People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
University of 8 Mai 1945Guelma

Faculty of Psychology and Educational Sciences
Department of Psychology
Domiciliation laboratory: **Research Laboratory in Social Sciences E1090800**
Skikda University

Thesis

Submitted in Candidacy for the Degree of *Doctorate in Third Cycle*

Field: Social Sciences Stream: **Psychology**
Speciality: Clinical Psychology

Presented by:
Bouhidel Chouaib

Title

The effectiveness of playing by using virtual reality technology in developing the skills of children with autism spectrum disorder

Defended on : ……..... Before the jury composed of:

Full name	Rank	University
M. BRAHMIA Samira	Professor.....	Univ. of 8 may 1945-Guelma.....President
Mr.BEHTANE Abdelkader	Professor.....	Univ. of 8 may 1945-Guelma.....Supervisor
Mr.BOUKHEMIS boufoula	Professor.....	Univ. of Batna 2.....Examiner
Mr SNANI Abdenacer.....	.... Professor.....	Univ. of Badji Mokhtar.....Examiner
Mr TOUATI Ibrahim Issa...	Associate Professor A	Univ. of 8 may 1945-Guelma.....Examiner
Mr Ben Cheikh Rezkia...	Associate Professor A	Univ. of 8 may 1945-Guelma.... .....Examiner

Academic year: 2023 / 2024

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IN THE NAME OF ALLAH, THE MOST
BENEFICENT, THE MOST MERCIFUL.

"Thanks and gratitude"

I thank God Almighty for His success and gratitude, and I pray and greet the Messenger as a mercy to the worlds, our Prophet Muhammad, the Seal of the Prophets and Messengers, and to all his family and companions, who taught us that the best work is "persistent, even if it is small."

I thank my generous parents for their encouragement, and my wife for her support and encouragement.

I thank Professor Abdelkader Behtane for his support, guidance and supervision of this thesis.

And everyone who supported me from near or far.

I thank the Constantine 2 Center and all its professional staff who gave me the opportunity to conduct the field study.

Thank you very much..

Dedication

« I thank Allah Almighty for His success and blessings.

I dedicate this scientific research to the following individuals, above all others: our courageous brothers in Palestine, my parents, my wife, my brothers, my sisters, my teachers, and everyone who supported me in completing this work, whether near or far.

I also dedicate this work to all individuals with determination in general, and specifically to children with autism spectrum disorder and their parents.

I hope that this research will contribute to the scientific work being conducted at Algerian universities.. »

The effectiveness of playing by using virtual reality technology in developing the skills of children with Autism Spectrum Disorder

Done by: BOUHIDEL Ch. Directed by: Pr. BÈHTANE. A

Abstract:

Technological mediums are so propagated more than ever. In this context, and as part of the experimental approach, the study aims to apply virtual reality technology, in particular, the virtual screen with a sample (M: 6; age : [7, 12]) of children with autism spectrum disorder to stimulate and develop social, communicative and emotional learning skills.

The duration of the experiment lasted about three months. Two modes of measurement were applied: before and after the use of the Childhood Autism Rating Scale (CARS: Reichler, Schopler, & Rochen-Renner, 1971) to prove the effectiveness of virtual reality technology with the studied sample.

The findings showed the significant effectiveness of virtual reality technology in the development of communicative, emotional and social educational skills in the study sample.

***Keywords**: game, virtual reality, development, skill, ASD, social interaction, communication, emotion.*

فعالية اللّعب باستخدام تقنية الو اقع الافتراضي في تنمية مهارات الأطفال المصابين باضطراب طيف التوحد

إعداد: طالب الدكتوراه بوهيدل شعيب تأطير: البروفيسور بَهتان عبد القادر

ملخص:

لقد انتشرت الوسائط التكنولوجية أكثر من أي وقت مضى. في هذا السياق، وفي إطار المنهج التجريبي، تهدف الدّراسة إلى تطبيق تقنية الواقع الافتراضي سيما "الشاشة الافتراضية" على عيّنة (ذ: 6؛ السن: [7 - 12]) أطفال مصابين باضطراب طيف التوحد من أجل تحفيز وتنمية المهارات التعلّمية الاجتماعية والتواصلية والانفعالية.

