












THE DESIGN AND IMPLEMENTATION OF AN ARABIC PRONUNCIATION
APPLICATION FOR EARLY CHILDHOOD

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Abstract

Learning is not limited to a certain age group or a formal study environment. However, the first eight years, and particularly the first three years, are the most important because the effects of the care and attention provided to the child during this period will continue throughout his/her life. A child's early learning processes develop his/her educational abilities and skills and fosters his/her academic achievements.

Preschool can be very beneficial to the development of and learning for children, but there are differences between countries in this area. Preschool programmes of high quality can reduce repetition in the classroom and raise achievement scores for students (Jacobson and Linda 2008). There are many applications in the Middle East that teach children but none link the vowels of the Arabic alphabet characters and sound for each character and the training to select the correct format of the Arabic alphabet (e.g. *fatha*, *dama* and *kasra*).

This study aims to develop an educational application for children aged 3–5 to help improve their skills and abilities. The application will prepare them for school by teaching them the Arabic letters, pronunciation and the short vowels (*fatha*, *dama* and *kasra*). The application also aims to help children communicate and interact more effectively with their external environment by employing several theories about learning skills, such as Piaget's "Theory of Cognitive Development", Dale's "Cone of Learning" and Bloom's "Taxonomy of Cognitive Goals". The application will focus on the first three levels of Bloom's "Taxonomy Pyramid", which are "Remember", "Understand" and "Apply". The application will be designed to aid children with their Arabic pronunciation, aural and oral skills, as well as to train and educate them in preparation for attending school. The expected result is that it will be considerably better than educational books for children's education. Combining education and play in e-learning applications is an important way to attract children.

Keywords – Learning, Education, Letters, Alphabet, Children's education.

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1. Introduction

One of the most important elements of parenting is to educate children. Therefore, preschool is essential if parents want their children to be at an advanced level. Preschool education is necessary for the optimum progression of the child's identity; traces of early education are clear in elementary and secondary education, where the child improves his/her skills and creative thinking (Spodek & Olivia, 2005). A child's brain begins to develop at an early age. The foundations of the architecture of the brain and the potential for growth over the subsequent life are set out in the early years of the child and are affected by external factors that influence the child's experiences at home and places of care. These places interact with the child's genes to shape the nature of the developments and the quality of the construct of the brain. The brain in the early years receives cognitive skills, such as languages and mathematics, and social skills, such as the ability to communicate and empathise (Yoshikawa et al., 2013).

Learning is an on-going process that can take place at any time and in any environment. However, the most critical learning years are between the ages of 0 and 8 years (especially from 0 to 3 years) because experiences during these years will significantly influence the child's future life. The education of young children at an early age is the most exciting and important aspect of human development for ease of communication and learning language (Whitehead, 2007).

It is accepted that parents bear a great responsibility to provide a purposeful education for their children, which gives them the opportunity to gain valuable life skills, and consequently helps them in developing their thoughts with equanimity to become independent, productive and effective in their communities. The importance of play in the expansion of the perceptions of the children cannot be ignored, as it enables the level of development of children through play and interaction to be determined (Griffith, Beach, Ruan & Dunn, 2008). Most mothers want their children educated before going to school, and they have different ways to teaching their children, such as by using a tutor who can come to the home, buying learning books, and joining kindergarten (KG). The most optimal solution with the technical development is to use an application to facilitate the learning of languages and skills that help to improve the performers. Our application will solve this problem by linking vowels of the Arabic alphabet with pictures and pronunciation.

The study concentrates on enhancing listening and pronunciation skills by teaching children the Arabic letters with sounds and how they can pronounce them with the short vowels (*Harakaat*). By giving them simple words for each letter, this method will help children learn more quickly and easily. The aim of the study is to identify potential improvements and formulate a strategy to target specific skills for young children, such as pronunciation, listening and speaking, as well as to train and educate them in preparation for school.

The main objectives of research are to clarify and teach the Arabic language to the children of preschool age and provide them with the three skills (Reading, Listening and Speaking) in an easy way as follows:

1. Improving the child's listening skill by listening to the vowels of the letters and how to pronounce them.
2. Improving the child's ability to focus and use all their senses in terms of pronunciation and listening.
3. Learning the letters and how to pronounce them in the correct way.

4. Teaching the child simple words and attaching images to them.
5. Providing a better graphical user interface (UI) and making the application easy for children to use.
6. Promoting the development of and learning for the child.

2. Theories of Cognitive Development and Learning

2.1. Piaget’s “Theory of Cognitive Development”

The various characteristics of the stages of growth are significant to the software designer and implementer because they describe the connections between the evolutions of the mental processes of the learner and the progression from the cradle to adulthood. Among the most famous psychologists who have made scientific contributions to the study of mental development and release phases is Piaget (2000), who established four developmental stages of growth, as illustrated in Figure 1.

In this study, we have focused on the preoperational stage. Piaget has confirmed the importance of this stage in the growth of the child’s ability to represent subjects and events mentally themselves. This phase is evident with the beginning of the emergence of language at almost two years old and will continue until the beginning of the concrete operational stage at the age of six or seven (McLeod, 2009). This phase is characterized by the following:

1. Linguistic growth;
2. Dependence on direct perception;
3. Formation of many-faceted mental pictures; and
4. Early comprehension of the concepts of time and space.

