



Autisme

IT 497: Graduation Project Report Product Release-2

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Autisme

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Abstract (English):

Regarding autism and education, no one method suits all individuals with autism. Especially when it comes to the success of the educational journey, it will entirely depend on the child.

Schools can be challenging for autistic children due to the need for improved learning environments and specialized learning techniques. Virtual reality (VR) technology has advanced in use in education, and it is believed to help children with autism learn more effectively by simulating real-world experiences in a managed and comfortable environment.

Therefore, it is essential to take a stand to ease the learning process for children with autism and their guardians.

This brings to light the idea of "Autisme," which is a mobile application intended for Arabic-speaking autistic children aged from 6 to 12 years old to teach them English letters and numbers with the help of their guardians to use at home. Our application will mix learning and playing within an attractive environment designed according to expert advice. Autisme application will consist mainly of two sections. The first section will cover numbers, including the numbers lesson and the counting game. And the second section, which is the letters section, contains the letters lesson and the matching game.



Abstract (Arabic):

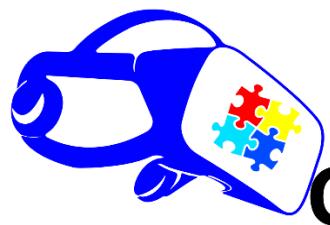
عندما يتعلّق المَوْضُوع بِتَعْلِيم أَطْفَال التَّوْحُد، فَإِنَّهُ لَا تَوْجُد طَرِيقَةٌ وَاحِدَةٌ تَنَاسِبُ جَمِيعَهُمْ، فَهُنَّ يَتَعَمَّدُونَ بِالكَّامل عَلَى الْطَّفْل وَقَدْرَاتِهِ.

هُنَّاكَ الْكَثِيرُ مِنَ الْأَسِبَابِ الَّتِي لَمْ يَضْعُفْهَا مُعْظَمُ النَّاسِ بَعْدَ الاعتبارِ، مِنْهَا بَيْنَهُنَّا الْمَدَارِسُ قَدْ تَكُونُ صَعْبَةً عَلَى الْعَدِيدِ مِنَ الْأَطْفَالِ الْمَصَابِينَ بِالتَّوْحُدِ وَهَذَا بِالْتَّأْكِيدِ سَيُؤْثِرُ عَلَى مَدْى تَكِيفِ الطَّلَابِ الْمَصَابِينَ بِالتَّوْحُدِ بِالْبَيْنَةِ التَّعْلِيمِيَّةِ، وَهَذَا يَتَطَلَّبُ تَحْسِينَ الْبَيْنَةِ التَّعْلِيمِيَّةِ وَتَقْنِيَّاتِ التَّعْلِيمِ الْمُتَخَصِّصَةِ، مَا يَمْثُلُ تَحْديًّا كَبِيرًا لِلْمُعَلِّمِينَ وَالْمَدَارِسِ.

لَقَدْ تَقْدَمَتْ تَقْنِيَّةُ الْوَاقِعِ الْأَفْتَاضِيِّ بِسُرْعَةٍ عَلَى مَدْى السَّنَوَاتِ الْعَشْرِ الْمَاضِيَّةِ مِنْ حِيثِ اسْتِخْدَامِهَا فِي التَّعْلِيمِ عَلَوْهُ عَلَى ذَلِكَ يَعْتَقِدُ أَنَّ تَقْنِيَّةَ الْوَاقِعِ الْأَفْتَاضِيِّ يُمْكِنُ أَنْ تَسْاعِدَ الْأَطْفَالِ الْمَصَابِينَ بِالتَّوْحُدِ عَلَى التَّعْلِيمِ بِشَكْلٍ أَكْثَرَ فَعَالِيَّةً لِأَنَّهَا يُمْكِنُ أَنْ تَحَاكِي تَجَارِبَ الْعَالَمِ الْحَقِيقِيِّ فِي بَيْنَهُنَّا تَمَّ إِدَارَاتُهَا بِشَكْلٍ مَنَاسِبٍ وَمَرِيحٍ لَهُمْ، لَذَلِكَ مِنَ الْمُضْرُورِيِّ اتِّخَادُ قَرَاراتٍ تَسْهِلُ عَلَيْهِ التَّعْلِيمَ لِلْأَطْفَالِ الْمَصَابِينَ بِالتَّوْحُدِ وَأَولِيَاءِ أَمْوَالِهِمْ.

وَمِنْ هَنَا أَنْتَ فَكِيرَةُ تَطْبِيقِ (Autisme) وَهُوَ تَطْبِيقُ جَوَالٍ مُخْصَصٍ لِلْأَطْفَالِ الْمَصَابِينَ بِالتَّوْحُدِ النَّاطِقِينَ بِالْعَرَبِيَّةِ الَّذِي تَنْتَرَاهُ أَعْمَارُهُمْ بَيْنَ 6-12 عَامًا لِتَعْلِيمِهِمُ الْحُرُوفَ وَالْأَرْقَامَ بِالْعَلَامَةِ الإِنْجِلِيزِيَّةِ بِمَسَاعِدَةِ أَوْلِيَاءِ أَمْوَالِهِمْ لِتَعْلِيمِهِمْ بِالْمَنْزِلِ، وَيَتَمَيَّزُ هَذَا التَّطْبِيقُ بَيْنَ التَّعْلِيمِ وَاللَّعْبِ فِي بَيْنَهُنَّا تَجَذُّبُ الْأَطْفَالِ الْمَصَابِينَ بِالتَّوْحُدِ وَمَصَمَّمٌ وَفَقَاءً لِنَصَائِحِ الْخَبَرَاءِ وَيَحْتَوِي التَّطْبِيقُ عَلَى قَسْمَيِنِ الْقَسْمِ الْأَوَّلِ: يَحْتَوِي عَلَى تَعْلِيمِ الْأَرْقَامِ وَلَعْبَةِ عَدِ الْأَرْقَامِ، بَيْنَمَا الْقَسْمُ الثَّانِي يَحْتَوِي عَلَى تَعْلِيمِ الْحُرُوفِ وَلَعْبَةِ مَطَابِقِ الْأَحْرَافِ.

Keywords: Autism; Autism spectrum disorder; ASD; Game design; Virtual Reality; Autistic children.



CHAPTER 1 | INTRODUCTION



1 Introduction

The evolution of technology has taken software to an advanced stage, creating a more complex artificial environment and the three-dimensional digital world of virtual reality (VR). Virtual reality systems are fundamentally transforming how we examine human sensory perception. Virtual reality is a technology-stimulated environment that develops an artificial but thoroughly immersive experience. It uses a head-mounted display to allow users to feel and experience these virtual environments [1].

Virtual reality has seen an evolution in its growth and potential uses lately. It is utilized for gaming, tourism, retail, and learning, and, due to its added advantages, has seen an increase in usability within the mental health therapy [2]. It is used in different forms of therapy. Moreover, virtual reality is practiced more as an application or device for social interaction. It gradually decreases the edge of finding help by overcoming physical barriers and allows possible to get immersive interactions from home [3].

Virtual reality (VR) aims to engage users into thinking they are in a virtual environment. Virtual reality is "a model of reality with which a human can interact, obtaining information from the model using ordinary human senses such as sight, sound, and touch, and controlling the model using typical human actions such as position" [4].

Virtual reality (VR) technology is a growing force beyond entertainment and an essential tool in industries such as manufacturing and healthcare. For instance, in manufacturing, VR allows engineers and designers to experiment easily with the look and build of a vehicle before commissioning expensive prototypes [5]. Also, VR is making a significant impact in healthcare. In November 2021, the FDA approved the prescription-use EaseVRx pain reduction in adults [6].

Another example will be found in dangerous worksites like oil platforms, where standard safety preparation and drills may familiarize staffers with their jobs' possible threats. Still, they must always be ready to act when something turns out for the worst. Contrary to the real world, virtual reality is secure; VR might assist workers in performing during difficult situations or dealing with how specific actions during unsafe tasks might threaten others.



Autism Spectrum Disorder (ASD) is a rare neurodevelopmental illness denoted by poor social communication, interaction, and speech and the keeping of limited and repetitive behaviors, interests, and activities. Children with ASD may also have different ways of learning, moving, or paying attention [7].

The problem is that some children with ASD live in their world. They are not interested in other children and lack social awareness. A child with ASD focuses on following a routine that may include normal behaviors. A child with the disorder also often has problems communicating with others. A study posted in Autism Research indicates that about 100 of every 10,000 children worldwide are diagnosed with autism spectrum disorder (ASD). This is an increase from the 2012 global prevalence report, which discovered that 62 in 10,000 children were autistic [8].

On the other hand, many individuals with ASD are associated with technology and a powerful visual memory. Some of them may have outstanding capabilities in areas such as mathematical computations and visual search tasks. These rare individuals are called autistic savants (someone with autism with a single extraordinary area of knowledge or ability) [9]. Some technological tools have been employed in training individuals with ASD, such as computers, mobile devices, and tablet devices, especially in the classrooms of ASD-specific schools and at some job training programs [10].

VR technology is being adopted by therapists, teachers, parents, and their children to help those with autism (locally) better express themselves and connect with others and the world around them in virtual reality.

Crucially, it can give autistic people a chance to explain and explore their world on their terms. On the other hand, it is likewise used to assist others without autism (global) in understanding what living with the situation means. The VR will help diagnosed people with ASD learn about the community and daily living, descriptive language, emotional principles, focusing, imitation, safety, and school conversational skills [11], [12].

In recent years, VR has become a popular training, treatment, and intervention tool for individuals with ASD [12], [13].

The National Autistic Society stated their positive opinions on using VR effectively for ASD, since VR offers an environment where people with ASD can feel comfortable. They affirmed the potential successful use of VR for training individuals with ASD, especially in life and social skills [14].



Each autistic child is unique, but there are some areas where many autistic children suffer. Motor skill challenges, cognitive processing delays, and social skills are aspects to consider when choosing the appropriate learning environment for an autistic child [15].

❖ Objectives

- Product (customer focus-value):

Research indicates that Technology helps children identified as existing on the autism spectrum to improve literacy, social-communicative skills, adaptive skills, and accurately detect the emotions of others, so our product will help children diagnosed with autism to educate them on the numbers and alphabetic letters by obtaining an Interaction method to use Technology.

- Project (solution focus plan):

To complete our project, our goal will be into three levels:

a. Predevelopment:

We are setting goals related to the end user and objectives related to our business. The goals should be clear and measurable. Further, we need to elicit requirements by using requirements discovery methods so that we will be conducting interviews and sending out questionnaires to autisms specialists, and preparing the required hardware (VR Headset)

b. Development:

The product requirements document will support our team in understanding and handling user needs. The paper should include all details such as the goal, stakeholders, a road map showing starting and ending dates, and the application features. The next step is to work with domain experts and business analysts to decide on app design elements, software, coding skills, and technical knowledge. And then, we will develop the software.

c. Post-launch:

We check that all software requirements are completed and then apply a testing method. Finally, get our app live and into the hands of actual users and wait for users' feedback.



- Learning (student focus):

Through this project, we will have the chance to experience how to develop a Mobile application to solve the problem and meet customer needs. Until we deliver the complete software, we will learn about managing the Android Mobile application software and its building process, its related new techniques, and how to manage the VR library and its related hardware. Additionally, we will improve some soft skills such as communication, teamwork, problem-solving, and time management.

❖ Scope

Autisme is an application that consists of two parts: hardware and software.

- The hardware comprises VR technology that educates Autistic children between 6 and 12 years old.
- The software is an Android mobile application downloaded from Google's Play Store.

The application will support the Arabic language to teach the children English.

In addition to that, our platform is unity.

❖ Learning

This project aims to familiarize us with game development and teach us about it.

The best frameworks and languages for game development have been searched for such as Unity. We will use YouTube and Unity tutorials to learn how to create games using the Unity engine.

❖ Problem & Solution

Regular schools are rarely a suitable environment for autistic children. Furthermore, teachers are not always able to manage the environment for autistic students and provide them with the attention they need. For many autistic children, school is significantly more challenging than any work because of factors that most people could never even think about.

Commonly, autistic individuals can find it difficult to make eye contact or have a two-way discussion with people. This difficulty can unthinkingly isolate others away. VR games use the VR simulator to both play and improve communication skills. The project aims to provide an interactive mobile application based on VR technology to support the educational



process for autistic children with level 1 and help their parents teach them at home. Our application will mix learning and play within an attractive environment designed according to expert advice.

We aim to develop our game with the support of the “مركز أجيال التخصصي” and with the help of the one who is responsible for autistic children, the psychologist Sarah Al-Sloli. We also consulted Sarah Al-Sloli if the autistic child could wear the VR headset, and she confirmed that the autistic child could wear it. Moreover, we have agreed with the center's director, Nouf Al-Saadi, to do the project's testing phase with their assistance. (See appendix C).

Moreover, we have established a connection with the Authority for the Care of Persons with Disabilities (APD) to get their support in terms of research in the autism field. They have made it easier for us by connecting us with official authorities with experience in consultation and examination of autism. The official sources who have agreed to help us are the King Salman Center for Disability Research with the help of Alanoud AlHargan, Ynmo Agency with the help of Jood Almgati, and the Autism Center of Excellence with the use of Abdulla AlOtaibi. (See appendix C).

❖ Product Vision

For an **autistic child** (a target customer)

Who **needs to educate in an appropriate environment** (statement of need or opportunity)

The **Autisme app** (product name) is a **mobile application** (product category)

That **will educate autistic children's English numbers and letters** (key benefit/ reason to buy)

Unlike **The applications developed for autistic children** (primary competitive alternative)

Our product **Will use recent technologies to facilitate autistic children learning through an interactive environment** (statement of primary differentiation)

❖ Methodology

Our agile project methodology starts with planning, collecting data using questionnaires and interviews, and searching for autism specialists to understand and design the application more efficiently, then creating and testing our application.



❖ Main contribution

Our project contributed to the education field. by educating autistic children about English letters and numbers. The use of VR technology helps in the learning process for them to be easy to use and understand. The process for the children's progress will be recorded and put in a report that will be shareable for the guardian to look at any time. Our project aims to help to improve the education process for autistic children by using new technology.

→ Local and global community:

- Local Impact:

Children in Saudi Arabia with autism spectrum disorders will be significantly affected by the Autisme application; it will increase their understanding of and enthusiasm for learning English letters and numbers. By adopting VR equipment and technology to teach Saudi autistic children the English alphabet and numbers, parents may provide their kids with a more motivating and efficient at-home education. Additionally, the educational lessons and games will raise the thinking and learning strengths of Saudi autistic children.

- Global Impact:

Autisme application will enrich the Arabic content in applications that support VR technologies and the Autism field; it will also promote the value of the Arabic language among children.

There are many different types of applications on the market. However, our application Autisme supports the Arabic language to teach autistic children English with VR technology.



❖ Summary

This document is organized as follows: Chapter 2 covers background in Virtual Reality, Autism Spectrum Disorder (Autism), and Android Operating Systems. Chapter 3 covers the Literature Review, which discusses Virtual Reality in Education and how Virtual Reality 3D worlds can provide opportunities for children to occupy settings similar to their everyday experiences. Moreover, we discussed the Competitive Product Analysis to show how our product differs from others. Chapter 4 describes the system design and development to identify system users, Requirements Elicitation and Analysis, and the methods of collecting data. Additionally, we illustrated the Product Backlog to a prioritized list of work for the development team derived from the roadmap and its requirements. Chapter 5 covers the system evaluation and Model-View-Control (MVC), representing the architecture design, and we covered the component level design. Chapter 6 presents the system implementation with the purpose of the performance to design and create a system element conforming to that Android mobile application's design properties and requirements. Chapter 7 System Testing is a process through which applications being developed for mobile devices are tested. The focus is to test the apps for functionality, usability, and stability. Also, we covered the demographics of Participants and discussed questionnaire results. Finally, Chapter 8 summarizes the research findings for this thesis and provides direction for future work in this area.



CHAPTER2|BACKGROUND



2 Background

This chapter focuses on giving readers a quick introduction to virtual reality, autism, and the Android operating system. Considering which regions are covered by the solution domain should aid in comprehending the suggested solution.

2.1 Autism definition

An extensive group of diseases collectively referred to as autism spectrum disorder (ASD) are characterized by difficulties with social skills, repetitive activities, speech, and nonverbal communication. The Centers for Disease Control and Prevention (CDC) [16] estimate that 1 in 44 children in the United States currently suffer from autism.