امتدت مدة التجريب إلى حوالي ثلاثة أشهر. و وزّعت خلالها جلسات اللّعب التعليمي.بحيث تم تطبيق قياسين: قبلي وبعدي باستعمال سلم تقييم التوحد الطفولي (CARS) لإثبات مدى فعالية تقنية الواقع الافتراضي بالنسبة للعينة قيد الدّراسة.

أفرزت النتائج دلالة فعالية تقنية الواقع الافتراضي في تنمية مهارات تعلّمية، وتواصلية، وانفعالية، واجتماعية لدى العيّنة قيد الدّراسة.

كلمات مفتاحية: لعب، واقع افتراضي، تنمية، مهارة، اضطراب طيف التوحد، تفاعل اجتماعي، تواصل، انفعال.

L'efficacité du jeu utilisant la technique de réalité virtuelle dans le développement des compétences des enfants atteints de *Trouble Du Spectre Autistique*

Réalisée par : BOUHIDEL Ch. Dirigée par : Pr. BÈHTANE. A

Résumé:

Les médiums technologiques sont tellement propagés plus que jamais. Dans ce contexte, et dans le cadre de l'approche expérimentale, l'étude a pour but d'appliquer la technologie de la réalité virtuelle, notamment l'écran virtuel à un échantillon (G : 6 ; âge [7,12]) d'enfants atteints de *trouble du spectre autistique*, afin de stimuler et de développer les compétences d'apprentissage sociales, communicatives et émotionnelles.

La durée de l'expérimentation s'est étendue sur environ trois mois. Deux modes de mesures ont été appliquées : avant et après l'utilisation de l'échelle d'évaluation de l'autisme infantile (CARS : Reichler, Schopler, & Rochen-Renner, 1971) pour prouver l'efficacité de la technologie de réalité virtuelle chez l'échantillon étudié.

Les résultats ont montré l'efficacité significative de la technologie de réalité virtuelle dans le développement des compétences éducatives communicatives, émotionnelles et sociales chez l'échantillon étudié.

Mots-clés : *jeu, réalité virtuelle, développement, compétence, TSA, interaction sociale, communication, émotion.*

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Introduction-Problematic:

The lives of humans today are becoming more complex than before. Numerous factors contribute to this complexity. For instance, the demands of daily life, the multitude of occupations across various sectors, and the aspiration of many individuals to lead a dignified life. However, these factors can sometimes lead to stress and psychological issues. In certain cases, these issues can escalate into psychological disorders, as indicated by various scientific studies. Research suggests that stress and depressive tendencies are more prevalent now than in the past, manifesting in multiple settings such as families, workplaces, colleges, and universities (Acharya et al., 2018).

The persistent problems, of course, can lead to disorders if prolonged. This is precisely what is happening today: the spread of illnesses is manifesting clearly at a rate that did not exist before. This has drawn the attention of researchers and scientists to this topic, motivating them to understand the underlying causes of these disorders. Among these disorders is autism spectrum disorder, where the rate of children with ASD has increased in recent decades. Therefore, this issue requires more attention and greater efforts to find effective and successful methods to help these children adapt and interact appropriately in their environment, as well as improve their language and communication skills.

Many methods exist, but the majority of the interventions that have been utilized have employed behavioral methodologies and have achieved varying degrees of success in improving outcomes (Parsons & Mitchell, 2002). In Algeria, the prevalence of children with ASD in 2018 was 500 thousand (Algerian radio, 2018). The World Health Organization's website states that one child out of every 160 children worldwide suffers from autism spectrum disorder (WHO, 2019). For example, in the USA, 1 out of 68 children had ASD in 2014, while in India, the ratio was 1 out of 250 in the same year (Lahiri et al., 2015). Many other countries are also grappling with this disorder. The increasing prevalence in reality indicates a significant threat that many people either overlook or do not give enough importance to the statistics provided by national and international organizations. Some studies that have been rigorously conducted suggest that the actual prevalence rate may be higher than reported. Additionally, the prevalence of autism spectrum disorder in many low-income countries with limited resources often goes unrecognized (WHO, 2019), the factors that contribute to the spread of these disorders include neglect of the issue and ignorance of its causes due to a lack of scientific research.