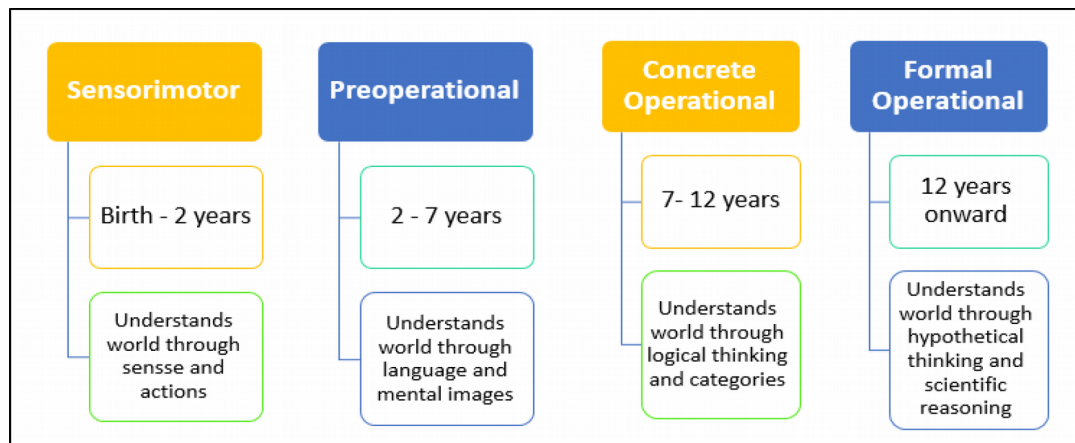


Figure 1. Piaget’s Theory of Cognitive Development

2.2. Dale’s “Cone of Learning”

In his book *Audio-visual Methods in Teaching*, Edgar Dale (1969) classifies teaching methods based on expertise represented by resources. This is depicted in the form of a cone, referred to as the “Cone of Experience”. Further details are provided in Figure 2, which shows Dale’s “Cone of Learning”.

The purpose of the cone is to offer a range of scenarios from direct experience and symbolic communication. It is constructed to begin with verbal symbols and ends with purposeful experiences. Dale contends that symbols and abstract ideas can be understood by the learner and remembered more easily if they are based on concrete experiences. Therefore, at the top of the cone he puts abstract experiences, such as verbal and visual symbols, and at the base concrete experiences, such as sensory realism. He arranges other teaching aids throughout the cone based on their proximity or distance to the

experiences of abstraction or realism rather than by difficulty, ease, importance or any other criterion. This was done so that from the base of the cone to the top, the real direct experiences decreased and the aspects of abstraction increased (Dange, 2015).

The abstract concepts are learned based on the imagination and the previous experiences of the learner, whereby the learner compares words preceding his/her experiences and the mental images that have already been created in his/her mind. If the images are unclear, then this can lead to the formation of concepts that are incorrect or integrated. Therefore, it has become necessary to provide much of the learner experiences that help to form concepts, mental images and clear words; hence, increased direct experiences are aimed at facilitating the learning process (Metiri Group, 2008).

The cone experience is consistent with the division Brunner core of expertise, which is required for the process of communication and understanding as follows (Takaya, 2008):

- a) Direct Inactive Experience: This includes a learner’s actual practice.
- b) Pictorial Experience – Iconic: Learning by seeing film or image, not the actual exercise, but it is a visual concept in the mind.
- c) Abstract Experience – Symbolic: Learning by hearing the words or abstract vision of the words whose specific elements do not signify them. This is what we used to build our application.

According to Dale’s research, the least effective method at the top of the cone involves learning from information presented through verbal symbols, i.e. listening to spoken words. Conversely, the most effective method is at the bottom and involves direct, purposeful learning experiences, such as hands-on or field experience. Direct purposeful experiences represent reality or the closest things to real, everyday life (Mantekofi, 2013).