There are several subtypes of autism; since autism is a spectrum condition, each autistic individual has a unique set of abilities and difficulties. There's a common level of autism [17]

- Level 1: Requires Support
 - Social communication has noticeable impairments under this level, a patient may be able to talk in proper/meaningful sentences. However, interactions are missed.
 - Difficulty initiating social relationships.
 - Lack of capacity to socialize and make new friends.
 - Inability to organize and formulate strategies.
- Level 2: Require Substantial Support
 - A lack of verbal and nonverbal communication abilities.
 - Little or no social interaction, and little response to attempts to interact with them.
 - Nervousness and shyness when watched by unfamiliar faces.
 - Reduced ability to function and participate in their daily activities.
 - Repetitive behavior is obvious.
- Level 3: Require Very Significant Support
 - Patients have severe problems with verbal or nonverbal communication.
 - Are less likely to reciprocate to social interaction.
 - Hardly responds to people trying to socially interact with them.
 - Strong or extremely restrictive /repetitive behaviors.



Moreover, People with autism can learn, understand, and solve problems in many ways, from highly proficient to severely impaired. While some persons with ASD need much everyday assistance, others might just need a little help. Surprisingly, in some circumstances might even live independently [18].

2.1.1 Children with autism spectrum disorder

Classic autism is one of several disorders categorized as autism spectrum disorders (ASD).

Asperger syndrome, Rett syndrome, childhood disintegrative disorder, and pervasive developmental disorder are possible additional ASDs. It has been proven that males are four times more likely than girls to have autism, according to the National Institutes of Health (NIH).

Worldwide, autism is a condition that is quite common. For instance, one in every hundred children in the UK has autism, as of 2007, there had been over 500,000 diagnoses nationwide. Additionally, One out of every 1,000 children in China has been identified as having autism. One in every 250 children in India is affected by the disease. Two to six out of every 1,000 children in Mexico have autism. No one socioeconomic, ethnic, or racial group is more likely to develop autism than another.

Autism is treatable and, with early diagnosis and treatment, autistic children can lead healthy, full lives [19].

Children with autism spectrum disorder face specific difficulties in receptive and expressive language, they have communication problems, whether verbal or non-verbal, and they have a delay or total deficiency in the development of spoken language. their verbal characteristics are abnormal, such as: pitch and intonation on the rhythm and tone of voice, and their grammatical language is described as repetitive or stereotypical, such as: the repetition of words or sentences that are related in meaning, and their language has a specificity as only people who are familiar with them understand them, such as: mother, father and teacher [20].

2.1.2 Recognizing Signs of Autism in children

Autism Children's behavioral symptoms and indicators may be similar, but they might differ in severity and presentation.



There are many variations in the quantity and intensity of symptoms, although there are a few typical indications that a kid with autism may have, such as social, communicative, and behavioral [21]

- Social differences in children with autism:
 - Reacts seldom or not at all to a parent's smile or other facial expressions.
 - Cannot point at things or activities to obtain a parent's attention.
 - Less likely to show parents items of personal interest.
 - Many people lack the proper facial expressions.
 - Has trouble interpreting others' facial expressions to determine what they could be feeling or thinking.
 - Less inclined to exhibit empathy (concernedness) for others.
 - Has trouble developing and maintaining the friendship.
- Communication differences in children with autism:
 - Less likely to point at things to indicate needs or share things with others.
 - Says no single words by 15 months or 2-word phrases by 24 months.
 - Repeats exactly what others say without understanding the meaning (*often called parroting or echoing*).
 - May not respond to name being called but does respond to other sounds (*like a car horn or a cat's meow*).
 - May refers to self as "you" and others as "I" and may mix up pronouns.
 - May show no or less interest in communicating.
 - Less likely to start or continue a conversation.
 - Less likely to use toys or other objects to represent people or real life in pretend play.
 - May have a good rote memory, especially for numbers, letters, songs, TV jingles, or a specific topic.
 - May lose language or other social milestones, usually between the ages of 15 and 24 months (*often called regression*).
- Behavioral differences (repetitive & obsessive behaviors) in children with autism:
 - Rocks, spins, sways, twirls finger, walks on toes for a long time, or flaps hands (*called "stereotypic behavior" or stereotypies*).
 - Likes routines, order, and rituals; has difficulty with change or transition from one activity to another.



- May be obsessed with a few or unusual activities, doing them repeatedly during the day.
- Plays with parts of toys instead of the whole toy (e.g., spinning the wheels of a toy truck).
- May not cry if in pain or seem to have any fear.
- May be overly sensitive or not sensitive at all to smells, sounds, lights, textures, and touch.
- May have unusual use of vision or gaze—looks at objects from unusual angles.

2.1.3 sensitivities of people with autism

Sensory problems are frequent in autistic people are part of the diagnostic criteria for autism spectrum disorder. Each autistic individual is unique, including their sensory sensitivity. People with autism might have sensitivities to:

- Sights
- Sounds
- Smells
- Tastes
- Touch
- Balance (vestibular)
- Awareness of body position and movement (proprioception)
- Awareness of internal body cues and sensations (interception)

Autistic people can experience hypersensitivity (over-responsiveness) and hyposensitivity (under-responsiveness) to a wide variety of stimuli. The majority of people with autism have a combination of both.

Many autistic people are hypersensitive to bright lights or specific light wavelengths (e.g., LED, or fluorescent lights).

Certain noises, scents, textures, and tastes might also be overwhelming. This can lead to sensory avoidance, or the attempt to avoid sensations that most people can easily tune out. Sensory avoidance can manifest as the aversion to physical touch, covering one's ears to avoid loud or unexpected sounds, or preventing specific types of clothes.

Hyposensitivity is another typical symptom. This can manifest as an insatiable want to move, difficulties identifying signs such as hunger, illness, or discomfort, or an attraction to loud noises, bright lights, and colorful colors. Hypersensitive people may engage in sensory seeking to obtain more sensory input from their surroundings.



Autism patients, for example, may activate their senses by making loud noises, touching people or items, or rocking back and forth.

What does sensory issues feel like?

Being sensitive to certain types of sensory input might cause difficulties in everyday contexts such as school, job, or community settings. It can be difficult for someone who is hypersensitive to spend all day under LED or fluorescent lights, maneuver a crowded place, or process discussions in rooms with background noise. This can be extremely physically and emotionally taxing, leaving the person too weary to perform other crucial responsibilities.

Sensory overload occurs when the intensity of a sensory experience exceeds your ability to cope. This might be triggered by a single event, such as an unexpected loud noise, or it can accumulate over time due to the effort required to deal with sensory sensitivities in everyday life. Sensory overload might manifest as acute anxiety, a desire to flee, or difficulties communicating. When the brain must devote all of its resources to sensory processing, other functions such as speech decision and information processing may suffer [22].

2.2 What is the virtual reality?

Virtual reality is A simulated three-dimensional environment that allows users to explore and interact with a three-dimensional world that closely resembles reality as experienced by the user's senses. Computers Hardware and software tools are used to construct the environment. The ability to engage with the environment requires users to wear equipment like VR headsets or goggles [23].

Virtual reality may be divided into three categories:

a) Non-immersive simulations:

that users may manipulate with their physical actions. And all you need to play video games is a computer with input devices.

b) Semi-immersive simulations:

It offers an experience where a user may participate in the virtual setting while feeling linked to the real world. It simulates the virtual environment using 3D visuals, high-resolution screens, powerful computers, and projectors. This technology is mostly employed in the sphere of education and training.

c) Fully immersive simulations:

This type of simulation life is the most accurate, and it depends on using immersive movies and audio to improve the experience. The user requires VR accessories like head mount displays or VR eyewear (HMD).

The video gaming and entertainment industries make extensive use of the technology.

The more deeply users can immerse themselves in a VR environment and block out their physical surroundings the more they are able to suspend their belief and accept it as real, even if it is fantastical in nature [24].

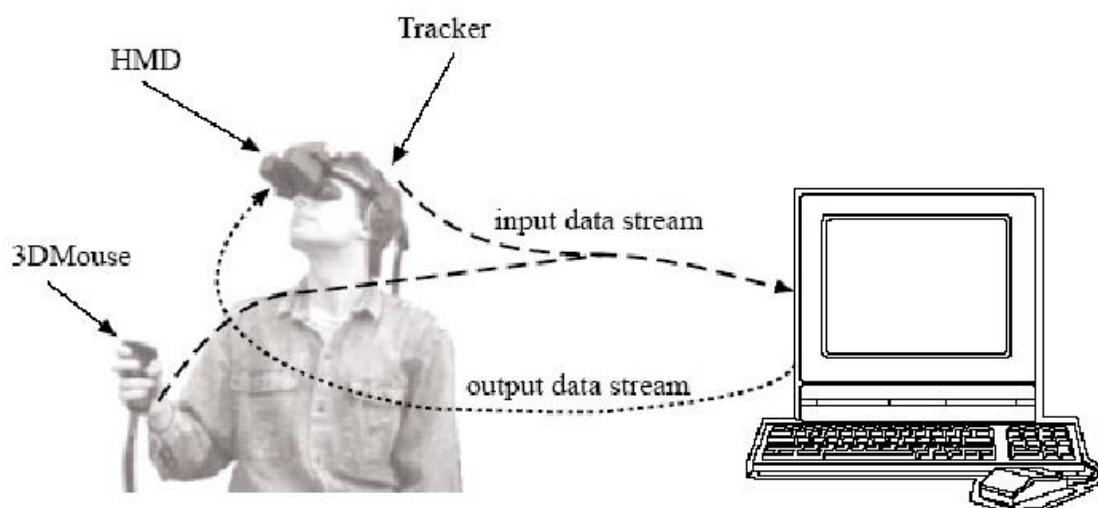


Figure 1: Basic components of VR immersive application [25]

2.2.1 Creating VR Content

These three phases are commonly involved in creating VR content:

Step 1: Draft an outline and goal, before converting it into a detailed flowchart with distinct learning objectives.

Create a flowchart that illustrates students' actions and explains how visual components will create a simulated environment at this level.

Step 2: Produce resources that satisfy learning objectives. 3D modeling, 2D graphic design, video components, and voiceover are some of these assets. Assets aligned with learning objectives must be generated during this phase.

Step 3: The developer creates original scripts and uses authoring tools to make the material playable. Creating of unique code scripts for the interactions that support the project is the final



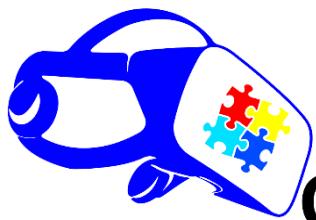
stage in generating VR content. The project may be played on the desired platform (VR headset, computer, web, etc.).

These three phases can be developed in-house or outsourced [26].

2.3 Android Operating System

Android is an operating system built on Linux primarily intended for touch-screen mobile devices like smartphones and tablet PCs. Android is currently one of the most popular mobile operating systems. In addition to that, Android is a powerful operating system, and it supports many applications on Smartphones; these applications are comfier and more efficient for users. Because Android is an open-source operating system, anybody may use it for free. Also, Android is highly well-liked since it provides a wide selection of apps that may help you manage your life in various ways and is inexpensively priced.

Android development supports the whole java programming language. While other packages that are API and JSE are not supported. The first version 1.0 of the android development kit (SDK) was released in 2008 and the latest updated version is a jellybean [27].



CHAPTER3 | LITERATURE REVIEW



3 Literature Review

Autism requires a variety of improvements to the learning environment and specialized learning techniques, which presents a significant problem for teachers and schools. The professional crew at the school's attitude, background, and level of expertise, as well as the accessibility of resources and the ability for collaboration, are all crucial factors in how successfully they can be incorporated.

However, research indicates that there need to be more foundations for these children to receive inclusive education, reflected in a higher risk of social and academic isolation and an increase in teachers' duties. Schools need to be more flexible when dealing with parents.

According to the research, high-quality inclusion provides autistic students with better opportunities to meet more challenging academic goals, improve their strengths and social skills, form friendships with classmates, and become independent from a divided school environment.

Moreover, the research reveals that many students with autism have had horrible school experiences, expressed as peer violence, social isolation, disapproval at school, problems with mental health, and poor academic performance.

The mindsets, experiences, and capabilities of school professionals and the flexibility of different professionals to collaborate are the main factors determining whether inclusion is successful [28].

A 3D recreation of a natural or imagined environment called virtual reality (VR) technology enables users to explore the virtual world and interact with items and other users in real time.

Virtual reality (VR) technology has advanced quickly over the past ten years in its use in entertainment, training, and education.

Children on the autistic spectrum benefit particularly from virtual reality because it can simulate real-world scenarios in a properly monitored and secure environment.

This technology has indeed been proposed to offer significant advantages and benefits for social and life skills training compared to other approaches, given the real-world social issues experienced by children on the spectrum.

While there has been considerable advancement in researching the usefulness and applicability of VR for autistic children in educational settings, there is still great difficulty in creating



reliable and practical techniques that can make an actual difference in real-world classrooms [29].

A virtual learning environment for students with ASD offers a safer, less-threatening setting for skill development. The amount of total stimulus may be controlled, and mistakes are less traumatic. Up until abstraction, environments can be changed in simple or complex ways. These environments may be chosen based on the user's preferences for specific topics of interest, degrees of tolerated input, and the management of undesired stimuli. Depending on the user's preferences or sensory tolerance, they can also be modified to be simple or complicated.

Based on the user's cognitive capabilities, social preferences, and current interests, characters inside the chosen virtual world can be generated and customized to match the person's requirements and expectations. Users may control and alter the virtual environment's visual and aural complexity.

More stimulation, greater interactivity, or a mix of both can grab and keep a user's attention when they are easily distracted or displaying indications of boredom or interest.

Slight changes and adaptations can be made to famous scenes in a virtual world, promoting more applicability and less formality [30].

Several studies have presented some initial proof that VR activities help autistic kids and teenagers learn [31] [32].

Researchers have highlighted the benefits and drawbacks of what distinguishes VR from 2D VM.

The autistic child pays more attention to crucial information, can interact with the virtual environment, and has access to a less harmful environment for learning daily life skills. Because of this, VR is a good fit for the learning requirements of people with autism and may offer unique benefits as a treatment for individuals with ASD [33].



3.1 Competitive Product Analysis

In this part, we will mention some of our competitors and compare them to our application Autisme features.

The first application, Autism iHelp is a vocabulary education game targeting autistic child. This application teaches autistic children vocabulary in the field of play. It supports IOS and Android platforms.

The second application, Aiko & Egor Animation 4 Autism is an educational game targeting autistic child. This application contains animated videos and games for developing autistic children's skills, such as matching and animal identification and turn-taking. It supports IOS and Android platforms.

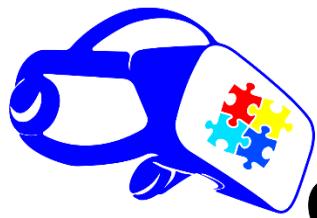
The third application, Magic fluids lite is a relaxing and colorful fluid simulation application targeting autistic children. This application helps calm and relax. It supports IOS and Android platforms.

The last application, Floreo VR is a virtual reality application targeting autistic children. This application has many lessons in a variety of fields to teach the autistic. For example, children's Community & Daily Living, Communicative Eye Gaze and Conversational Skills. It supports the IOS platform.



Table 1: Competitive Product Analysis

App Feature	 Autism iHelp	 Aiko & Egor Animation 4 Autism	 magic fluids lite	 Floreo VR	 Autisme
Support VR	No	No	No	Yes	Yes
Support Arabic	No	No	No	No	Yes
Target Autism	Yes	Yes	Yes	Yes	Yes
Audio Guide	Yes	Yes	No	Yes	Yes
Educational	Yes	Yes	No	Yes	Yes
Learning letters	No	No	No	No	Yes
Learning numbers	No	No	No	No	Yes
Support android	Yes	Yes	Yes	Yes	Yes
Support iOS	Yes	Yes	Yes	Yes	No
Video	No	Yes	No	No	Yes
Game	Yes	Yes	Yes	No	Yes



CHAPTER4|System Design & Development



4 System Design and Development

4.1 Methodology

- Agile approach

The Agile methodology is a technique of project management that divides a project into phases. It entails ongoing engagement with stakeholders and continuous increment at each stage. When we started working on our project, we went through four cycles of sprint planning, implementation for sprints backlog, reviewing, Sprint retrospective, eventually, increment of our product. While taking great care in Collaboration between team members and project stakeholders [34].