Psychologists need to develop effective therapeutic programs and tools to reduce symptoms of autism spectrum disorder, help children with ASD integrate into their social environment, and improve their communication and language skills. While there are many methods available to assist children with ASD, their effectiveness varies from child to child. This has prompted the student researcher to create educational methods specifically tailored to each child with ASD in order to enhance their language and communication skills, especially when intervention occurs at an early age (Parsons & Mitchell, 2002), but of course, the student researcher will control the using of VR game in order to prevent any kind of addiction, or any other undesired behaviors(Parsons & Mitchell, 2002), through VR

and play by using it, and basing on some play theories, development theory, and behavioral theories, the virtual reality can be considered as new experimental tool as Wilson described it (Wilson & Soranzo, 2015), The researcher aimed to investigate the effectiveness of using virtual reality glasses in a controlled environment for treating children with ASD. While games today serve various purposes such as entertainment, education, and simulation, the researcher sought to develop a game specifically tailored as a therapeutic and educational tool for children with ASD. Unlike existing games, which are primarily scenarios designed by experts for teaching or treating necessary skills, this study focused on creating an interactive game to aid in the care of children with ASD.

Various theories, including Pavlov's theory, Watson's behaviorism, Skinner's theory, Thorndike's theory, and others, offer psychologists different approaches to learning and treating disorders. Building on these theories, a new method was devised to reduce ASD symptoms, involving the development of an educational game to be experienced through virtual reality glasses. Extensive research and references were utilized to design the game, incorporating diverse educational programs.

The study recognized the significant impact of modern technology on human cognition and behavior. By harnessing these tools effectively, individuals can enhance their skills and capabilities. This thesis specifically focuses on applying virtual reality technology and a custom-designed game to children with ASD. Through an experimental approach and a selected sample group, attention has been given to virtual reality as it can mirror the communication style of individuals with autism, highlighting their differences from peers. To many, it may seem like an illogical world, akin to cartoons.

The central question guiding this research is: To what extent can the use of virtual reality playing effectively develop the skills of children with autism spectrum disorder?

- **Study questions:**
    - Does play with virtual reality technology have effectiveness in developing the social interaction of children with ASD?
    - Does play with virtual reality technology have effectiveness in developing the linguistic skills of the child with ASD?
    - Does play with virtual reality technology have effectiveness in developing the emotional skills of children with ASD?

1.Study hypotheses:

General hypothesis:

Play with virtual reality technology have effectiveness in developing skills for children with autism spectrum disorder

Partial hypotheses:

Play with virtual reality technology have effectiveness in developing the social interaction of the child with ASD

Play with virtual reality technology have effectiveness in developing the communicative skills of a child with ASD

Play with virtual reality technology have effectiveness in developing the emotional skills of the child with ASD

2. Objectives of the study:

-Supporting the use of virtual reality technology

-Understanding the role of virtual reality in enhancing skills for children with autism spectrum disorder

-Developing the use of virtual reality in the psychological field in Algeria

-Identifying an effective method to enhance current practices

-Creating a virtual program, therapeutic approach, and Android application for use in a care setting, as well as in private centres for children.

3.The importance of the study:

-Supporting the virtual reality approach in developing the skills of a person with an autism spectrum

-Spreading the use of virtual reality in the psychological field because of the safe environment which it provides

-Virtual reality can be used as a projective content that provides an important amount of data about the future personality of the child with autism spectrum disorder through his interaction with the various contents within the game, and his way of dealing with these contents, which allows for a good understanding of the child with autism spectrum disorder and the enhancement of his various abilities.

-Finding easy ways to care for children with autism spectrum disorder, by creating a game or program that includes several specializations in one care (Muskens et al., 2017) that is provided to children with autism spectrum disorder using a virtual reality device.

-Developing a novel therapeutic approach to be incorporated into the arsenal for treating autism spectrum disorder involves offering care within the family setting and facilitating the monitoring of a child with autism at medical care facilities (Singh & Nathan-Roberts, 2019). Virtual reality also offers a level of support, particularly due to its cost-effectiveness, mainly because actual sponsorship frequently leads to extra costs for parents and demands additional time and effort.

-Facilitating ways to care for a child with autism, especially since the development of technology combines a lot of efforts in one technology, which is virtual reality, which contains many virtual treatments whose effects will spread to reality because the mind reacts in the same way it reacts in reality.

- Providing more possibilities for parents to deal with their children and more responsibility instead of centres so that they can understand their child by supporting him with virtual reality technology while subjecting the child to a weekly evaluation by specialists to determine the extent of his progress.