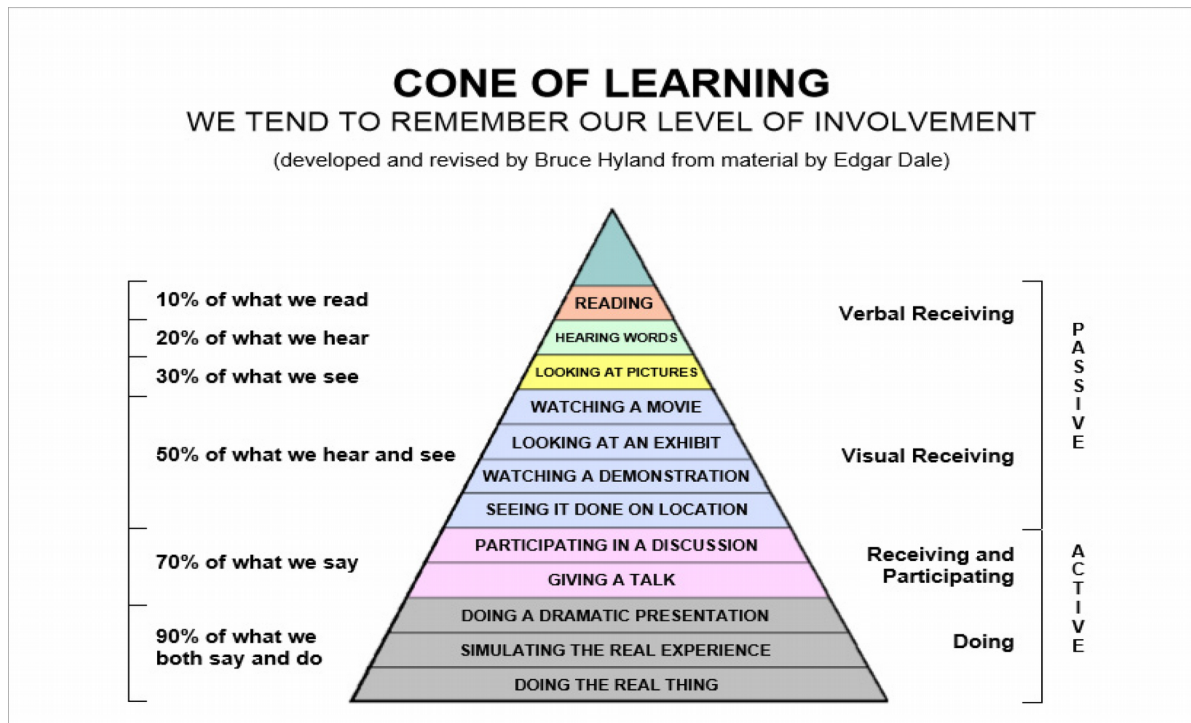


Figure 2. Dale’s Cone of Learning (1969)

2.3. Bloom’s “Taxonomy of Learning Domains”

Benjamin Bloom and his colleagues established the most widespread classifications in formulating and identifying objectives. This classification divides the objectives into three areas:

- Cognitive domain;
- Affective domain; and
- Psychomotor domain.

Bloom was interested in dividing the cognitive domain and gave most of his attention to other spheres, which is where we will focus. He concentrates on capacity or mental processes that relate to the knowledge of facts, the operations of understanding and remembering, and the discovery methods of identifying information and building concepts, principles and generalisations (Clark, 1999).

Bloom divided this area into six graded levels, ranging from simple to complex, as shown in Figure 3.

“Remember” is the simplest of these levels, followed by “Understand” and “Create” at the top of the pyramid, which is the most complex of these levels. The application focuses on the first three levels from the pyramid, which are “Remember”, “Understand” and “Apply”. The similarities and differences treated between the theories and Arabic Pronunciation Application as shown in Table 1.

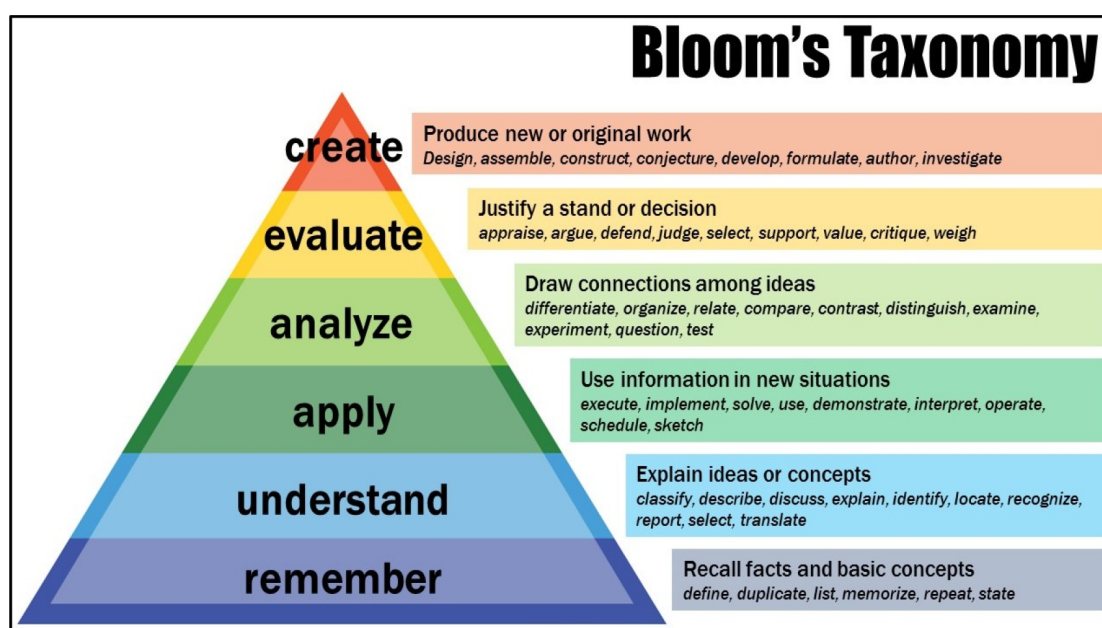


Figure 3. Bloom’s Taxonomy of Cognitive Goals

Theories of Cognitive Development and Learning	Arabic Pronunciation Application
Piaget’s Theory of Cognitive Development	The application focuses on the preoperational stage: understanding the world through language and mental images (see Figure 1).
Dale’s Cone of Learning	The application focuses on verbal receiving: 10% of what we read, 20% of what we see and 30% of what we hear (see Figure 2).
Bloom’s Taxonomy of Cognitive Goals	The application focuses on the first three levels of the pyramid, which are “Remember”, “Understand” and “Apply” (see Figure 3).