- Scrum Framework

We, as team developers, has practiced Scrum Framework in each sprint. Starting from the Sprint Planning throughout daily scrums and other events while focusing on artifacts until the product increment [35].

- Tools

GitHub¹:

- Helped us with Documentation for our work.
- Helped with easy collaboration for the unity project with huge files quickly.
- Keep track of all the changes that have been pushed to the repository.
- Easy Backup for any missing files.

Jira²:

- Jira is flexible and easy to customize for our team's workflow.
- Helped us with Documentation for our meeting and important notice.
- Assisted with the agile methodology process, as all supervisors can keep track of all the changes that have been pushed to the repository.

¹ https://github.com/2022-GP1-14/2022_GP1_14.git

² [Projects - Jira \(atlassian.net\)](https://atlassian.net)



4.2 System Requirements

4.2.1 System Users

The users of the system are autistic children and their guardians.

- The education level for the autistic child can be from primary school and below.
- The autistic child's age should be from 6-12 years old.
- The guardian of the autistic child should be familiar with using Android applications.
- The guardian of the autistic child must have an Android operating system device.
- The guardian of the autistic child should have basic technical skills.

4.2.2 Requirements Elicitation and Analysis

In this section we used two methods, questionnaires, and interviews, to gather the necessary information. We conducted interviews with relatives of autistic children along with writing a questionnaire that targeted relatives of autistic children too. and we collected questions in the questionnaire related to the children of autism, such as age, whether they are interested in VR technology or not. We found many responses from parents of autistic children, teachers/specialists, and doctors interested in VR technology.

A short online questionnaire was distributed over social media during the information-gathering process. To learn more about their observations of their children's behaviors when using electronic devices and their interest in VR technology, we specifically targeted parents, experts, and teachers of autistic children between the ages of 6 and 12. In addition, we conducted our questionnaire using Google forms [36], then distributed it across several social media applications like Twitter, Instagram, Telegram, and WhatsApp. We questioned the respondents on several questions, including whether they face difficulties in teaching their children in traditional teaching methods and whether there are different ways for children to learn. So that when we build our features in the application, we can take advantage of them (Appendix A).



We interviewed a group of people, including a mother of a child with autism, a teacher who deal with autistic children, and a specialist. We concluded that there are autism types, and the most challenging class is aspired, which is the third level of autism disorder that requires excellent support. When we asked which skills are not complex for an autistic child, they all agreed that they differ according to their cognitive skills, attention, and concentration .For the things, an autistic child is attracted to vary depending on the child and all items are attracted to the autistic child but often pay attention to the moving thrills in the back of it that are static without dispersion and sensory objects and experience things. In addition to that, the autistic child is not attracted to overlapping objects and annoying sounds. Moreover, when we asked the question of the number of people in places, they agreed that each child is different. Still, for the third-level autistic child, a few prefer because they severely lack verbal social communication skills (Appendix B).



4.2.3 User Interactions

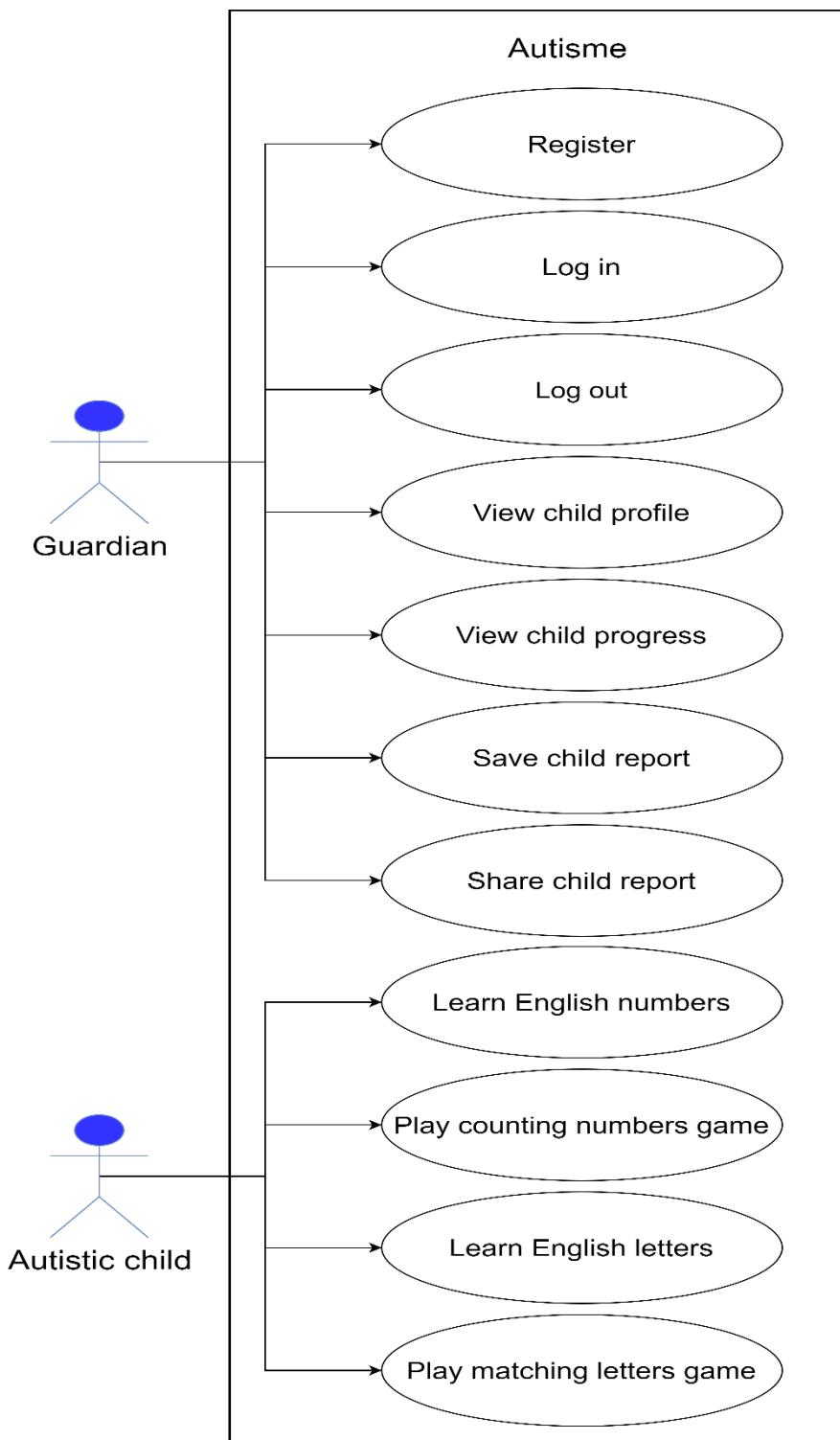


Figure 2: Use case diagram



4.2.4 Roadmap and Product Backlog

Our product will be built over five sprints, with two releases in between. Our product will utilize technology and entertainment to help autistic children learn English letters and numbers. We plan to develop an educational app to aid children with autism by first teaching English numbers and then introducing a counting game. Then there's the matching game with the letters.

Autisme Roadmap

		Q1(Release-1)			Q2 (Release-2)		
DATE	START	SPRINT-0	SPRINT-1	SPRINT-2	SPRINT-3	SPRINT-4	SPRINT-5
DELIVERABLES	6 th September 2022	29 th September 2022	7 th November 2022	22 nd December 2022	12 th January 2023	23 rd March 2023	30 th April 2023
PROJECT PROPOSAL	BACKGROUND LITERATURE REVIEW SYSTEM DESCRIPTION REQUIREMENTS ELICITATION PRODUCT BACKLOG	DEVELOPING LEARNING NUMBERS TESTING INTEGRATION	LEARNING LETTERS NUMBERS COUNTING GAME INTEGRATION	LETTERS MATCHING GAME CHILD PROFILE INTEGRATION	CHILD PROGRESS TRACKING TESTING INTEGRATION	REPORT EXPORTATION INTEGRATION TESTING	INTEGRATION TESTING

Figure 3: Visual diagram of the roadmap



Table 2: Product Backlog

PBI (User story)	Size (Story points)	Type	Status	Acceptance Criteria
1. As a guardian of an autistic child, I want to have instruction for use so that I can get to know the time limit of using the application.	1	Feature	Done	<ul style="list-style-type: none">- As a guardian of an autistic child, if I run the application, an instruction message for the use of the application appears.- The instruction for the use time message of the application should appear for 5 seconds longer, then automatically the user moves to the next page.
2. As a guardian of an autistic child, I want to sign up to the application so that I can have an account to my child	1	Feature	Done	<ul style="list-style-type: none">- As a guardian of an autistic child, if I clicked on the sign-up button, a sign-up form should appear.- As the guardian of an autistic child, if I entered the fields correctly, the application should validate my information.- As the guardian of an autistic child, if I entered the required fields correctly, then the application should display the login page.- As the guardian of an autistic child, if I entered the required fields wrongly, then the application should display an error message.
3. As a guardian of an autistic child, I want to log in to my child account so that I can use the application	2	Feature	Done	<ul style="list-style-type: none">- As a guardian of an autistic child, after I launch the application, a log-in form should appear.- As a guardian of an autistic child, if I entered the required fields correctly, then the application should display the homepage.- As a guardian of an autistic child, if I entered the required fields wrongly, then the application should display an error message.- As a guardian of an autistic child, if I clicked on “نسيت كلمة المرور؟”， a password reset form should be displayed in case I have forgotten my password.
4. As an autistic child, I want to wear VR headset so that I can experience the VR environment	2	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I wear the VR headset, a 360-degree rotating environment should appear.
5. As a guardian of an autistic child, I want to be able to log out from my account so that I can leave the account	3	Feature	Done	<ul style="list-style-type: none">- As a guardian of an autistic child, if I clicked on the log out button, then the log in page should be displayed.- As a guardian of an autistic child, if the log-out process has not been completed, then an error message should be displayed.



6. As an autistic child, I want to watch an interactive video about English numbers so that I can learn English numbers.	3	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I clicked on the "درس الأرقام" button, an interactive environment teaching about English numbers should be displayed.- As an autistic child, if I clicked on the "درس الأرقام" button and the interactive environment about English numbers did not display within 2 minutes, an error message should appear.
7. As an autistic child, I want to play counting number game so that I can count numbers.	4	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I clicked on the "لعبة عد الأرقام الإنجليزية" button, a counting number game should begin.
8. As an autistic child, I want to watch an interactive video about English letters so that I can learn English letters.	5	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I clicked on the "درس الأحرف" button, an interactive environment about English letters should be displayed.- As an autistic child, if I clicked on the "درس الأحرف" button and the interactive environment about English letters did not display within 2 minutes, an error message should appear.
9. As an autistic child, I want to be informed if I entered the correct answer so I can know if I pass or not.	5	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I clicked on the correct answer, an indicator should appear to inform the autistic child that he or she clicked on the right answer.- Then the autistic child should be moved to the next question.
10. As an autistic child, I want to be informed if I entered the wrong answer so I can know if I failed or not.	5	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I clicked on the wrong answer, an indicator should appear to inform the user that he or she clicked on the wrong answer.
11. As an autistic child, I want to play matching letters game so that I can match each letter with its object.	6	Feature	Done	<ul style="list-style-type: none">- As an autistic child, if I clicked on the "لعبة توصيل الأحرف الإنجليزية" button, a matching letters game should begin.
12. As a guardian of an autistic child, I want to save a report containing my child personal information and his/her learning progress so that I can send it to his/her specialist	7	Feature	Done	<ul style="list-style-type: none">- As a guardian of an autistic child, if I clicked on the "تقرير الطفل" button, a report should be displayed.- As a guardian of an autistic child after the report has been displayed two buttons should appear save or share the report.- As a guardian of an autistic child, if I clicked on save button, the document should be saved to my device.- As a guardian of an autistic child, if I clicked on share button sharing options should be displayed.
13. As a guardian of an autistic child, I want to have a progress report for the learning process of my child so that I can know what my child achieved	7	Feature	Done	<ul style="list-style-type: none">- As a guardian of an autistic child, if I clicked on the "الملخص," a page containing a weekly progress report should be displayed.



14. As a guardian of an autistic child, I want to know which level my kid stands at in the games so that I can keep track the learning process for him/her	8	Feature	Done	- As a guardian of an autistic child, if I clicked on the "المُلْك," a graph illustrating levels for each game that my child has finished should appear.
15. As a guardian of an autistic child, I want to have a profile page for my child so that I can view and edit his/her personal information	8	Feature	Done	- As a guardian of an autistic child, if I clicked on " ملف الطفل ", a page containing the child's personal information should be displayed. - As a guardian of an autistic child, if I clicked on "تعديل", I should be able to edit my child's personal information.

For the user story number eleven we have edited it from “As an autistic child, I want to play matching capital letters with its small letters game so that I can match letters” To “As an autistic child, I want to play letters matching game so that I can match each letter with its object” because when we have done multiple studies and consulted a specialist, we have concluded that teaching the children the capital and small letters could overwhelm and confuse them, and that is not our aim. Our aim at this stage is to teach the child the letter and ensure that they get it without getting into the details of a letter [37].

4.3 System Design

4.3.1 Architectural Diagram

In our "Autisme" application, we chose Model-View-Control (MVC) as our architecture design. Considering that it allows the data to change independently of it is a presentation and vice versa.

We chose this architecture because it is the most popular in-app architecture design; in addition to that, it separates presentation and interaction from each other and provides an efficient structure for our system, where efficiency, maintainability, and performance can be easily obtained. This is why we are choosing MVC architecture to help us separate the development of the Autisme application based on three components: system logic as the controller to control and manage user interaction. It is often considered the brain of the MVC system-a link between the user and the system, the Autisme application interface as the view to manage how data is presented to the user, and data as the model to associated operations on our application and represents the data to the user and defines the storage of all the application’s data object [38].

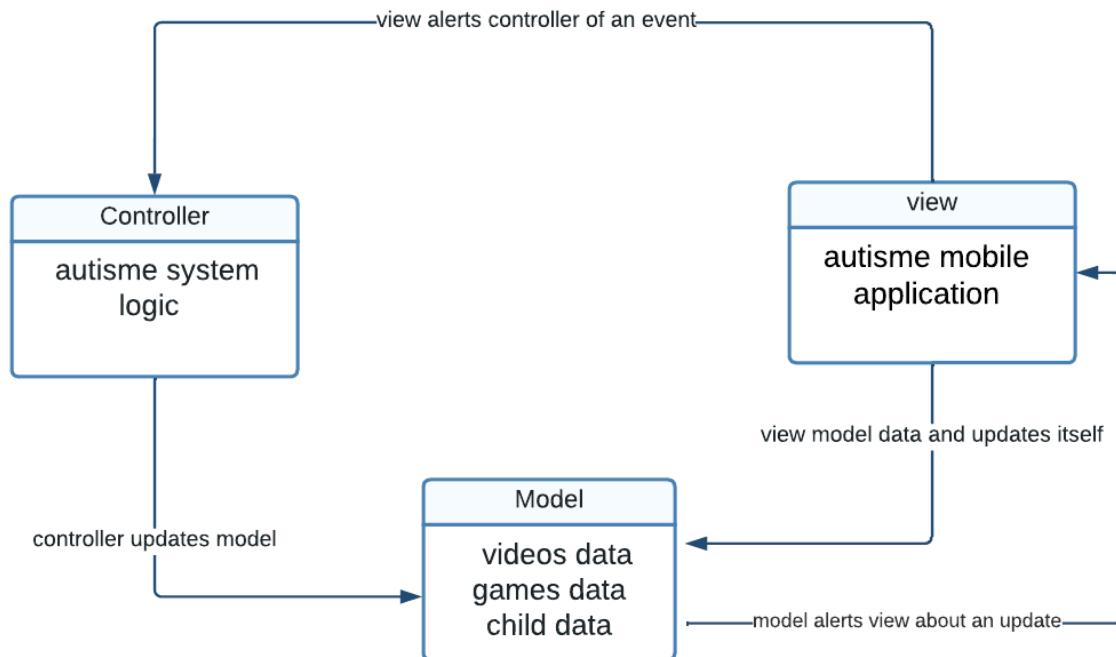


Figure 4: Architectural diagram

4.3.2 Class Diagram

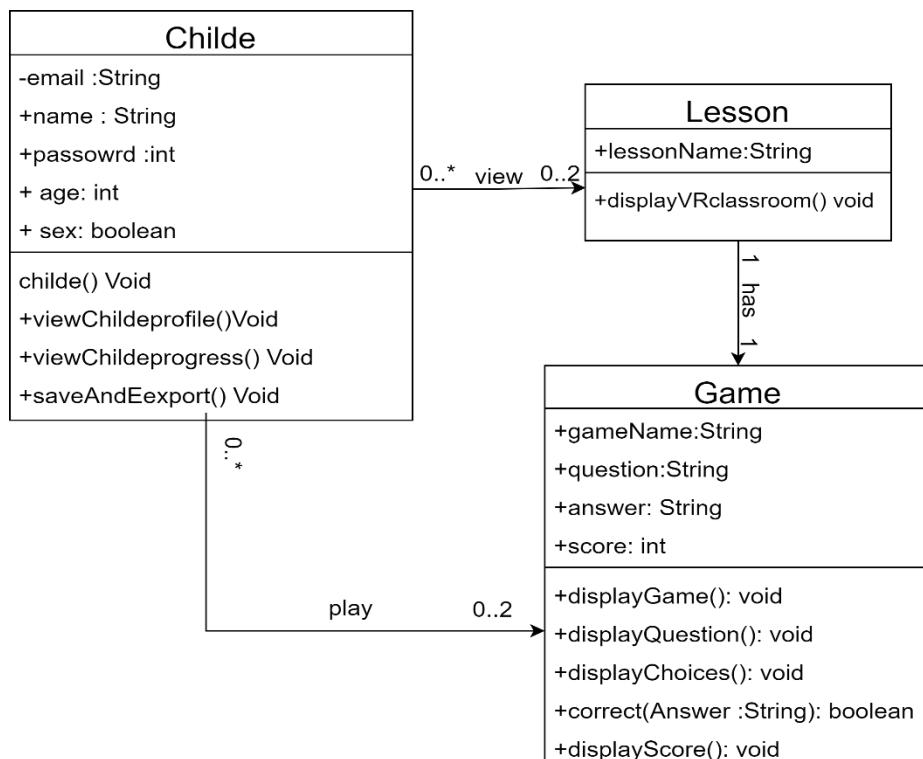


Figure 5: Class Diagram



4.3.3 Component Level Design

1. View letters lesson

Classification:

Function

Definition:

Allow the child to view the letters lesson.