- Facilitating dealing with a child with autism spectrum disorder, and trying to provide supportive tools using a virtual method

- Encouraging the creation of thoughtful therapeutic games that contain many virtual events that may teach an autistic child the things he needs in his life.

-Developing a comprehensive program that enhances the social interactions, communication, and behavior of children with an autism spectrum disorder. (ROGE, 2003, p. 20)

-Establishing self-treatment for autism spectrum disorder involves using virtual reality technologies to help the autistic child gradually develop the basic abilities needed to live a more normal or adapt to their surroundings.

4. The precedents studies:

1. In an article titled "***Two case studies using Virtual Reality as a Learning Tool for autistic children*** ", in 1996, made by Dorothy Strickland from North Carolina State University, Lee M. Marcus, Gary B. Mesibov, and Kerry Hogan from the University of North Carolina at Chapel Hill School of Medicine, the researchers found that the senses are susceptible to the content of virtual reality, Strickland called this content the "illusion". (Strickland et al., 1996),she added that the persons who have acrophobia had a real sense of realism when they underwent to the new world created by the computer. (Strickland et al., 1996), the major idea mentioned in the study of Strickland is that when a person watched some kind of films or exposed to some VR contents, the body made a physiological reaction that influence on the whole mind and body, for example the increase of adrenaline when watching horror movie (Strickland et al., 1996), the same thing can happen if we play a horror game, the important thing in this study is that the different stimuli in virtual world creates the same physiological reactions that happen in real world,if the person confront or see or smell a stimulus, he will reacts in the same way of reaction in the real world, but the difference will be on the level of emotions, for example if a dog is attacking you in a real world, the response will be the same on the level of reaction, but the emotional feeling will be different, because you know simply that the dog in virtual world not real, in some kind of fear for example, the claustrophobia studies, participants responded to an immersive shrinking virtual room with claustrophobic symptoms when the room reached a minimum size. Because VR can give the player or the user total immersion in the game or the planned program, the important idea is that the user has the same interaction between the virtual and the real world, this gives us the possibility to use VR as a learning tool.

   The results of the study are:

   - The children repeatedly immersed themselves in the virtual scenes to the degree that they verbally labelled objects and the colours of objects.
   - The children consistently tracked moving objects in a scene, with both eyes, head, and body turning (Strickland et al., 1996)
   - The study gives a vision to future researchers that children with autism spectrum disorder can interact with VR technology even if there are some difficulties at the beginning, and it confirmed that the children will accept the VR helmet or the glasses on their head, they identify familiar objects and qualities of these objects in their environment while using the helmet, and locate and move toward objects in their environment while wearing the helmet (Strickland et al., 1996).

2. In a study titled "***A Virtual Reality Application with Autistic Children***" made by Dorothy Strickland department of Computer Science at the University of North Carolina in the United States in 1996, this study is similar to the mentioned previous study, Strickland describes the advantages of the sense of presence generated by virtual reality, a system to help children with autism was developed, in that time Strickland considered that there is no effective way for treating children with ASD, the study contained two cases of children with autism, one boy of 9-year-old, one girl of 7-year-old, the method was quasi-experimental, where the two-child were exposed to VR content that is street with sidewalk, and a car, the target of the study is to know if VR can benefit this kind of cases, the results were as follows:
    - Virtual reality has the potential to provide a safer, customized learning environment for individuals with autism
    - VR as a developed technology provides a controllable input stimulus that forms a sense of presence in the child's mind
    - The study revealed that the virtual world and headset were well-received, and the two children provided feedback on its content.
    - The potential for modification to allow for generalization within the virtual world.
    - The child can learn with minimal human interaction.
    - The study finally concluded that more tests are needed to determine the extent of training that children received in virtual environments. (Strickland, 1996)
    - This study confirmed that glasses and virtual reality (VR) are acceptable for children.
3. In an article titled " ***The Development of Educational Collaborative Virtual Environments for Children with Autism*** " in 2010, made by L. Millen, R. Edlin-White, and S. Cobb from the University of Nottingham, in this study, The Virtual Reality Applications Research Team studied the impact of VR on children with ASD. The team created the first virtual environment designed to improve social skills. The researchers confirmed the following findings:
    - Technology has great potential as an educational tool for teaching social skills.
    - VRE is a suitable tool for learning and developing the interaction of children with ASD
    - Computer technology (VR) can provide a safe situation that can be unsafe or unacceptable in real life
    - More work is needed to understand how involving children with autism in the design process (Millen et al., 2010)
    - The design of any virtual content should be suitable for the child's abilities.
    - It can be difficult to design suitable content in VR for children with ASD
    - The design of any content must be well-studied and highly controlled