Table 1. similarities and differences between the theories and Arabic Pronunciation Application

3. Literature Review

This section explores previous Arabic and English pronunciation applications, thereby providing a clear understanding of the technology used in past works. There are many existing studies, several of which are discussed in this section.

3.1. IXL Learning – United States (1998)

In 1998, Quia Web released IXL Learning, which was the first site that allowed teachers and learners to exchange their courses and educational materials. The initial version consisted of three sections: a matching game, a game focus and flash cards. The current version has many kinds of games and competitions useful for children and adults. The site also focuses on teaching the English language through the correct pronunciation of the letters and connects students with words and pictures, making it quicker and easier for them to remember. Many countries have used this site for education purposes, as have approximately 10% of schools in the United States that go from the age of two until the undergraduate level. The website contains four main sections: language, science, mathematics and social studies (IXL Learning, 1998).

3.2. WriteReader-app – Denmark (2013)

The fundamental aim of the WriteReader-app is to highlight how students learn to write with phonetic strategies, which is based on the idea of “learning to read by writing”. This app also needs support from adults. The students and teachers are required to register with the WriteReader-app, so the students can take and upload pictures. Their texts can also be uploaded as a book, which can then be published in the application library and shared with friends or family. Furthermore, teachers can track their students’ progress. Students can write to test the letter with its pronunciation and within words (Thomas, 2016). The WriteReader-app is aimed at children aged 3–5 who are at home and those aged 6–7 in the first grade. It was founded in 2012 and published in 2013 (Thomas, 2016).

The application was issued to the first grades of five schools in Denmark. Each school divided their students into two classes. The class that participated in the experiment with the WriteReader-app showed greater improvements in their writing and reading skills after six weeks than the class that did not participate. The WriteReader-app is found on their website and as an application for iPad and Android devices (Thomas, 2016).

3.3. Reading Raven Parent and Teacher Guide – Seattle (2013)

Reading Raven is an application developed by a team of experienced learning developers, illustrators and game designers. The application helps children to learn and improve their reading ability. It is an interactive, multisensory application that aims to teach children to read through games that instil the fundamental subskills of reading, giving them many ways to learn. One of these games is focused on letters and sound recognition word building (spelling), reading words, determining words and practicing reading aloud (with voice recording). It has an adventure guide to help children interact through the application. It also contains lesson, with each comprised of many activities and a variety of methods. In the application, parents can determine which areas to focus on and select those specifically. The application also suggests activities based on age appropriateness as follows (White, Voelker, Snider, Jasinski, Snider & Stephens, 2013):

- a) Age 3 plus: the application provides activities such as Letter Recognition, Letter Sounds, Letter Tracing and Word Matching.
- b) Age 4 plus: the application provides activities such as Vocabulary, Word Beginnings, Word Building and Word Spotting.
- c) Age 5 plus: the application provides activities such as Reading Aloud, Word Groups and Word Tracing.

The Reading Raven application improves hand–eye reading, writing and listening skills that help children to make more connections between spoken and written language, thus increasing confidence and comprehension (White et al., 2013).

3.4. Muslim Kids Series (Hijaiya) – Indonesia (2014)

Hijaiya is an application created by Indonesian developer Fadel Basymeh and Yufid Inc. It is available on the Apple iOS store, Android store and Windows store. The application helps children to learn the Arabic alphabet in a fun and interactive way, and it is beneficial for children and adults.

The application consists of two sections. The first section teaches children the Arabic alphabet letter by letter, and how to pronounce each with the *Harakaat*. Each letter is displayed with image and audio, and the child has the option to click on one of three pictures to hear the letter pronunciation. The second section teaches children how to write the Arabic letters correctly and allows them to practice. The application uses a simple method to teach the children how to write the letter by having them connect the dots on a whiteboard. It then awards the children stars according to how perfect the connection is, which encourages them to learn how to write the letter precisely (Mohamed, Mantoro, Ayu, & Mahmud, 2015). The application's design is colourful, but the children may need parents' guidance to use it because there is no text or audio instructions (Mohamed et al., 2015). The application has been developed with Object C programming language for Apple devices, Android Studio using Java programming language for Android devices and C# programming language and Visual Studio program for Windows devices (Yufid, 2014).

3.5. Arabic Letters and Tachkil – Canada (2014)

Arabic Letters and Tachkil is an application developed by Khaled Moumene and is available on the Android store. The application's main objective is to aid the learning of the Arabic letters with *Tachkil* or *Harakaat*, and it is useful for children and adults.