Constraints:

Pre-condition:

- Logged in.
- Use of the VR headset.

Post-condition:

- The video will be displayed.
- Update the progress page.

Pseudocode:

BEGIN

SELECT the letters page section

THEN the system displays the letters page section

SELECT the letters lesson page

THEN The system displays the selected lesson

WHILE (running letters lesson in VR mode)

IF (child was looking at the screen) **THEN**

DISPLAY the lesson video.

ELSE

PAUSE the lesson video

DISPLAY a "الرجاء النظر للفيديو ل تستطيع اكماله" message

DISPLAY a "مبروك لقد انهيت الدرس يمكنك اللعب الان" message

END



2. Play matching letters game (level two)

Classification:

Function

Definition:

Allow the child to play the second level of the matching letters game.

Constraints:

Pre-condition:

- Logged in.
- Watch the letters lesson.

Post-condition:

- Play an interactive matching letter game.
- Update the progress page.

Pseudocode:

BEGIN

The guardian will select a game.

IF (child did not watch the lesson) **THEN**

The game will be locked.

ELSE The system displays a game with a letter element

FOR each question:

The child will match one of the letters with a suitable object.

THEN the system will verify the child's answer

IF (the selected answer is correct) **THEN**

DISPLAY a “احسنت” voice message OR **DISPLAY** a “ممتاز” voice message

ELSE

DISPLAY a “حاول ثانية” message.

END IF

ENDFOR

END IF

END



3. View numbers lesson

Classification:

Function

Definition:

Allow the child to view the numbers lesson.

Constraints:

Pre-condition:

- Logged in.
- Use of the VR headset.

Post-condition:

- The video will be displayed.
- Update the progress page.

Pseudocode:

BEGIN

SELECT the numbers page section

THEN the system displays the numbers page section

SELECT the numbers lesson page

THEN The system displays the selected lesson

WHILE (running numbers lesson in VR mode)

IF (child was looking at the screen) **THEN**

DISPLAY the lesson video

ELSE

PAUSE the lesson video

DISPLAY a “الرجاء النظر للفيديو لتنستطيع اكماله” message

DISPLAY a “مبروك لقد انهيتك الدرس يمكنك اللعب الان” message

END



4. Play counting numbers game (level one)

Classification:

Function

Definition:

Allow the child to play the first level of counting numbers game.

Constraints:

Pre-condition:

- Logged in.
- Watch numbers lesson.

Post-condition:

- Play interactive counting numbers game.
- Update progress page.

Pseudocode:

BEGIN

The guardian will select a game

IF (child did not watch the lesson) **THEN**

The game will be locked

ELSE The system displays a game with questions

FOR each question:

The child will select one of the options.

THEN the system will verify user answer

IF (the selected answer is correct) **THEN**

DISPLAY the correct button answer to green color

THEN child to proceed to the next question

ELSE

DISPLAY the wrong button answer to red color

END IF

ENDFOR

END IF

END



5. View Progress

Classification:

Function

Definition:

Allow the Guardian view child progress.

Constraints:

Pre-condition:

- Logged in.

Post-condition:

- The progress page will be displayed.
- The guardian can export or save the data as image file.

Pseudocode:

```
BEGIN
    SELECT Parents mood
    THEN The system will display progress page
    IF (Guardian click on share) THEN
        Share page will appear to select share contact
    END IF

    IF (Guardian click on save) THEN
        Image of the progress will be saved in the user device
    END IF

END
```



4.4 Data Design

4.4.1 Data Models

- ER diagram

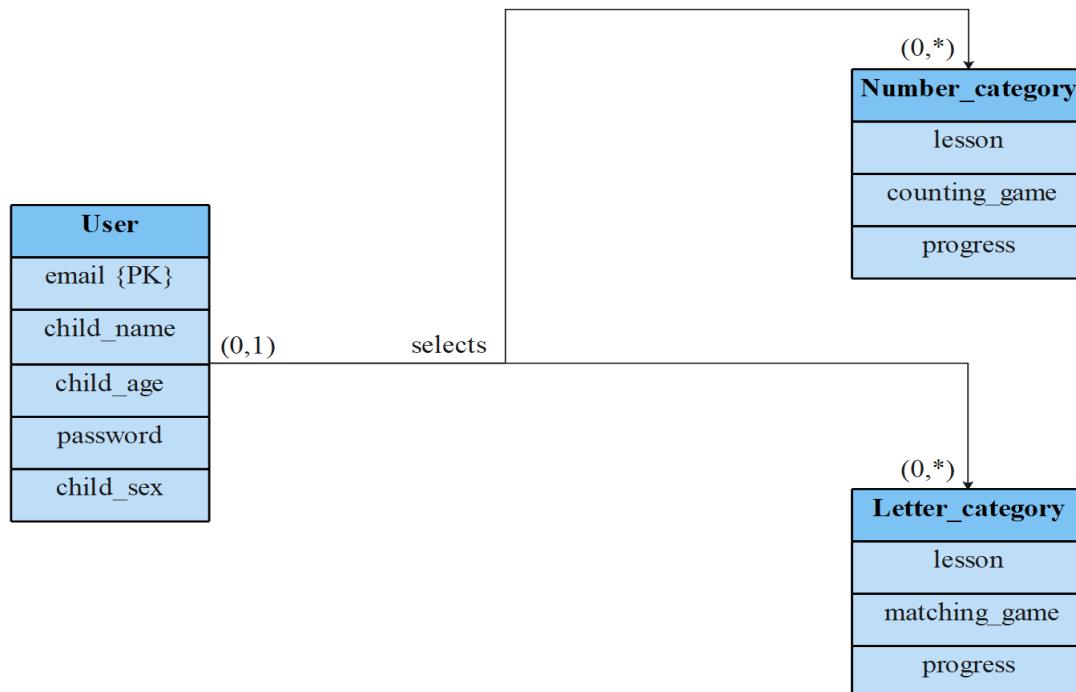


Figure 6: ER Diagram

- Non-relational data model

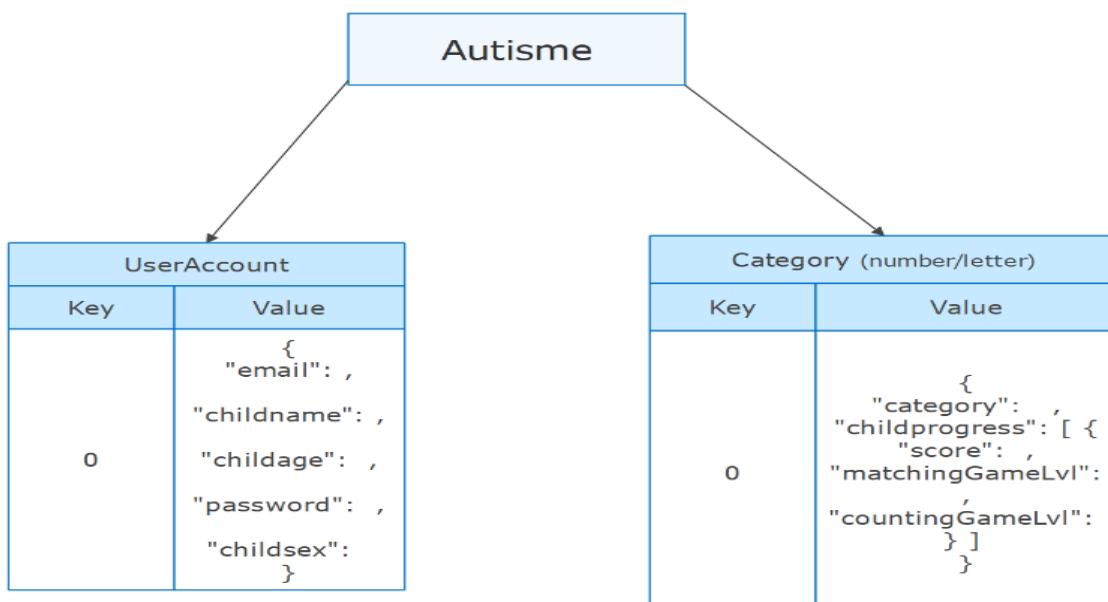


Figure 7: non-relational data model



4.5 Interface Design

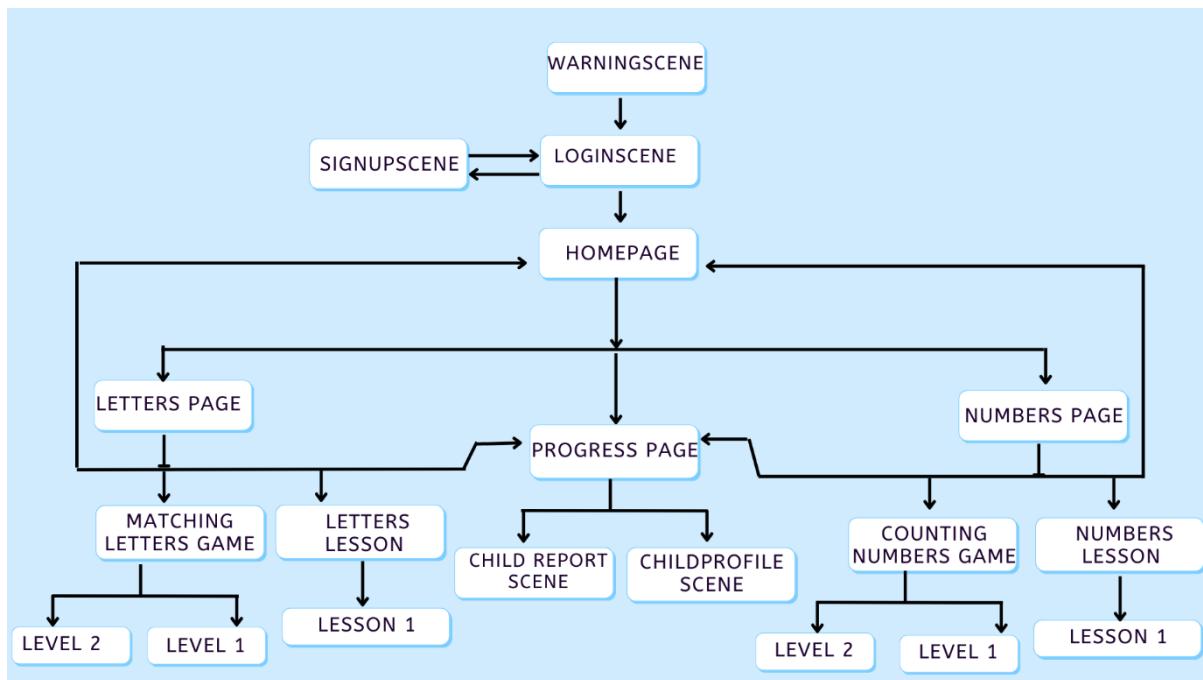


Figure 8: Sitemap

To enhance user interactions, we have applied several UX guidelines. We considered how well the application facilitates the user's capacity to complete their desired tasks. The following design considerations were also made by us [39] [40]:

- Error messaging: Users could frequently encounter such a problem that prevents them from completing the task properly. Any undesired user behavior or system response has been reported to the user with a concise and instructive error message. For instance, describe something in a single, concise statement if something goes wrong.
- Button labels should always use action words and be as brief as possible in describing the action. They should be at most four words long. "ملف الطفل" and "تسجيل الدخول" are two examples we have applied.
- Buttons Placement: Avoid placing buttons close to each other when it comes to fusing button placement. They only function effectively when placed far apart. Place the UI in such a way that it is easy to interact with.
- Text readability: Avoid using large text blocks and complex user interface elements in VR applications to minimize reading difficulties. Also, know how far you should mark these elements as being observed. The size of the screen, along with the size and density



of the content on it, will depend on the ideal viewing distance from which these screens are intended to be viewed.

- Use common UI elements: Users will feel more at ease and can quickly accomplish tasks using familiar UI elements. E.g., we have used radio buttons and dropdown lists as applications for this.
- Constructing our application in landscape orientation, we designed our game in landscape layout because the Unity engine does not support both portrait and landscape modes.



Figure 9-Warning Screen

Table 3-Warning Description

No	Description
1	Guardian wait until warning message finish.

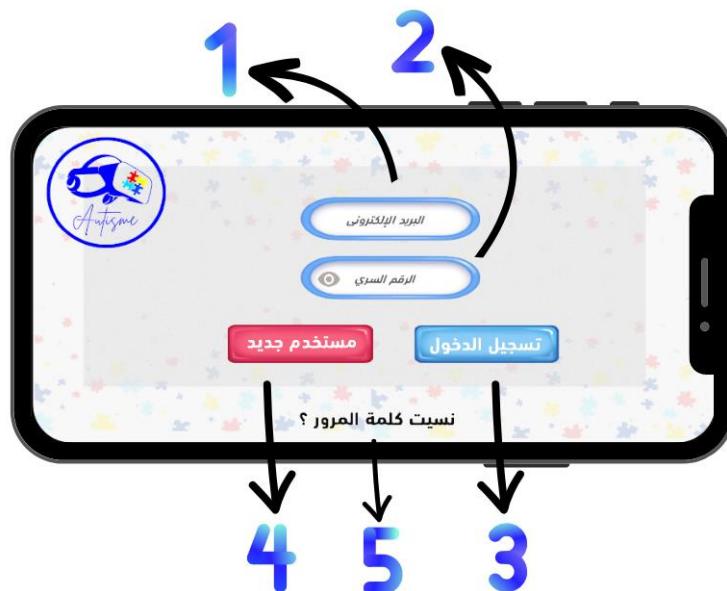


Figure 10-Login Screen

Table 4-Login Description

No	Description
1	Guardian click this text box to enter account email.
2	Guardian click this text box to enter account password and click the eye to show and hide password.
3	Guardian click this button to login.
4	Guardian click this button to open register page.
5	Guardian click this button to restore the password.