4. In an article titled "***Virtual Reality in Pediatric Neurorehabilitation: Attention Deficit Hyperactivity Disorder, autism, and Cerebral Palsy"***, made by Michelle Wang and Denise Reid, in 2011, the researchers talked about the use of VR for children with

ADHD, autism, and cerebral palsy, The study focused on exploring the VR system and its use as a treatment tool to enhance the abilities of children with various impairments based on their disorders. Three major classes of VR display systems are identified that can be characterized by the type of human-computer interaction provided: (1) feedback-focused interaction, (2) gesture-based interaction, and (3) haptic-based interaction. (Wang & Reid, 2011), the researchers discussed every single-use, According to researchers, virtual reality (VR) has benefits for developing or rehabilitating potential cases. VR's ability to create a sense of presence within a virtual experience can lead to better treatment outcomes. Additionally, the flexibility to control the environment can also contribute to improved results. The study's findings are as follows:

- The VR content must be flexible and changeable because every child who has a neurodevelopmental disorder is different in ability from the other
- Specialists in neurorehabilitation have two challenges, one is the problem of generalization, and the other is safety because some children can't make the difference between danger and safety, but with VR these two challenges can be controlled and adapted according to the child's ability
- Using virtual reality may be an easy tool, especially with children suffering from high-cost neurological disorders, as it can contain several virtual exercises as an alternative to reality.
- Specialists in treatment must be very competent in using that technology
- VR till now needs to be more explored in the field of psychology

5. In an article titled "***Virtual Conversation Partner for Adults with Autism***" made by Cheryl Y. Trepagnier, Dale E. Olsen, Laura Boteler, B.S., and Corinne A. Bell, in 2011, in this article, the researchers applied a simulated conversation in virtual reality to learn the child with ASD engaging in structured conversational interaction with multiple opportunities to practice monitoring the conversation and verbal and nonverbal behavior of partner (Trepagnier et al., 2011) and give an appropriate answer for building a rapport over multiple turns. (Trepagnier et al., 2011), The material used in this study is a simulated conversation developed by Immersion LLC to teach children with ASD communication skills. The conversation will cover various topics such as school, work, or the home, and will teach them how to end a conversation. There were a total of 16 participants, including adolescents and adults, in the study which lasted for 2 weeks. Participants were provided with the program on a DVD along with a microphone and instructions for home installation in order to practice the conversation at home. The study also aimed to develop appropriate emotional responses, such as irritation and surprise. The results of the study were as follows:
    - Child with autism spectrum disorder achieved meaningful conversations
    - The participants express their admiration of the program except for some observations that are concerned with the help agent, some found that he is an assistant but others didn't accept his role.

- The participants found that their experience was useful and they increased their interest in talking with people(Trepagnier et al., 2011)
- The experience was less stressful than in the real world
- Virtual reality can be supported by children with ASD

6. In a study titled "***A serious game with virtual reality for travel training with Autism Spectrum Disorder***", made by Miguel Bernardes, Fernando Barros, Marco Simoes, and Miguel Castelo-Branco from the University of Coimbra in Portugal in 2015, the study describes the application of a virtual content made by using Unity game engine on 5 children with ASD, three males, and two females, the application was by using an Oculus Rift headset, the content is a game that is oriented for learning purpose, the child with ASD takes a place and wait for the bus to arrive, in another task, the child takes buses to reach specific destinations, or waiting for a right bus, the results of this study as follows:
   -Children with ASD are often interested in computer-based activities
   -There is a difference between participants with ASD in dealing with the games and the virtual environment.
   -The virtual graphics need to be more realistic and more visible
   -The children with ASD take a longer time than the control group to execute different tasks
   -The content of virtual reality should be varied from humans, animals, and cars to increase the complexity of the tasks and travel challenges. (Bernardes et al., 2015)
7. In an article titled " ***Virtual Reality-Based Behavioral Learning for Autistic Children***" in 2015, made by Ramachandran Chandra Reka, Jomhari Nazean, Thiyagaraja Shamala, and Maria Malissa, in this study, researchers aimed to know the role of a virtual reality environment in facilitating the learning for children with ASD, this study combined between qualitative and quantitative method, and an experiment planned for practising many tasks by the child with ASD inside the virtual world, the sample is children with autism and their parents that are 41, the VR content was a toilet, a bedroom, a kitchen, a dining and living room.
   The results were as follows:
   - The VR technology can be used for educational purposes as same for entertainment
   - The VR is an important e-learning tool because it facilitate this process
   - The VR gives lots of facilities and guidance to disabled children
   - The VR support effectively the social skills
   - The VR must support both the observation of content and practising some tasks because the child who just observing the content will not effectively learn (Ramachandran et al., 2015)
8. In a study titled with " ***Virtual reality social cognition training for children with high functioning autism*** "made by Nyaz Didehbani, Tandra Allen, Michelle Kandalaft, Daniel Krawczyk and Sandra Chapman from University of Texas in USA, in 2016, the