The application has two modes. First, there is the Learn Mode in which the user learns how to pronounce the Arabic letters with *Tachkil*. The application displays images of the letters, and each time the user clicks on the image, its name is pronounced and shown at the top of the screen. Second, there is the Exercise Mode in which the user must guess what is pronounced. Once the user hears what to guess, he/she can give their answer by selecting the appropriate letter or *Tachkil*. It also offers many educational videos. The application has been developed by Android Studio using Java programming language (Moumene, 2014).

3.6. English Learning Application for Preschoolers – Korea (2015)

The English Learning Application for Preschoolers comes from Korea and was created to educate preschool-aged children in the English language. It is organised into four skills: listening, speaking, reading and writing. The application is designed for children to learn English two or three times per week, and each session lasts only 20–25 minutes. For preschool-aged children, there is no formal learning goal. It is estimated that children of this age can learn up to 2,500 sentences by the age of 5. If learning is performed three times a week, then they will achieve the goal of learning more than 550 words. Accordingly, the application was designed for children to learn and practice two or more sentences for each class, as well as listen and speak eight sentences in a month through the learning method of communication between teachers and children. The UI is tailored to preschool children by using colours, appropriate font size, sounds and video. These components will attract the interest of children and consider the individual characteristics according to their age.

The application includes some cartoon characters, known and beloved by children, which will attract their attention. Although the attention span of preschool-aged children is short, this method is very useful in teaching English. It simplifies the understanding of the sentence, especially when the sentence is repeated several times. The application also contains many activities, such as dancing and singing, to help the children learn the English letters (Lee, Shon & Kim, 2015).

3.7. Lamsa Application – Jordan and the United Arab Emirates (2017)

The Lamsa application is a specialist application aimed at educating and expanding users' knowledge of the Arabic language in the Middle East. Lamsa provides useful information and is developed to be fun and entertaining for children. The developer team tries to avoid traditional learning methods, so it contains more than 200 toys, stories, videos and colouring. It is updated weekly by adding a new story. Each section focuses on a particular aspect for the children, and there are many sections specific to each gender. The application is suitable for children aged 2–9 (Lamsa Group, 2017).

The application is classified into six main themes:

- a) forms and colours;
- b) numbers and letters;
- c) my family and friends;
- d) the world around me;
- e) animals.

The Lamsa team has several specialised departments, including programmer, designer, engineer and animator groups, and the programming team is further divided into two sub-teams that work on Android programming devices and iOS programming devices, respectively. The application has been developed by Android Studio using the Java programming language and for iOS devices using the Objective-C programming language (Lamsa Group, 2017). The designer team receives some work requirements from the programming department, such as buttons and dimensions of the designs, and others from the content section, such as stories, games and colouring. This team uses Adobe Photoshop and Adobe Illustrator programmes (Lamsa Group, 2017).

The Lamsa application has two work centres. The first is in Jordan and has programming and customer services sections. The second is in the United Arab Emirates, where the content production is managed (Lamsa Group, 2017).

3.8. A+ Spelling Test (2017)

A tailored vocabulary set can be formulated for learners through this free spelling app. It encourages self-guided learning among children, who can revise and undertake the quizzes as they wish, through the simple adaptable characteristics and interface. There is a simple test procedure, whereby email or screen grabs can be used by the learners to send their test scores. This application focuses on children aged between 6 and 8. Three different tests are utilised—“ace it”, “unscramble” and “practice”—which provide the number of letters in the word. As Innovative Mobile Apps (2017) explained, the application is compatible with the iPad and iPhone

4. Methodology

The overall methodology for the research consisted of four stages as outlined below.

Stage 1: Review of literature and previous works on the Arabic Pronunciation Application

Stage 2: Prior Questionnaire

We collected the data required for the educational applications for children by distributing a questionnaire through social media platforms, such as Twitter and WhatsApp. By doing this, we reached some mothers and fathers, teachers in schools and universities, students of universities and secondary schools, and offices of brain training and psychological counselling. We distributed the questionnaire to answer some important questions, such as “Have you ever used a program that helps you to teach your children how to correctly pronounce the Arabic letters? Do you support the idea of establishing an educational application that helps with teaching children the Arabic alphabet and how to pronounce it correctly from an early age

(3–5 years) and before they attend school?”. Opinions were also gathered on statements such as “The use of smart devices for children can be a good way to teach the Arabic language”.

The sample size according to the replies received was 605. The complete survey is presented below in Section 5

Stage 3: Interview

An interview was conducted with a psychological counsellor from the Brain Training and Psychological Counseling Office, who has expertise in the field of children’s education in general and special needs (learning difficulties) in particular. The interview concentrated on the methods of teaching children the basics of the Arabic language, especially Arabic alphabet letters and their formation. She explained to us that the appropriate age to teach children the language is from 3 to 5 years. Furthermore, she clarified the suitable strategies for education, including the use of sounds and images to stimulate and expand the child’s mind, and how to avoid some educational pitfalls, such as if a child missed an answer then provide feedback with the correct answers without highlighting his mistake.

Stage 4: Design and implementation of the application

In evaluating several theories, such as Piaget’s (one of the most famous psychologists who have made scientific contributions to the study of mental development), we have confirmed the importance of this stage in the growth of the child’s ability to represent the subjects and events mentally within himself/herself.