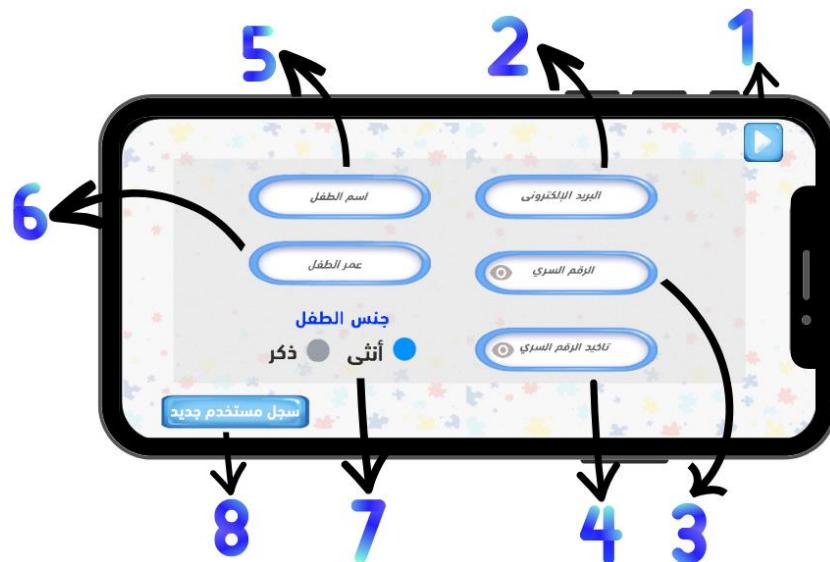


Figure 11-The Register Page screen

Table 5-The Register Page Description

No	Description
1	Guardian click this button to go back to the login page.
2	Guardian click this text box to enter account email.
3	Guardian click this text box to enter account password and click the eye to show and hide password.
4	Guardian click this text box to re-enter account password and click the eye to show and hide password.
5	Guardian click this text box to restore the password.
6	Guardian click this text box to enter child name.
7	Guardian click one of the two buttons to choose child gender.
8	Guardian click this button to create a new account and go back to the login.

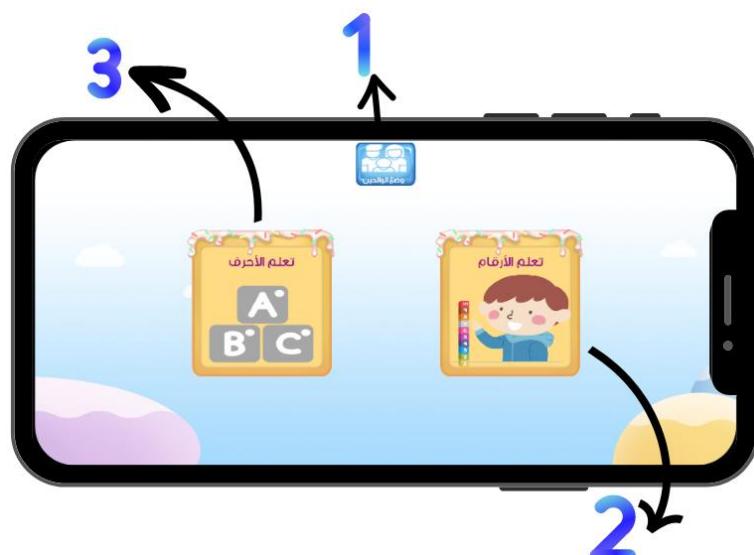


Figure 12-Home Page Screen

Table 6-Home Page Description

No	Description
1	Guardian click this button to go to the progress page.
2	Guardian click this button to go to the numbers page.
3	Guardian click this button to go to the letters page.

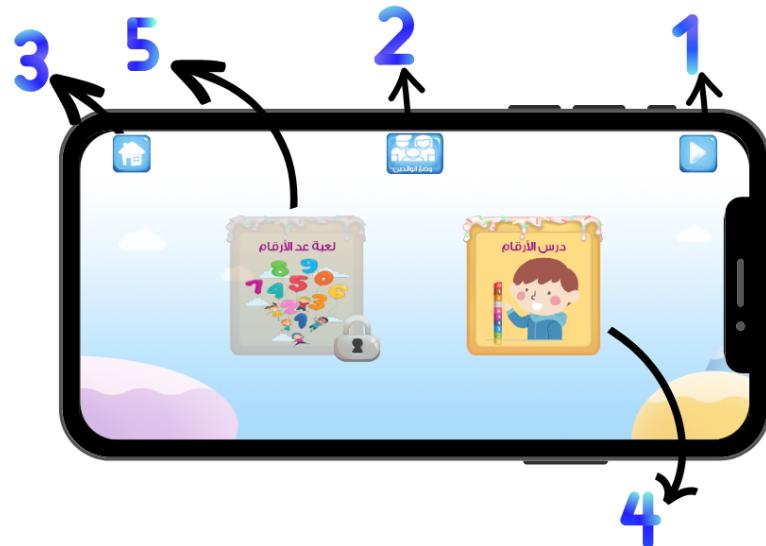


Figure 13-Numbers Page Screen

Table 7-Numbers Page Description

No	Description
1	Guardian click this button to go back to the homepage.
2	Guardian click this button to go to the progress page.
3	Guardian click this button to go to the homepage.
4	Guardian click this button to open numbers lesson page.
5	Guardian can click this button after finishing the lesson to go to counting numbers game page.



Figure 14-Numbers Lesson Page Screens

Table 8-Numbers Lesson Page Description

No	Description
1	Guardian click this button to go back to the numbers page.
2	Guardian click this button to go to the progress page.
3	Guardian click this button to go to the homepage.
4	Guardian click this button to open VR numbers lesson.
5	360-degree VR classroom appear and numbers lesson start.
6	Child click this button to go back to the numbers page.

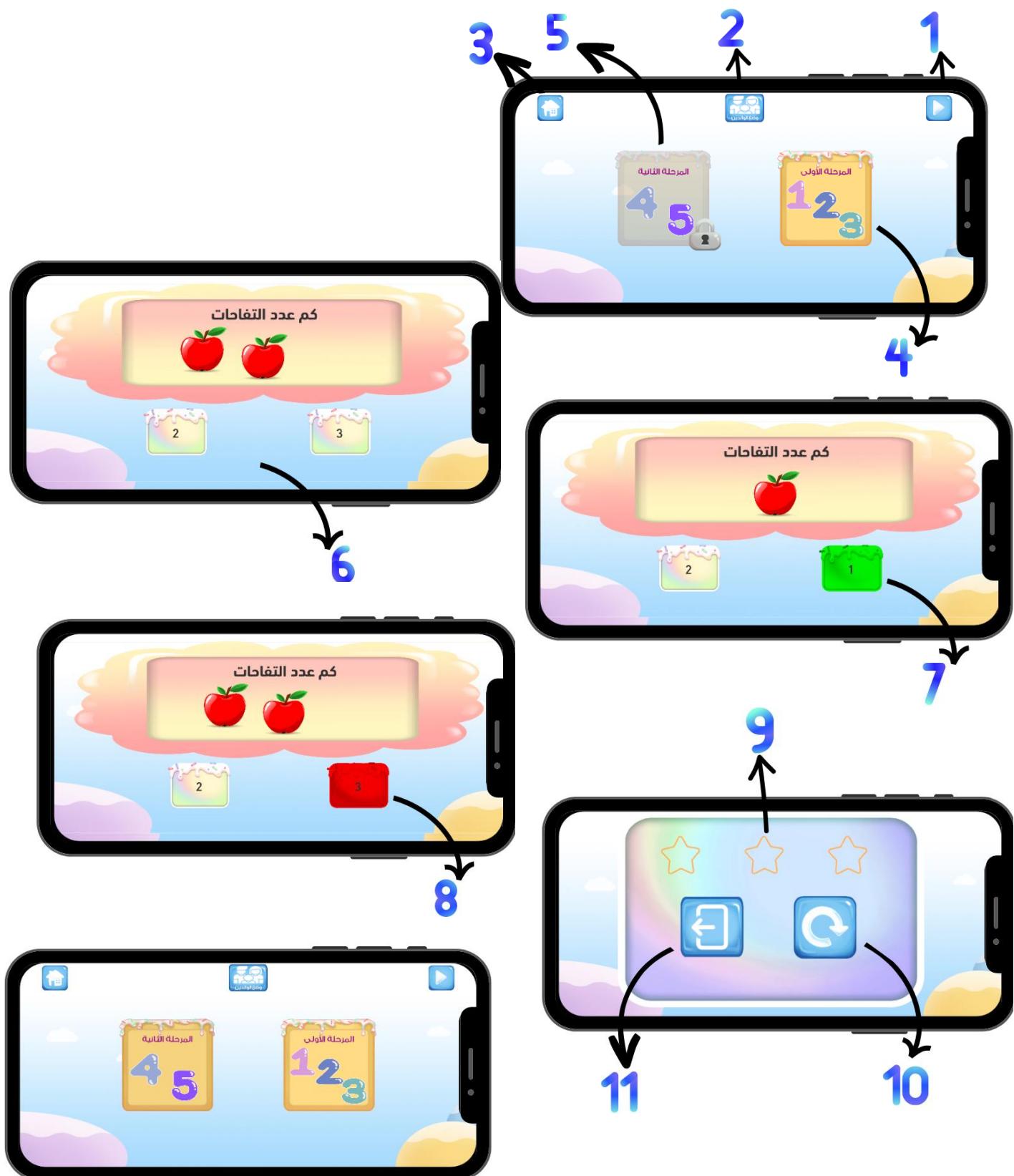


Figure 15-Counting Numbers Game Page Screens



Table 9-Counting Numbers Game Page-Description

No	Description
1	Guardian click this button to go back to the numbers page.
2	Guardian click this button to go to the progress page.
3	Guardian click this button to go to the homepage.
4	Guardian click this button go to the numbers game level one.
5	Guardian click this button go to the numbers game level two after finish level one.
6	Child click one of these buttons to select an answer.
7	If the selected answer is correct the button turns green.
8	If the selected answer is correct the button turns red.
9	The score of the game represented as stars.
10	Child click this button to retry the game.
11	Child click this button to go back to the numbers page.



Figure 16-Letters Page Screen

Table 10-Letters Page Description

No	Description
1	Guardian click this button to go back to the homepage.
2	Guardian click this button to go to the progress page.
3	Guardian click this button to go to the homepage.
4	Guardian click this button to open letters lesson page.
5	Guardian can click this button after finishing the lesson to go to matching letters game page.

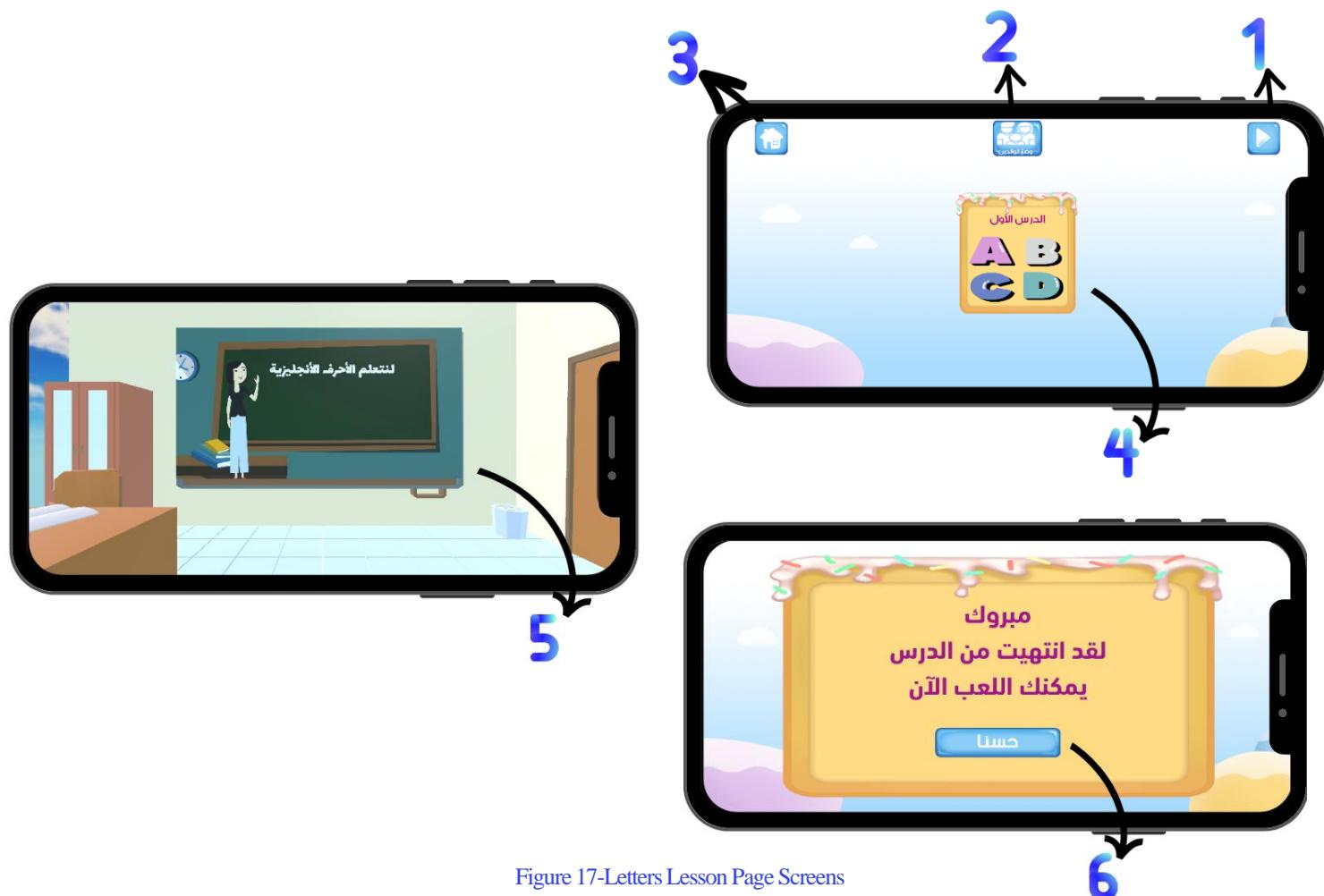


Figure 17-Letters Lesson Page Screens

Table 11-Letters Lesson Page Description

No	Description
1	Guardian click this button to go back to the letters page.
2	Guardian click this button to go to the progress page.
3	Guardian click this button to go to the homepage.
4	Guardian click this button to open VR letters lesson.
5	360-degree VR classroom appear and letters lesson start.
6	Child click this button to go back to the letters page.