study use the experimental method that is an environment planned in a virtual world, this virtual world contains a scenarios that the children with ASD deal with it, these scenarios are similar to real-life situations,Didehbani said:***"the primary aim of the study is to assess feasibility of virtual reality social cognitive training in children with ASD and measure changes in effect recognition, social attribution and executive function pre and post-training"*** (Didehbani et al., 2016), the experience contains two pictures of scenes, each scene contains five items that represent objects, people or animals (Didehbani et al., 2016). the sample is 30 children with ASD, the procedures of the study were made at the Center for Brain Health at University of Texas, the results were as follows.:

- The virtual reality social cognition training allowed children to interact and respond to various social opportunities with other people in real time.
- The children with ASD in this study showed significant improvements in their ability to reason analogically when comparing social scenes.
- The virtual reality platform offers an effective developmental option for improving social impairments commonly found in ASD. (Didehbani et al., 2016)

9. In a study titled " ***The Use of a Virtual Reality Headset in Autism Populations***" in 2016, made by Nigel Newbutt from Bristol University, Connie Sung from Michigan state university, Hung-Jen Kuo from California state university, Michael J. Leahy, Chien-Chun Lin from western Oregon university, and Boyang Tong, the researchers described in this study the role of VRT head-mounted displays that are called Oculus Rift, the researchers are created educational contents that develop the skills of a child with ASD in different situations of life, because there is no enough published study about using head-mounted displays with children with ASD and its impact on them, in the study, it was used an Oculus Rift^{TM} head-mounted display, headphones, an Xbox 360^{TM} controller, and laptop computer. The researchers created three different scenarios, the experiment was for one week, and the number of samples was 29 children with ASD, in the study, the majority of participants showed acceptance of wearing the HMD, they find enjoyment when they put the Oculus Rift, and other exposed to negative effects like dizziness and tiredness, in general, the study proved that people with ASD accepted the HMD and were willing to complete (Newbutt et al., 2016),the tasks associated with VR scenarios in full, and the realism experienced through using HMDs could further help the generalizability from the virtual to real-world contexts, the study asserts that generalisation from the virtual to the real world must be one of the key objectives for future research, and the results were as follows:
    - Greater immersion could lead to better generalizations of learning to the real world
    - The VR provides a sense of presence that can help in promoting learning
    - VR is a safe, repeatable and diversifiable environmental platform
    - VR have differing degrees of immersion and interactivity
    - VR provides a safe space to test social situation
    - VR is affordable to many consumers
    - VR glasses are easily accessible to many consumers and lightweight

- VR provides a sense of realism when using the device
- VR may cause lower level of negative effects or not at all
- Potentiality to develop real-life skills

The future recommendations of the study are:

- The researchers must applicate the VR with larger samples
- This kind of research needs a specific software
- Take into consideration qualitative data to ensure a rich dataset for interpretation(Newbutt et al., 2016)