We have seen some applications teach children how to pronounce the letters in English correctly and teach them some words. We similarly have created an application in Arabic where the child is helped to pronounce the Arabic letters correctly within the formats. In the Arabic language, the three primary formats are *fatha*, *dama* and *kasra*, and the application pronounces the formats to the child correctly.

Stage 5: Usability testing

We applied three types of questionnaire: a pre-test questionnaire to collect background information about participants, a post-task questionnaire to evaluate each task separately by using criteria of measuring usability According to Nielsen (2003) and post-test questionnaire to get the users’ opinions about the whole website. The complete survey is presented in Section 7.

5. Results of Prior Questionnaire

Ranking analysis was applied to parents ($N = 605$) to rate the quality of the Arabic Pronunciation Application from their perspective. The overall attitudes and Cronbach’s Alpha for each question are displayed in Table 2. Parents had been questioned and grouped according to:

- a) Gender (83% female and 17% male); and
- b) Age: Parents were divided into three groups (53.1% aged 15–25; 23.6% aged 26–36; 23.3% aged over 37).

Questions	Strongly Agree %	Agree %	Somewhat %	Disagree %	Strongly Disagree %	Mean	Standard Deviation	Cronbach's Alpha	Attitude
1. Do you support the idea of establishing an educational application that helps you teach your children the Arabic alphabet and how to pronounce it correctly from an early age (3–5 years), before they attend school?	82.6	14.4	2.3	0.5	0.2	4.79	0.513	0.723	Strongly Agree
2. Do the children spend long periods of time using smart devices?	51.6	23.5	13.1	8.3	3.6	4.11	1.138	0.718	Agree
3. Does the smart device increase awareness for children in a positive way?	11.9	19.5	50.4	13.2	5	3.20	0.98	0.689	Somewhat
4. The use of smart devices for children can be a good way to teach the Arabic language.	23	40.2	26.8	7.4	2.6	3.73	0.982	0.671	Agree
5. E-learning applications are considered better than educational books in children's education.	22.1	27.3	33.1	13.1	4.5	3.50	1.106	0.691	Agree
6. Combining education and play in E-learning applications is an important method of attracting children.	52.4	36.5	9.3	1.2	0.7	4.39	0.757	0.702	Strongly Agree
7. The appropriate age for teaching children how to pronounce the letters is between 3 and 5 years.	53.2	36.4	7.3	2.6	0.5	4.39	0.776	0.722	Strongly Agree
8. E-learning applications help to improve their levels of education in elementary school.	67.9	27.1	4.5	0.3	0.2	4.62	0.604	0.725	Strongly Agree
9. It is preferable to teach children how to pronounce the letters first, before teaching them the letters with the Harakaat.	49.3	36.4	7.8	6.1	0.5	4.28	0.885	0.720	Strongly Agree
10. Do you prefer teaching children the letters linked with images?	44.5	41.8	11.1	2.3	0.3	4.36	1.408	0.728	Strongly Agree

(Parents' answers) (N = 605)

Table 2. Ranking Analysis of the Likert-Type Scale and Reliability Test

6. Design and Implementation of the Application

The Arabic Pronunciation Application was designed and developed to help children communicate and interact more effectively with the world around them by using some theories about learning skills, such as the above-mentioned Piaget's *Theory of Cognitive Development*, Dale's *Cone of Learning* and Bloom's *Taxonomy of Cognitive Goals*. The application focuses on preschool children aged 3–5 to teach them the Arabic letters with simple signs and words. It aims to improve the most important skills for children, which are aural and oral skills, in a simple and clear design to attract their attention by using images and sounds.

The UI is what displays to the user of the program; the user can interact with the UI, see it, touch it and talk to it. So, UI design is important. It must be simple, easy to understand, simple to navigate and clear to

the user, especially to our target users who are children aged 3–5. In addition, the UI should be colourful and full of pictures. Typically, we focus on high graphical user interfaces for designing the UI. We followed some principles mentioned by Shihong (2013) that apply to the application, such as aesthetically pleasing, user familiarity, simplicity, predictability, responsiveness and consistency.

The application is connected to an external database that we established using the WAMP Server and is uploaded on the GoDaddy website to connect it with the Internet to send and receive the sounds and images. It is SQL based, so we have used the Android Studio program to develop the application and its design. We also have used the Notepad++ program to write the PHP codes, which work as a mediator between the database and the application to send and receive instructions. Furthermore, we used Photoshop to design the backgrounds, letters and the words, as well as the Acapela Groupwebsite to create the sounds and save it in the database.

The application consists of three primary sections:

- a) Alphabet letters;
- b) Alphabet letters with formation; and
- c) Training.

It also contains “Contact us” and “About” buttons. Figure 4 shows a high-level architectural diagram of the Arabic Pronunciation Application.