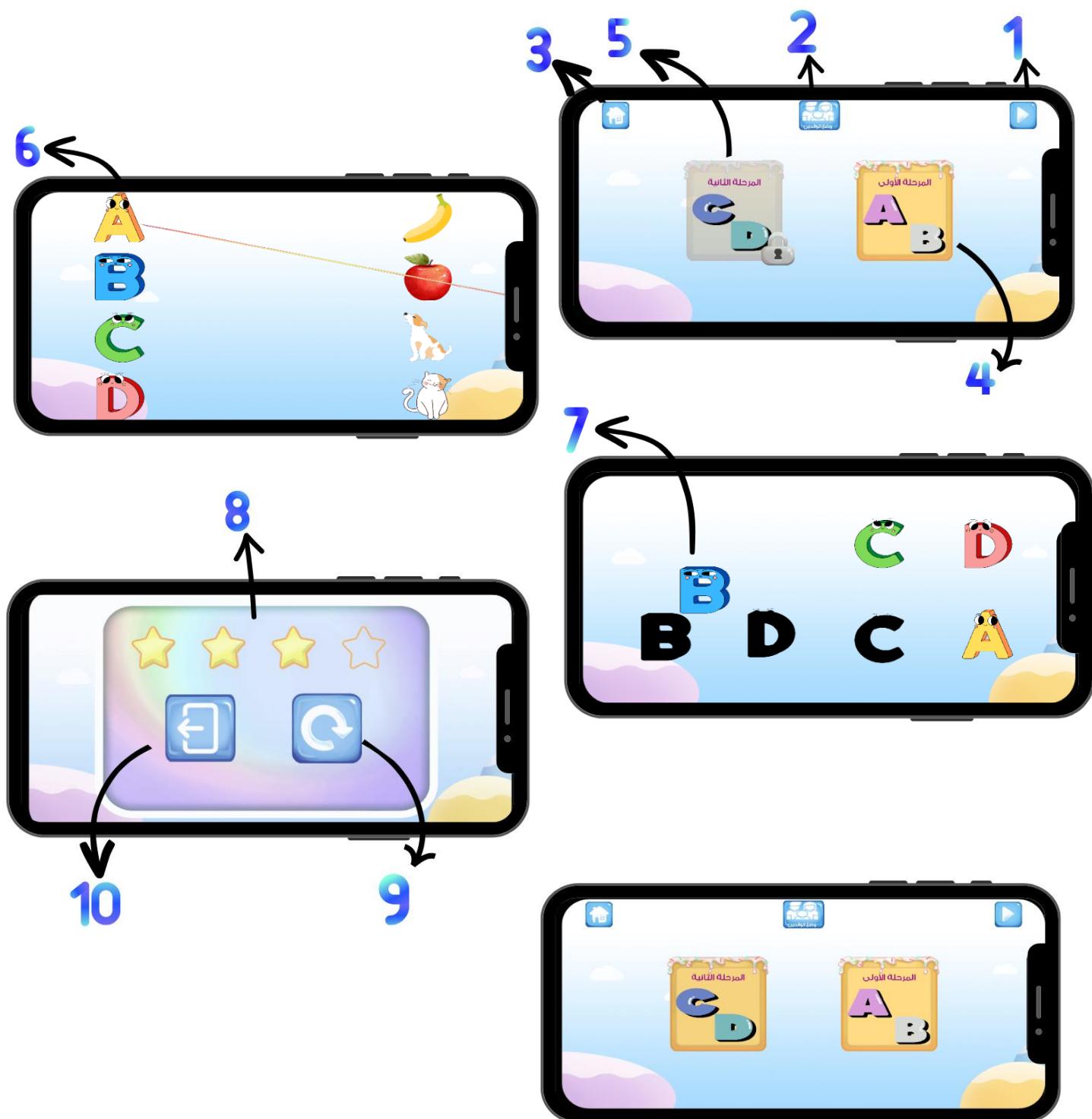


Figure 18-Letters Game Page Screens



Table 12-Letters Game Page Description

No	Description
1	Guardian click this button to go back to the letters page.
2	Guardian click this button to go to the progress page.
3	Guardian click this button to go to the homepage.
4	Guardian click this button go to the letters game level one.
5	Guardian click this button go to the letters game level two after finish level one.
6	Child click one of these buttons to select an answer.
7	Child drag the letters to the correct place.
8	The score of the game represented as stars.
9	Child click this button to retry the game.
10	Child click this button to go back to the letters page.

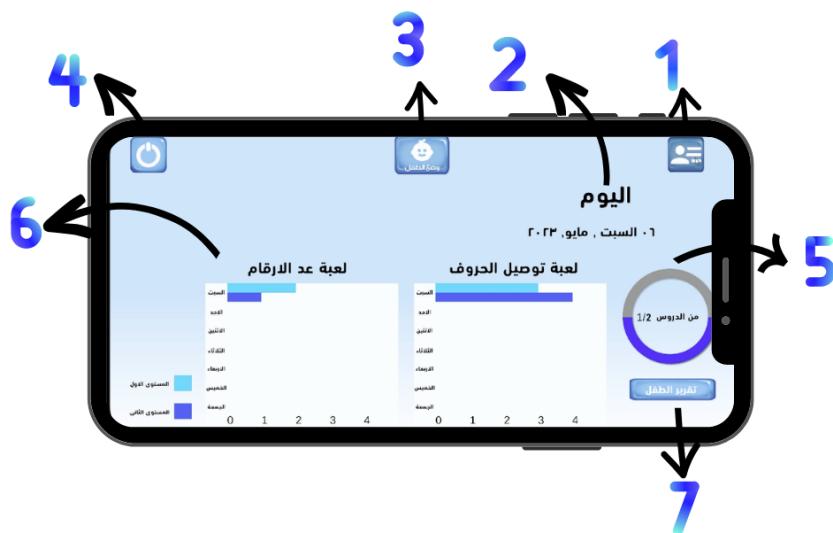


Figure 19--Child Progress Screen



Table 13-Child Progress Description

No	Description
1	Guardian click this button to go to the child profile page.
2	Today's date.
3	Guardian click this button to go to the home page.
4	Guardian click this button to go to logout.
5	Graph showing the number of completed lessons.
6	Graph showing the results of the games for week.
7	Guardian click this button to go to the child report page.

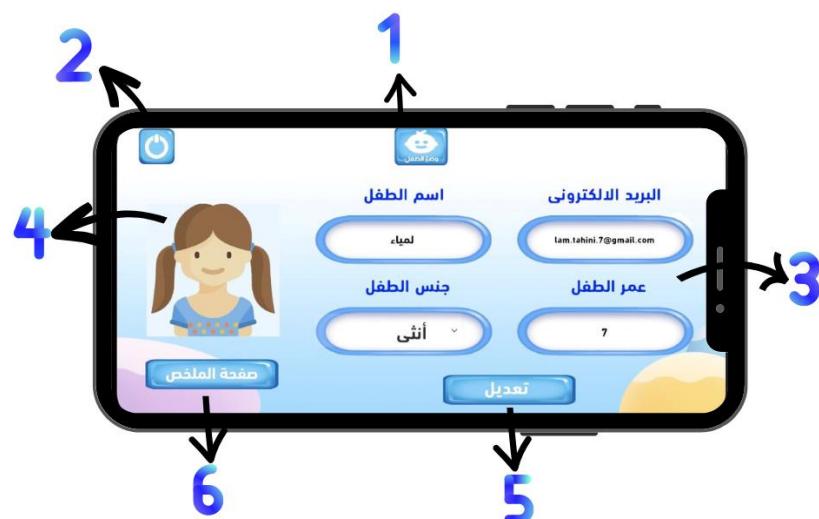


Figure 20-Child Profile Screen

Table 14-Child profile Description

No	Description
1	Guardian click this button to go to the home page.
2	Guardian click this button to go to logout.
3	View child information.
4	Child profile picture and it depend on his or her gender.
5	Guardian click this button to edit child information.
6	Guardian click this button to go to the progress page.

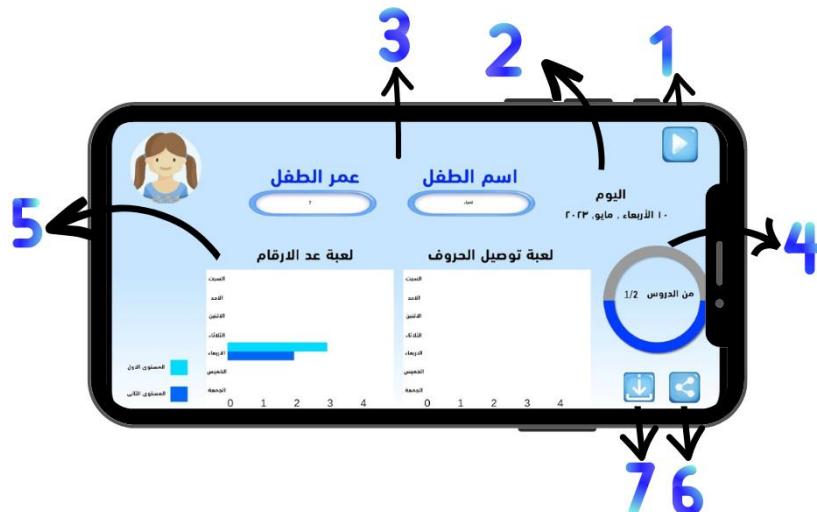


Figure 21-Saving a report Screen

Table 15-Saving a report Description

No	Description
1	Guardian click this button to go back child progress page.
2	Today's date.
3	The name and age of the child.
4	Graph showing the number of completed lessons.
5	Graph showing the results of the games for week.
6	Guardian click this button to share the report.
7	Guardian click this button to save the report.



4.5.1 Design considerations for children with autism

Most games are made with the ordinary person in mind and are intended for the general market. Therefore, the game design principles are inappropriate for dealing with special needs individuals, especially children with autism.

In this section, we will talk about the game design principles that we have applied during our game development and that have made it appropriate for autistic children and facilitated interaction among children with ASD based on consulting with and getting feedback from the specialist.

- Interface and game stuff used are seamless, straightforward, and simple to comprehend and remember, with only a few elements to keep in working memory at any given time.
 - For example, in our app, we avoided cramming too many elements into a single interface, especially for interfaces aimed at children, such as using a tangible interface devoid of distracting elements.
- Provide short game levels to give a sense of accomplishment.
 - For example, we have divided the number range into two short levels to make it easier for children to grasp and give them a sense of achievement.
- Stay away from including overly fantastical and complicated characters.
 - As an illustration, we used a teacher as a character when creating the lessons in our application.
- The game environment and objects mirror environments that children with autism are familiar with.
 - For instance, we used natural objects (animals and fruits) in the lessons and games.
- From a user-centered viewpoint, design aids children with autism based on their learning styles and focuses on their capabilities, requirements, interests, and motivation.
 - Such as, when developing the number counting game, we focused on the autistic child's ability to solve it.
- Elements' colors were chosen based on children with autism needs and with the help of specialist consultation.
 - For example, using primary and dissimilar colors for the letter-matching game simplifies matching.



4.6 Implementation

Autisme is an Android mobile application that targets Arabic-speaking autistic children to assist them in learning letters and numbers in a fun way.

We have encountered multiple issues, obstacles, and difficulties in our project.

Gamification, VR technology and a range of interactions are all used in the Autisme application. On the Unity3D platform, Autisme was created using the C# programming language.

First, using the Unity hub is a platform for managing all the projects the team has uploaded to the cloud. A game engine for creating games, VR, and AR applications is Unity 2021.3.10f1. Our C# scripts were created using Visual Studio.

We planned to use a NoSQL database, as was previously stated in the data design section. We have used the Firebase Realtime Database, which stores and synchronizes data with our NoSQL cloud database. Data is synced across all clients in real time and remains available when our app goes offline. Google's Firebase includes Authentication, Database, Storage, and Hosting. After that, we downloaded the Firebase Unity SDK (`FirebaseDatabase.unitypackage`). And set up Firebase Authentication so our app users can log in with an e-mail and password or create a new account easily [41].

The Autisme application is separated into two primary sections: learning and playing with two primary categories: numbers and letters.

When developing our application, we began the numbers learning, including the counting game, where the autistic child can learn English numbers by watching an animated educational video in an interactive environment using VR.

The animated educational video explaining the numbers was first created using the Powtoon. After the lesson period, the application moves the child to the next page, indicating that the lesson is over and that they are now ready to play the counting game. And the same process goes for the letters category.

We customized a ready-to-use 3D model in Blender, animated it to our needs, and used it as a classroom environment. Following that, the child can interact with the 3D object and watch and hear the video projected in the 3D model. Using a VR headset, the child can tour the scene, including the classroom model. The learning section will provide interactive lessons on English letters and numbers.



For recording the child's progress, we have the progress page that records the child's activities in the game. For example, if the child entered the numbers lesson and watched it, it will appear on the progress page that the child has observed one study out of two.

Also, if the child played the first level of the counting game, its record will be sent to the progress page showing the played level and their score.

In addition, a child profile page displays the child's information, such as name, gender,...etc. The guardians also can save the child's report and send it to the specialist.

The most challenging part of our release was linking the Blender 3D model to Unity and using it as a model in the Unity scene. Furthermore, we encountered too many conflict issues while developing Arabic-supported packages; we were unable to store and retrieve Arabic inputs, so we searched for a solution and then contacted an Arab Unity developer for assistance, who was able to assist us in this matter.

We additionally developed a warning mechanism to ensure that the child watched the lesson. More specifically, the lesson will pause, and a message will be displayed until the child returns to the lesson area and the lesson resumes. This will happen if the lesson begins, and the child moves their head to explore the VR world.

Lastly, the gamification part will educate the child about English letters and numbers in a fun way. The child can play two types of games based on the selected category: one is a letter-matching game, and the other is a number-counting game, each with two levels.

To point out that meeting the autistic children's needs and requirements, we considered the child's ability when we developed level two of the letters matching game, dragging the letter to its shape. We used a suitable dragging area for each letter. More details are provided in the table.

([GitHub Link](#)).



Table 16: 3D model in Blender

Object	3D model in Blender
Description	The 3D model shows a classroom model, and we customized it with colors that appeal to autistic children.



Table 17: TimerLoader function

Function Name	TimerLoader
Description	The time loader functions show the loading bar in the warning page for 5 seconds then login scene is displayed

```
public class TimerLoader : MonoBehaviour
{
    public string LevelToLoad;
    private float timer = 5f;
    //private Text timerSeconds;

    // Use this for initialization
    /* void Start()
    {
        timerSeconds = GetComponent<Text>();
    }*/

    void Update()
    {
        timer -= Time.deltaTime;
        //timerSeconds.text = timer.ToString("f0");
        if (timer <= 0)
        {
            //int currentScene = SceneManager.GetActiveScene().buildIndex;
            SceneManager.LoadScene("LoginScene");
        }
    }
}
```



Table 18: LockNumberPage function

Function Name	LockNumberPage
Description	Releasing the lock from the numbers counting game if the numbers lesson was watched
<pre>Unity Script (1 asset reference) 0 references public class LockNumberPage : MonoBehaviour { public Button button; public GameObject lockbtn; // Start is called before the first frame update void Update() { if (PlayerPrefs.GetInt("LockNumberPage") == 1) { Debug.Log("Coming in if"); button.interactable = true; lockbtn.SetActive(false); } } }</pre>	

Table 19: SetAnswers() Function

Function Name	SetAnswers()
Description	Checking the question with the selected answer if it was correct or not.
<pre>void SetAnswers() { for (int i = 0; i < options.Length; i++) { options[i].GetComponent<Image>().color = options[i].GetComponent<AnswerScript>().startColor; //Debug.Log(QnA[currentQuestion]); options[i].GetComponent<AnswerScript>().isCorrect = false; options[i].transform.GetChild(0).GetComponent<Text>().text = QnA[currentQuestion].Answers[i]; //Debug.Log(options[i].GetComponent<AnswerScript>().isCorrect); if (QnA[currentQuestion].CorrectAnswer == i + 1) { options[i].GetComponent<AnswerScript>().isCorrect = true; } } }</pre>	



Table 20: steps of dragging the letters and the allowed distance.

Description	Dragging the A to its shape in the letters matching game level two

Table 21: DropA() Function

Function Name	DropA()
Description	A function checking the dragged letter and setting the allowed distance to letter A.
	<pre>public void DropA() { float distance = Vector3.Distance(A.transform.position, ADark.transform.position); if (distance < 300) { A.transform.position = ADark.transform.position; //Score.scoreNumber += 1; //carrotBool = true; source.clip = correct[Random.Range(0, correct.Length)]; source.Play(); score += 1; ABool = true; } else { A.transform.position = AInitialPos; source.clip = incorrect; source.Play(); AABBool = true; A.SetActive(false); } }</pre>



CHAPTER5 | SYSTEM EVALUATION



5 System Evaluation

In this chapter, we evaluate our system to find any mistakes and ensure it functions correctly and effectively.

Beginning with the user acceptance testing section, the system is tested and examined to determine whether it satisfies business requirements and is usable by end users.

The Demographics of Participants subsection follows with a breakdown of the UAT testers' demographics.

Following that, we described the questionnaire's responses in the subsection titled "Questionnaire Results".

Additionally, we have described how we tested the non-functional requirements in the quality attributes section.

The discussion section explains our analysis and summary of the testing stage's results.

5.1 User Acceptance Testing

User Acceptance Testing (UAT), also known as End User Testing, is the final stage of the software testing process and lifecycle. UAT is conducted to enable the end-user to check and validate the requirements as well as evaluate whether the application meets the requirements and can be approved.

We formed a testing team of twenty end users (autistic children and their guardians) for our UAT. The children varied in age from 6 to 10. The users were all male. The majority of them did not know English well.

We test the application with each autistic child present, along with a guardian who is skilled in basic technology. The guardian then evaluates how well the guardian's features perform in real-world scenarios. After that, we gave the parent permission to begin the child's application usage. In addition, the Autisme application was tested on a child with autism to see if its features functioned properly.

In order to ensure that we get feedback from Autisme users, we additionally conducted a questionnaire. The questionnaire asks a variety of questions about the application as a way to get feedback from users on the user interface, interaction, usability, and system as a whole.