10. In a study titled "***Teaching Process for Children with Autism in Virtual Reality Environments***", made by Naranjo Cesar, Ortiz Jessica, and Anibal Alvarez Marcelo, in 2017, the researchers found that the implementation of modern technologies in a virtual reality environment for autism spectrum disorder can be useful and develop different skills of the child, in particular the areas of weakness such social interaction and conversation with others, communication deficits, these important skills are essential for realizing the adaptation normal for life, according to this study, virtual reality is an effective tool for developing the child's skills, VR is a pedagogical tool (Naranjo et al., 2017), the results of the study were the following:
    - Children with ASD became more stimulated when exposed to VR content
    - The children showed development in social interaction
    - The child did a lot of simulation and imitation
    - VR can be an assistive tool with other tools such as robots.
11. In an article titled " ***Technologies as Support Tools for Persons with Autistic Spectrum Disorder: A Systematic Review*** " in 2018, made by Begonya Garcia-Zapirain and Nuria Aresti-Bartolome, in this systematic review study, researchers focus on the impact of technology for making changes in behavioral aspects of children with ASD, mainly communicative ability and social interactions, the technology that was tackled in this study is virtual reality applications, robots, dedicated applications, telehealth system, and some other tools for support, the technique is depending on imitation skills that the child must execute it, for acquiring new abilities, technology provide multisensory stimulation, that are generally visual and auditory, the researchers depended on different scientific websites to do the review which are: IEEE Xplore, Scopus, and ACM Digital Library(Aresti-Bartolome & Garcia-Zapirain, 2014), also, technology of VR facilitate the manner of child interaction with different stimulus, in other manner, the child recognize the expression of an avatar, it can be said that VR provide an easy feedback for making future changes more appropriately to children with ASD, the results were as follow:
    - VR helps children with ASD in recognizing different emotions
    - VR facilitates getting feedback about the behavior and manner of thinking of the user
    - VR creates a safe environment
    - VR gives more chances to users for repeating the tasks without fear or difficulty
    - VR is a promising tool for developing social skills
    - VR content can be a supporter of therapy for children with ASD

- VR can be effective in neurorehabilitation for children (Aresti-Bartolome & Garcia-Zapirain, 2014)

12. In an article titled "***Reducing Specific Phobia/Fear in Young People with Autism Spectrum Disorders (ASDs) through a Virtual Reality Environment Intervention***" in 2018, made by Jacqui Rodgers, Jessica Lowry, Morag Maskey, Jeremy R. Parr, Helen McConachie, in this article; the researchers tackled the role of VRE intervention in decreasing anxiety and specific phobias, fears, and distress, VR facilitate the mental ability that is the imagination, the child with ASD has difficulties with this mental ability, and the therapist doesn't be sure if the child or the patient in general imagine the appropriate stimulus, VR can provide the appropriate stimulus without losing the focus on it because the eyes are transferring the image from virtual reality environment to mind, that is to say, less effort of concentration and imagination of different stimulus that causes the anxiety to a child with ASD, The results were as following:
    - The VR in combination with the CBT technique provides an effective tool for treating phobia in some children with ASD
    - The VR improved the ability of children with ASD
    - VR helps children to overcome their phobia
    - The improvements stay from 12 to 16 months after the undergone VRE treatment (Maskey et al., 2014)
13. In an article titled "***A Survey on Virtual Reality for Individuals with Autism Spectrum Disorder: Design Considerations*** ", in 2018, made by Bozgeyikli Lal, Raij Andrew, Katkoori Srinivas, Alqasemi Redwan, in this study, the researchers shew many studies concerned the VR technology application with children with ASD, this technology proved an important role for VR with children who have ASD, the main idea is the imitation of the behavior, so the child can acquire the behavior through imitating it, for example, imitate the conversation of two peoples, through this study; the VR experience is more acceptable by children with ASD, in particular the Oculus rift, this last depends on spatial information that is highly accepted by the sample of the previous studies above-mentioned, in general, the study confirmed the followings:
    - VR provides a safe environment without stress
    - VR gives the ability to control and makes the tasks gradually more difficult
    - VR provides the ability to reinforce the tasks through repetition
    - The high control of stimuli inside the experience
    - Making the abstractions in visual forms
    - The mistakes in VR are permitted largely till the learner masters the task
    - VR is a promising tool soon
    - VR is effective with many aspects of the personality of the child with ASD

The results of the study confirmed that virtual reality is a suitable tool for training and learning children with ASD, also all previous studies confirmed this conclusion, in addition to the need of more studies concerned the development of VR applications for individuals with ASD.