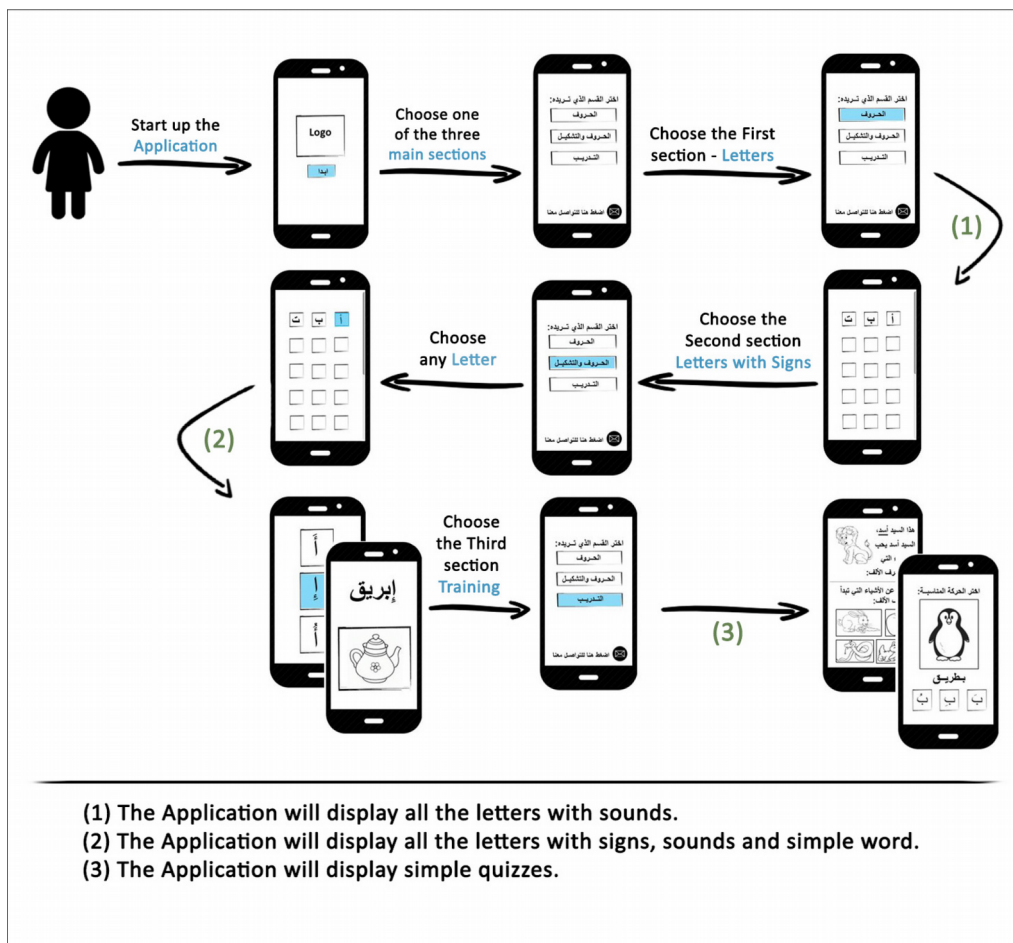


Figure 4. High-level architectural diagram of the Arabic Pronunciation Application

- a) **Letters page:** This page shows the letters and sounds of how each letter is pronounced.
- b) **Letters with formation page:** This page displays the letters with formation, sounds of how to pronounce each letter with its formation and words linked with its picture.
- c) **Training:** This page offers small and simple quizzes for children to assess themselves.
- d) **Contact us:** This shows how users can communicate with us if they have any questions, suggestions or complaints.
- e) **About the application:** This displays the application's information, mission and goals.

7. Results of Usability Testing

7.1. Participants and Study Design

Twenty-eight people participated in the testing process, comprising 6 administrators to test the admin function on the application, 2 teachers to test the application and 20 children to test the application.

We attended an application usability testing conducted at the brain training and collation Center and with some children at home. The test dates were Sunday 16th April 2017 and Monday 17th April 2017.

7.2. Criteria of Measuring Usability

With regard to website usability test, Nielsen (2003) describes usability as a “...quality attribute that assesses how easy user interfaces are to use” and provides the following five principles to measure usability (see Tables 3 and 4). According to Nielsen (2003), these criteria of measuring usability were used for all tasks in our website and for both teachers and children.

7.3. Analysis of the Results of the Pre-test Questionnaire

This kind questionnaire is designed to capture the feedback of teachers and children concerning every task in the application, the difficulties they faced during each task and their recommendations for each task. The users had to complete this questionnaire after each task in the test.

7.3.1. Teachers

This section explores the results of the Pre-Test Questionnaire for each task as shown in Table 3.

7.3.2. Children

This section explores the results of the pre-test questionnaire for each task as shown in Table 4.

7.4. Problems and Recommendations from the Pre-test Questionnaire

This section explores the problems and recommendations from the pre-test questionnaire, as illustrated in Table 5.

7.5. Analysis of the Results of the Post-test Questionnaire

The feedback of the pre-test questionnaire from the Administrator, Teacher (Instructor) and Children questionnaires suggest updates and improvements to Task 4.2 for the teacher and children.

7.5.1. Teacher (Instructor) and Children Post-test Questionnaire

See Table 6.