5.1.1 Demographics of Participants

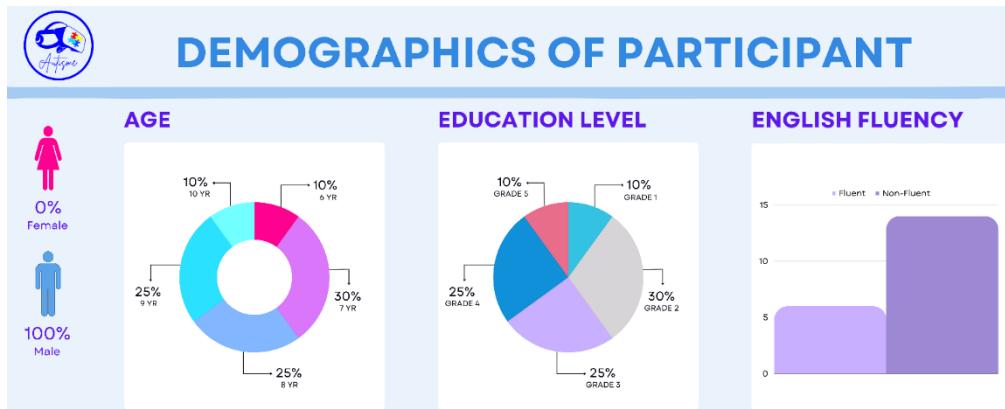


Figure 22: Demographics of Participants

5.1.2 Questionnaire/Interview Results

We chose to use the System Usability Scale (SUS), which is one of the most used questionnaires to measure usability. The way it works is the answers are given points ranging between 1-5, where strongly disagree is given 1, and strongly agree is given 5. To calculate the SUS score we use this formula $(X + Y) \times 2.5$. Where $X = \text{Sum of the points for all odd-numbered questions} - 5$, and $Y = 25 - \text{Sum of the points for all even-numbered questions}$.

Below is the general guideline on the interpretation of SUS score:

Table 22: SUS score interpretation

SUS Score	Grade	Adjective Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 – 68	D	Poor
< 51	F	Awful



Table 23: Illustrative table that shows the frequency for each question

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I think that I would like to use this application frequently.				9	11
2. I found the application unnecessarily complex.	13	7			
3. I thought the application was easy to use				5	15
4. I think that I would need the support of a technical person to be able to use this application.	12	6	2		
5. I found the various functions in this application were well integrated.				8	12
6. I thought there was too much inconsistency in this application	15	5			
7. I would imagine that most people would learn to use this application very quickly.				8	12
8. I found the application very cumbersome to use.	11	9			
9. I felt very confident using the application			1	7	12
10. I needed to learn a lot of things before I could get going with this application.	12	7	1		



Table 24: Participant's SUS scores and their interpretation

Response no	SUS score	Grade	Adjective rating
1	97.5	A	Excellent
2	97.5	A	Excellent
3	80	B	Good
4	87.5	A	Excellent
5	92.5	A	Excellent
6	97.5	A	Excellent
7	90	A	Excellent
8	85	A	Excellent
9	87.5	A	Excellent
10	77.5	B	Good
11	100	A	Excellent
12	80	B	Good
13	72.5	B	Good
14	100	A	Good
15	85	A	Excellent
16	97.5	A	Excellent
17	92.5	A	Excellent
18	100	A	Excellent
19	97.5	A	Excellent
20	100	A	Excellent
Average	90.875	A	Excellent

As the table above shows the SUS score ranged between 72.5 and 100, which is based on the above mentioned guidelines, this means that the system's usability is excellent.



5.2 Quality Attributes (NFR testing)

Table 25: Quality Attributes (NFR testing) [42]

User story	Quality Attribute	Measure	Results
As an autistic child, I want to learn how to use the main functionalities of the system within 10-20 minutes so that I can easily navigate its interface.	Usability: How the system is easy to learn and use?	The Autistic child should be able to learn how to operate major system functionalities within 20 minutes.	<ul style="list-style-type: none">We tested on 20 children we measure the Usability by how many completed the task. We tested 3 main features: letters lesson, counting number game, and matching letters game.20 out of 20 children complete the lesson successfully. $20/20=1$20 out of 20 children complete the counting number game successfully $20/20=1$18 out of 20 children complete the matching letters game successfully $18/20=0.9$
As an autistic child ,I want the application's response time between 1 to 30 seconds at most, so that I can interact with the system features quickly.	Performance: How quickly and predictably the system responds to user input or other events?	The application's response time should range between 1 to 30 seconds.	<ul style="list-style-type: none">For each child we measure the performance of the system using a timer tool. From the result, we found that the maximum time of each task was 20 sec, and the minimum was 500 milliseconds,



As an autistic child, I want the application to be available 24 hours a day, so that I can play whenever I want.	Availability: Is it available when and where I need to use it?	The application should be available for users 99% of the time.	<ul style="list-style-type: none">Our application depends on Firebase which is available 99.95% of the time [43].Which lead us to the fact that the availability of the application is going to be > 99.
As an autistic child, I want the application to provide 99.9% accurate information so that I can learn correct information.	Accuracy: measure how the provided information is accurate.	The application should provide 99.9% accurate information.	<ul style="list-style-type: none">Application lesson and games content all depend on English alphabetic and numbers. it's all accurate information
As an autistic child, I want the application support Arabic language, so that I can learn easily in my Native language.	Supportability: How will the system support Arabic language.	The application should be supported with Arabic language.	<ul style="list-style-type: none">All Application instruction and titles supported by Arabic language



5.3 Discussion

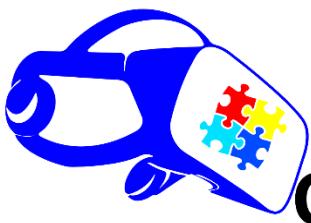
Starting With the user acceptance test, we found out that all our requirements met our goal in testing the Autisme application.

The result of the test was successful. Our participants were 20 autistic children, all males between the ages of 6 and 10 years. 13 were between 6 and 8 years old, and the other 7 were 9 to 10 years old. Their educational levels varied: two were in the first grade, six in the second grade, five were in the third grade, five were in the fourth grade, and the last two in the fifth grade. In terms of their English level (fluent or not), five of them were fluent, while the other fifteen were not.

The method we used to be questionnaire because we believe it is the most suitable method for our project. We decided to use the System Usability Scale (SUS), one of the most used tools for measuring usability. Our participants were 20 specialists in autism (guardians of the 20 autistic children). The questionnaire results show that the System Usability Scale (SUS) ratings ranged from 72.5 and 100. This means that the system's usability was excellent.

For our non-functional requirements we measured Usability, Performance, Availability, Accuracy, and Supportability. For the usability we tested on the 20 children by how many could complete the task we give them on 3 main features. On the letters lesson all of them passed successfully, On the counting number game they all also passed the test, and on the matching letters game 18 out of 20 passed successfully. For the Performance the application's response time ranged between 1 to 30 seconds. We measure the time of the performance for each child. The result was very successful, we found that the range time of each task was between 500 milliseconds and 20 seconds. Then we have Availability which means that the application should be available for users 99% of the time. Since it depends on firebase database. We found out the result was successful. For the Accuracy we talk about the accurate information that were provided in the application. All the information that are in the application are basic and common knowledge (English alphabetic and numbers). Last, we have Supportability the application should be supported with Arabic language. We designed our application instruction and titles in Arabic.

The tests results are good, and we are delighted with that. However, we believe that there is a possibility for improvement. For example, we can add the number of participants with different ages, gender, location, and knowledge.



CHAPTER6 | Conclusions & Future Work



6 Conclusions and Future Work

When you reach this section of the document, you have almost gone through all the stages of the Autsime project, which we will summarize for you to recall its entertaining stages.

In this document, we explain our application, "Autisme", which aims to teach autistic children English letters and numbers and improve their knowledge of the language.

The focus of our application is to educate autistic children in an interactive environment by using virtual reality (VR) technologies to make the child's experience learning English letters and numbers more enjoyable and entertaining. This method of learning helps kids with autism learn English letters and numbers in an efficient way.

In addition, the adoption of virtual reality in education is much better than the traditional method of learning in regular schools.

Also, the method allows them to immerse themselves in the virtual environment and improve other skills.

In the introduction chapter, we presented the questionnaire to collect project requirements, and based on its result, we defined the functional and nonfunctional requirements along with the main system models, including the use case diagram and class diagram.

In the background chapter, we discuss what VR is, how it helps autistic children, the level of autism in children, and why Android is used.

In the Literature Review chapter, we collected studies of the obstacles to traditional education faced by children and the ways in which children are being taught with virtual techniques, as well as the schools they attend.

In the system design chapter, we defined the architecture that best suits our project and drew a diagram of it. Then we designed the entity relationship (ER) for the data design.

In addition, we defined the detailed system design, which includes an activity diagram and pseudocode. Then we designed the user interface, and we have defined it in two diagrams, which are the sitemap and the user flow diagram. In the system implementation section, we presented the implementation stages that have been conducted in the Autisme application.

Lastly in the system evaluation chapter we evaluate our system functions using user acceptance testing, Demographics of Participants, Questionnaire Results, NFR testing and all of our analysis and summary from the testing stage's results explained in the discussion section.



- Global and Local Impact.

- Local Impact

Children in Saudi Arabia with autism spectrum disorders will be significantly affected by the Autisme application; it will increase their understanding and enthusiasm for learning English letters and numbers.

By adopting VR equipment and technology to teach Saudi autistic children the English alphabet and numbers, parents may provide their kids with a more motivating and efficient at-home education. Additionally, the educational lessons and games will raise the thinking and learning strengths of Saudi autistic children.

- Global Impact

Autisme application will boost the Arab community in the field of applications that support VR technologies and autism; Autisme, will also promote the value of learning English letters and numbers among autistic Arabic children.

- Problems and challenges encountered during software development.

- Unity is a new technology for us, and with game development and a lack of related sources, also hard to find assets and suitable UI for our application.
 - Unity is not supported for the Arabic language, since our project content on Arabic so we had to look up an Asset that helped us. We faced another problem with the database not saving information in Arabic, so we had to look for packages that helped with this problem.
 - VR headset didn't implement correctly with Unity Hub, so we had to look for an asset that perfectly helped us with connect it Unity Hub



- Limitations of the system.

The Autism application satisfies the requirement for teaching English letters and numbers to autistic kids. However, because of the time constraints we face our small scope, our application is limited by the following limitations:

- It only supports the Arabic language.
- Educate only the English language (letters and numbers) and will not cover all of them.
- It only supports Android users (Play Store).
- Notifications in the background are not supported.
- Each section will provide one lesson and a game with two levels.

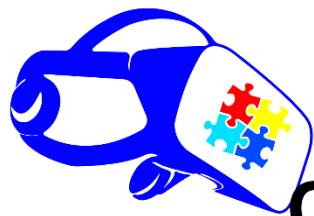
- The main contribution of the project.

Our effort contributed to the field of education by teaching autistic children about English letters and numbers. The use of VR technology to aid the learning process is simple to use and comprehend. The children's progress will be documented in a report that the guardian can access anytime. With innovative technologies, we want to improve the educational process for autistic children.

- Future work.

The future work of this project will be to implement:

- New lessons to cover all English letters and numbers (from 1 to 10) with new levels of challenging games.
- Expansion into new context concepts such as colors, shapes, basic mathematics, and vocabulary.
- The ability for Adding multiple children under the same guardian.
- It to be available online so that children from around the world can be competitive with each other.



CHAPTER7 | Acknowledgements



7 Acknowledgements

First, we thank Allah for giving us the strength, knowledge, and opportunity to develop this project. We thank everyone who supported and helped us accomplish our Autism ask.

We want to take this opportunity to show our humble gratitude and appreciation to our supervisor, Dr. Sahar Bayoumi for her advice and guidance bestowed upon us, her unlimited efforts, and her kind and encouraging words throughout the work of our graduation project.

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CHAPTER8 | References



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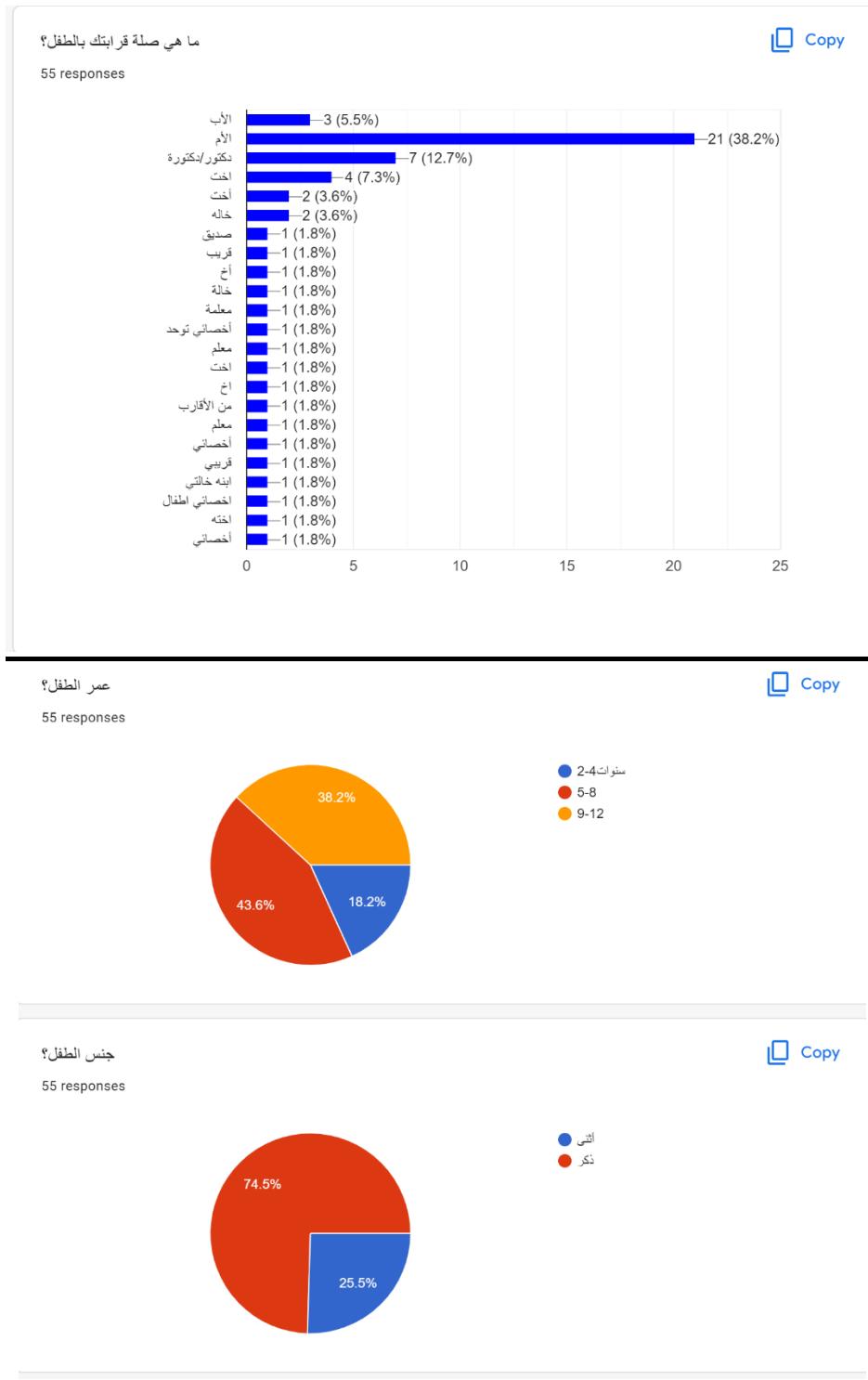


