives New York: Springer.

[28] Weinberger, A. (2011). Principles of transactive computer-supported collaboration scripts. Nordic Journal of Digital Literacy, 6(3), 189-202.

[29] Gee, James P. (2005). Why video games are good for your soul. Sydney, Australia: Common Ground.

[30] Gee, J. P. (2008). What video games have to teach us about learning and literacy, revised and updated, 18. Basingstoke: Palgrave Macmillan.

[31] Gee, J.P., Hull, G., & Lankshear, C. (1996). The New Work Order: Behind the Language of the New Capitalism. Westview Press, Boulder, CO.

[32] Virvou, M., & Katsionis, G. (2008). On the usability and likeability of virtual reality games for education: The case of VR-ENGAGE. Computers & Education 50(1), 154-178.

[33] Kerne, A., Koh, E., Choi, H., Dworaczyk, B., Smith, S., Hill, R. & Albea, J. (2006). Supporting Creative Learning Experience with Compositions of Image and Text Surrogates. In E. Pearson & P. Bohman (Eds.), Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2006, 2567-2574. Chesapeake, VA: AACE.

[34] Piper, A.M. (2008). Cognitive and Pedagogical Benefits of Multimodal Tabletop Displays. Position paper presented at the Workshop on Shared Interfaces for Learning.

[35] Morris, M.R., Piper, A.M., Cassanego, T., and Winograd, T. (2005). Supporting Cooperative Language Learning: Issues in Interface Design for an Interactive Table. Stanford University Technical Report.