Task 1: Run the application Task 2: View the first section (letters) Task 2.1: Choose the requires letter Task 3: View the second section (Letters with signs) Task 3.1: Choose the required letter Task 3.2: Choose the required letter with sign Task 4: View the third section (Training) Task 4.1: Choose one of the training section (Beginner and Advanced) Task 5: View all the application	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	100%				
Satisfaction: How pleasant is it to use the design?	100%				
Task 4.2: Move to the next question	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	50%	50%			
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	100%				
Satisfaction: How pleasant is it to use the design?	100%				

Table 3. The results of the pre-test questionnaire for each task

Task 1: Run the application Task 2.1: Choose the required letter Task 3: View the second section (Letters with signs) Task 3.1: Choose the required letter Task 4: View the third section (Training)	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	100%				
Satisfaction: How pleasant is it to use the design?	100%				
Task 2: View the first section (Letters)	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				

Task 1: Run the application					
Task 2.1: Choose the required letter					
Task 3: View the second section (Letters with signs)					
Task 3.1: Choose the required letter	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Task 4: View the third section (Training)					
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	85%	15%			
Satisfaction: How pleasant is it to use the design?	100%				
Task 3.2: Choose the required letter with sign	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	70%	30%			
Satisfaction: How pleasant is it to use the design?	100%				
Task 4.1: Choose one of the training section (Beginning and advanced)	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	100%				
Satisfaction: How pleasant is it to use the design?	70%	20%			10%
Task 4.2: Move to the next question	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	75%	15%	10%		
Satisfaction: How pleasant is it to use the design?	80%	20%			
Task 5: View all the application	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				

Task 1: Run the application Task 2.1: Choose the required letter Task 3: View the second section (Letters with signs) Task 3.1: Choose the required letter Task 4: View the third section (Training)	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	80%	20%			
Satisfaction: How pleasant is it to use the design?	80%		10%		

Table 4. The results of the pre-test questionnaire for each task performed by the children

Repetition Rate	Description	Suggestion and Recommendation
Task – 3: 1 of the 2 teachers (instructor)	She did not like the colours of the letters.	She recommends we use the blending colour method to see which colour is appropriate with the other.
Task – 2: 1 of the 4 children	He did not know how to repeat the pronounce sound of the letter.	He suggests adding an icon for the sounds to allow them to repeat.
Task – 4.2: 1 of the 2 Instructors	She prefers to change the way the children choose the answer to make it clearer for them.	She suggests adding a tick mark for the correct answer and a wrong mark for the wrong answer.

Table 5. Problems and recommendations

Task 4.2: Move to the next question	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?	100%				
Efficiency: Once users have learned the design, how quickly can they perform tasks?	100%				
Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?	100%				
Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?	100%				
Satisfaction: How pleasant is it to use the design?	80%	20%			

Table 6. The results of the post-test questionnaire for each task performed by the children and teacher

8. Discussion and Conclusion

This Arabic Pronunciation Application aimed at helping children learn and improve their ability and enhance the skills of young children in areas such as pronunciation, listening and speaking, as well as training and educating them in preparation for school. In this Arabic Pronunciation Application, we have employed several theories to help us determine children's learning skills, such as Piaget's "Theory of Cognitive Development", Dale's "Cone of Learning" and Bloom's "Taxonomy of Cognitive Goals".

The application focused on the first three levels of Bloom's "Taxonomy Pyramid", which are "Remember", "Understand" and "Apply"; the preoperational stage of Piaget's "Theory of Cognitive Development"; and understanding the world through languages and mental images and verbal receiving (10% of what we read, 20% of what we see and 30% of what we hear) of Dale's "Cone of Learning". This has hopefully enabled the Arabic Pronunciation Application to benefit children by developing and improving their abilities and skills to increase their ease of learning.

There are many areas that can make the application more efficient by adding more function, such as:

- Apply the application on iOS devices.
- Create a Web-based version.
- Expand the field of vowels (formation) such as *shada* and *tamween*.
- Add some extra features to the training section such as calculating scores.
- Develop the application to apply for all levels of primary schools
- Develop the application to apply for children with disabilities.
- Develop the application to apply to the four stages of Piaget’s “Theory of Cognitive Development”, all levels of Dale’s “Cone of Learning” and all levels of Bloom’s “Taxonomy of Cognitive Goals”.

The system analysis phase is an important stage in any project. This stage is to identify where the problem is and to reform it more easily, it is a solution to the problem that will help to break the system into pieces and analyse each piece separately.

This paper discusses the way we gathered information to build the system and analysed by in a statistically accurate manner to develop and achieve the user requirements and objectives of this application. The questionnaire received a positive response from 605 parents. Parents were asked to complete the questionnaire and were grouped according to their gender and age. Before the construction of the educational application for children, we distributed a questionnaire to study and examine some important aspects of the Arabic Pronunciation Application.

In this paper we explored the purpose of the test, functions to correct the paths for each task, the goal of testing participants, the requirements of the tasks methodology, the actual performance of the tasks, the criteria to measure the usability for the users, methods used in the test process, processing testing, the resources and software required to complete the test, analysis of the results of the pre-test questionnaire, analysis of the results of the post-test questionnaire, and problems and recommendations.

Declaration of Conflicting Interests

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