CHAPTER9 | Appendix



9 Appendices

9.1 Appendix A

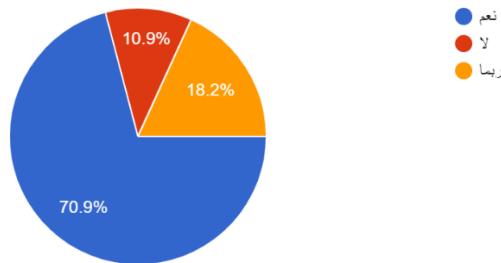




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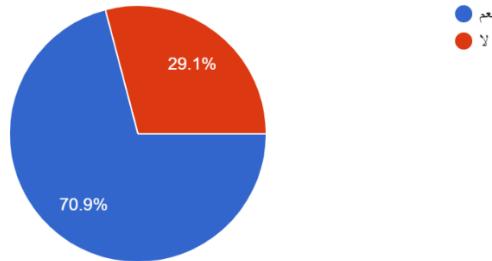
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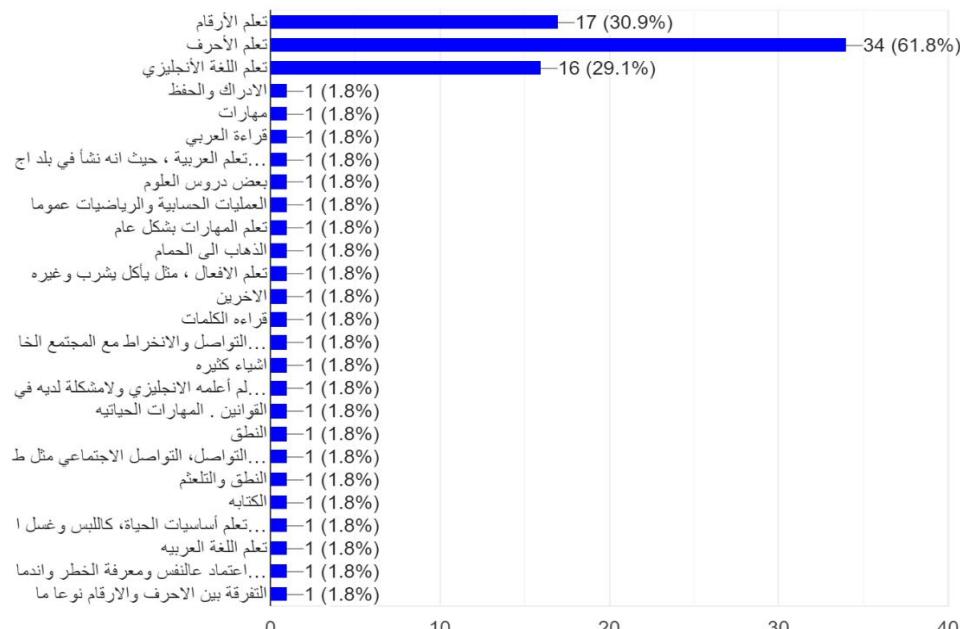
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ما رأيك ما هي الصعوبات التي يواجهها طفل التوحد؟

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إذا كانت إجابتك على السؤال فيما سبق (نعم)، فما هي التطبيقات أو التقنيات التي استخدمتها؟

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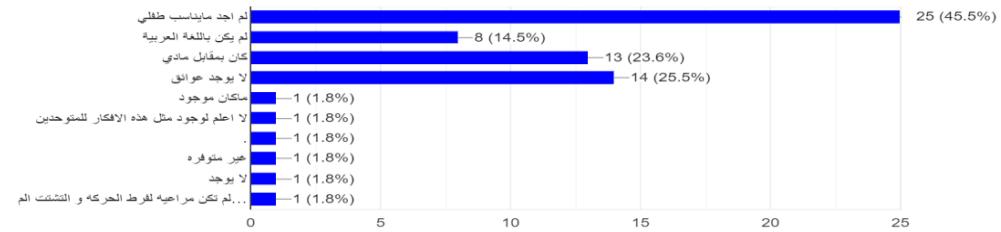
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ردود سؤال إذا كانت إجابتك على السؤال فيما سبق (نعم)، فما هي التطبيقات أو التقنيات التي استخدمتها؟

اليوتوب والمجلات والصور لتعديل السلوك وتعلم الكلام والمصحف الناطق لتحفيظ القرآن الكريم

الفيديوهات وتطبيقات تهتم بنظام التواصل من خلال الصور

تطبيقات تعليمية ترفيهية على الآيياد

تقنيات المحاكاة على تطبيق

اليوتوب

تطبيقات القراءة للحروف والأرقام

الحاسب وبعض البرامج التعليمية

فيديوهات يوتوب للأرقام والجمل

يصعب التركيز لمدة طويلة على الشاشة

السبورة التفاعلية

انشيد تعليميه مع التردد

الأنشطة الحركية

الواقع المعزز

المجاز

الصور

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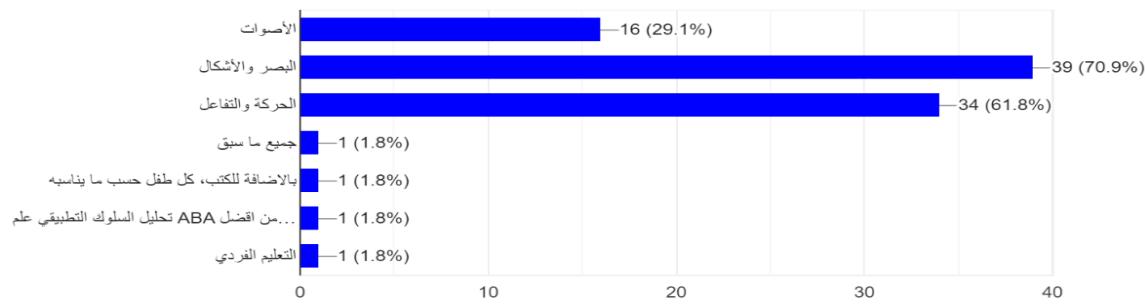
38 رد من الردود لم يسبق لهم استخدام تطبيقات أو تقنيات



ما أنساب طرق التعليم لطفل التوحد؟

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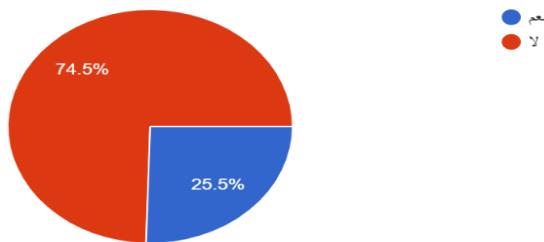
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هل وسق استخدمت الواقع الإفتراضي أو تقنيات أخرى لتعليم طفلك؟

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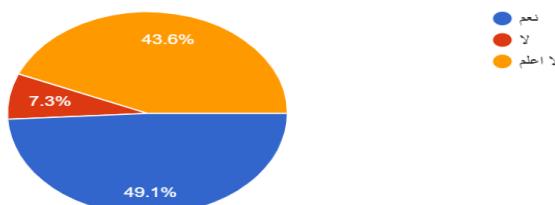
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هل تعتقد/ين تجربة الواقع الإفتراضي نافعه ومفيدة لطفلك؟

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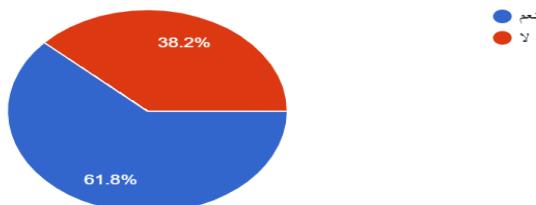
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هل لاحظت/ لاحظتي اثر ايجابي عند استخدام الواقع الإفتراضي أو التقنيات الأخرى؟

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هل هناك اي خاصية او اقتراح تود /تودين اضافتها في تطبيقنا ارجو ذكرها

28 responses

ان يكون المحتوى واضح (المشارع او التعبيرات تكون جيدة مثلا عند عمل شيء صحيح يتسم عند التشجيع وليس الضحك بالصوت العالي او عمل حركات

ووجدت تطبيقات تفيد طفل لكن يقاد جميع الأشياء حتى الضحك العالي وردة الفعل

يكون التطبيق يعتمد على تعديل السلوك وكيفية تعلم المهارات الحياتية

ان يكون جميعه باللغة العربية جميع الشخصيات او الايقونات بدون وجود اي شيء غير ناطق لأن الطفل يقاد الغير ناطق ويستك يعجب بالشخصية او الشيء الذي بالفعل بدون الكلام

لا شكر

.

طرق تعليم متنوعة

تعلم الطفل بشكل اسرع

More visuals and pictures will help them to learn more, autism kids love visuals

ان يكون المحتوى واضح (المشارع او التعبيرات تكون جيدة مثلا عند عمل شيء صحيح يتسم عند التشجيع وليس الضحك بالصوت العالي او عمل حركات وجدت تطبيقات تفيد طفل لكن يقاد جميع الأشياء حتى الضحك العالي وردة الفعل يكون التطبيق يعتمد على تعديل السلوك وكيفية تعلم المهارات الحياتية ان يكون جميعه باللغة العربية جميع الشخصيات او الايقونات بدون وجود اي شيء غير ناطق لأن الطفل يقاد غير الناطق ويستك يعجب بالشخصية او الشيء الذي بالفعل بدون الكلام ليكون أوضح وأشمل لك اخضاعي تربية وأفضل بوضع مدة استخدام البرنامج مع الأطفال او إضافة خاصية انه بعد 10 د مثلا او ربع ساعة بفصل البرنامج لأن أثر الشاشات عليهم كبير. الله بقوكم وبال توفيق

اولاً الفكرة رائعة وابداعية وخرافية اقترح ان يعزز التواصل مع الناس، مثل تكون هناك شخصيات يتواصل معها تعلم او تحفز الطفل للاستمرار، حيث ان غالبية المتوحدين يفضلون الاجهزه والتكنولوجيا الحديثة على التواصل البشري المباشر، فأخشى ان يكون ادماناً لهم

More visuals and pictures will help them to learn more, autism kids love visuals

أسأل الله لكم التوفيق، فكره ممتازة جداً جداً

تكوين بيئه دراسية مناسبه لهم

طرق تعليم متنوعة

عدم توفر مراكز حكومية خاصة بالتوحد

اتمنى يكون تواندي ومرافق ترفيهية وتربيوية مساندة مجاناً لأطفال التوحد بعد المدارس والمراكم

يوفرون مراكز مجانية للذى ما عندهم استطاعة وفي كثير ما يقدر ن على رسوم المراكز المبالغ فيها



9.2 Appendix B

Interview 1:

الاسم: أ. أبرار حمد العمل: معلمة في برنامج التربية الخاصة فصول مدمجة في مدارس التعليم العام	ما هو نوع التوحد؟
بسیط/متوسط/اسبرجر	ما هي المهارات التي لا يجد طفل التوحد صعوبة فيها؟
يختلف باختلاف قدرات الطفل	ما رأيك باستخدام تقنية الواقع الافتراضي لتعليم طفل التوحد؟
تفيد بحسب ميول الطفل ذوي التوحد وقدرته في مهارات الادراك والانتباه والتركيز	ما هي الألوان التي يفضلونها أطفال التوحد؟
الألوان الهادئة	ما هي الأشياء التي ينجذب لها طفل التوحد عن التعلم؟ وما هي الأشياء التي لا ينجذب لها؟
يختلف باختلاف الحالة، ولكن غالباً ينتبه للمثيرات المتحركة في خلفية ثابته بدون مشتتات لا ينجذب للأشياء المتدخلة والأصوات المزعجة	هل هناك عدد معين لوجود الأشخاص حول طفل التوحد؟
يختلف باختلاف الحالة وقدرات الطفل، ولكن الأفضل شخص واحد	هل تتوقعين أن تعليم الطفل بتقنية الواقع الافتراضي أفضل من التعليم بالطرق التقليدية
بحسب قدرات الأطفال البعض قد يفيده الواقع الافتراضي والبعض قد لا يستجيب لها أبداً	

Interview 2:

الاسم: والدة طفل توحد ما هو نوع التوحد؟	اسبرجر وهو المستوى الثالث من اضطراب التوحد الذي يتطلب دعم كبير جداً
ما هي المهارات التي لا يجد طفل التوحد صعوبة فيها؟	يختلف باختلاف قدرات الطفل
ما رأيك باستخدام تقنية الواقع الافتراضي لتعليم طفل التوحد؟	ممكن تناسب الأطفال، لم يسبق لطفي التجربة، ولكن عادةً الأطفال ينجذبون للأشياء التقنية
ما هي الألوان التي يفضلونها أطفال التوحد؟	اللون الرمادي والألوان الخافتة تعتبر مفضله عند طفل التوحد
ما هي الأشياء التي ينجذب لها طفل التوحد عن التعلم؟ وما هي الأشياء التي لا ينجذب لها؟	كل الأمور ينجذب لهاأطفال التوحد تختلف باختلاف الطفل
هل هناك عدد معين لوجود الأشخاص حول طفل التوحد؟	على حسب نوع التوحد وأصعب نوع هو اضطراب التوحد وهو المستوى الثالث لأن لديه قصور حاد في مهارات التواصل الاجتماعي اللغوي لكن غالباً يفضلون وجود القليل من الأشخاص
هل تتوقعين أن تعليم الطفل بتقنية الواقع الافتراضي أفضل من التعليم بالطرق التقليدية	لا اعلم، من رأيي يجب ان يكون شيئاً يحبه ميول الطفل لكي يلفت انتباهه ويركز مع التدريب



Interview 3:

الاسم: أ. جواهر العمل: أخصائية توحد	ما هو نوع التوحد؟
بسيط/ متوسط / اسبرجر	ما هي المهارات التي لا يجد طفل التوحد صعوبة فيها؟
يختلف على حسب الطفل	ما رأيك باستخدام تقنية الواقع الافتراضي لتعليم طفل التوحد؟
اراء انها مفيدة ونافعة وجذابهم لهم	ما هي الألوان التي يفضلونها أطفال التوحد؟
بشكل عام الدمج ما بين الألوان الساطعة والألوان الخافتة هي الألوان الأكثر شعبية	ما هي الأشياء التي ينجذب لها طفل التوحد عن التعلم؟ وما هي الأشياء التي لا ينجذب لها؟
الأشياء الحسية وتجربة الأشياء التي لا ينجذب لها له التلقيم والتنظير	هل هناك عدد معين لوجود الأشخاص حول طفل التوحد؟
لا كل طفل يختلف عن الآخر	هل تتوقعين أن تعليم الطفل بتقنية الواقع الافتراضي أفضل من التعليم بالطرق التقليدية
برأيي أفضل لأن الطفل ينجذب	



9.3 Appendix C

جامعة الملك سعود (034)

المملكة العربية السعودية
ص.ب. 22452 الرياض
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أقسام العلوم والدراسات الطبية

طلب إفادة

إلى من يهمه الأمر
السلام عليكم ورحمة الله وبركاته،،، وبعد

نُفيد سعادتكم بأن طالبات بكالوريوس قسم تقنية المعلومات في كلية علوم الحاسوب والمعلومات
بجامعة الملك سعود يعملن على مشروع تخرج بعنوان (Autisme) وهن:

Supervisor	Dr. Sahar Bayoumi	
Group members	Lamia Altuhibi	441201243
	Rana alhababi	441200908
	Ruba alabdulai	441200817
	Reemah alshehri	438201708

وقد اعطيت هذه الإفادة بناءً على طلبهن.

وتقبلوا خالص التحية والتقدير،،،

رئيسة قسم تقنية المعلومات المكلفة

د. بسم بنت عبدالعزيز الصقر



(موافق)

(مذكرة)

(ملاحظات)



طلب إفادة

الموقرة

سعادة مديره مركز أجيال التخصصي / أ. نوف السعدي

السلام عليكم ورحمة الله وبركاته،،، وبعد

نُفيد سعادتكم بأن طالبات بكارلوريوس قسم تقنية المعلومات في كلية علوم الحاسوب والمعلومات
بجامعة الملك سعود يعملن على مشروع تخرج بعنوان (Autisme) وهن:

Supervisor	Dr. Sahar Bayoumi		
Group members	Lamia Altuhini	441201243	
	Rana alhababi	441200908	
	Ruba alabdulai	441200817	
	Reemah alshehri	438201708	

وقد اعطيت هذه الإفادة بناءً على طلبهن.

وتقبلوا خالص التحية والتقدير،،،

رئيسة قسم تقنية المعلومات المكافحة

د. بسم بنت عبدالعزيز الصقير



ملاحظات

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الملفات المطلوبة لمشروع طالبات جامعة الملك سعود RE:

KA

Khulood Alharbi <kAlharbi@apd.gov.sa>

لها، الطحيني

Cc sahali@KSU.EDU.SA; Dr. Manal AlMakoshi

Reply Reply All Forward

Thu 9/29/2022 8:17 AM

السلام عليكم ورحمة الله وبركاته،

تحية طيبة

تم التواصل مع عدد من الجهات المذكورة في الملف وقد أبدوا عن رغبهم في دعم مشروعكم البعض.

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تحياتي



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