14. In an article titled " ***Communication and Education: an example of an autistic child***", in 2018, made by Abdelkader BEHTANE from the University of Guelma, in this article, the author mentioned that children with ASD have communication whatever its manner and the child need an individualized educative intervention according to his needs because he has ASD(Behtane, 2018), this gave the student researcher a vision about the necessity to determine the game according to the needs of the child with ASD, and the game must be planned by communication rules, to transmit knowledge to him by using virtual reality, the author also mentioned that the patience, the future researcher can use games and PC that permitted the use of diverse contents for developing the different communicative abilities (Behtane, 2018), so, the results were as follows:
    - Autism needs individualised educational intervention according to the child's needs (Behtane, 2018), this can be applied through games or virtual reality.
    - The child with ASD should undergo early treatment between the ages of three and six, this advice can also be applied through VR intervention.
    - The numerical field provides lots of educative content (Behtane, 2018)
    - Behtane confirmed that the child needs a well-defined framework to alleviate their anxiety (Behtane, 2018).This idea can be easily applied with VR due to the safety provided to the user.
    - Developing language for an autistic child is a difficult task, in virtual reality, it is recommended to create an effective language stimulus for children with ASD.
    - Communication has become easier due to new technologies (Behtane, 2018), so virtual reality will be useful if it has the interest of researchers.
15. In an article titled "***Enhance Emotional and Social Adaptation Skills for Children with Autism Spectrum Disorder: A Virtual Reality enabled Approach"*** in 2018, made by Horace H.S. Ip, Simpson W.L. Wong, Dorothy F.Y. Chan, Julia Byrne, Chen Li, Vanessa S.N. Yuan, Kate S.Y. Lau, Joe Y.W. Wong (Ip et al., 2016), in the study, the researchers depended on using the virtual reality as a tool of research to deal with children with ASD, the experience was made in Hong Kong, in the center of innovative applications of internet and multimedia technologies, with cooperation between the department of psychology and department of pediatrics, faculty of medicine, the VR was used to improve the emotional and social adaptation skills, the program contained six learning scenarios, the children with ASD undergo to these scenarios through an immersive virtual reality environment A.K.A and half cave, the method was experimental, a control group was used, the sample of the study was the children who have ASD, their number is 94 children between the age of 6 to 12, 86 boys and 8 girls, the program formed of six scenarios and was applied for 28 sessions in 14 weeks for training, the experimented group underwent to VR scenarios, and the other control group didn’t receive any scenarios, the results were as follows:

    -There is an improvement in emotion expression and emotion regulation

    -There is an improvement in social interaction, and it was shown that VR can be a feasible and effective tool for training children with ASD and boosting their social skills(Ip et al., 2016)

-VR facilitate psychoeducational learning for children with ASD

-VR depends on graphical content, and the child with ASD support visual thinking, so, this will be helpful for him

-Results in general are encouraging and motivating

16. In an article titled " ***Using virtual reality to train emotional and social skills in Children with autism spectrum disorder***" in 2018, made by Sze Nagar Vanessa Yuan, and Horace Ho Shing Ip, in this article; the researchers made an experiment at AIMTech Centre in Hong Kong University, the VR scenarios were created, the type is a cave that permits to use it for interacting with objects and avatars, the scenarios contained real-life conditions, the sample is 72 child with ASD, it is confirmed that technology has a moderate effect on the children, the participation of the sample individuals is voluntary and they have the choice to abandon at any time with their parents, the session takes one hour, the results were as follows:
    - There is a clear improvement in the level of emotional expression and regulation
    - The children after the experience became more proactive in greetings and communicative abilities according to their parents
    - Some new activities appeared, such as taking food easily
    - The children becoming to make more friends and make conversation in the two ways
    - Some children accept the VR goggles despite some reluctance in the beginning
    - The children can understand the audio and video stimulus in the virtual reality content
17. In an article titled "***Social Stories for Children with Autism Spectrum Disorder: Validating the Content of a Virtual Reality Program***" in 2018, made by Kristin Mow, Jill G. Zwicker, Alyssa Ledingham, B.S., Joseph Lucyshyn, Parisa Ghanouni, and Tal Jarusin, in this article; the researchers developed a virtual reality program in form of social and emotional stories, with the aim of helping children with ASD, and learn them the correct perception to different emotional reactions, and emotion recognition, in plus of the ability to interpret the social situations, the program is created for training, developing and learning behaviors, depending on mind theory in an important part of it, this theory considered that if the child can understand the feelings and emotions of others, he will have appropriate responses and interpersonal skills, due to the technological tools like VR, the learning process can be realized in a fast form, the study have an aim that is the creation of a validated library of different level of social stories in order to develop emotional reactions for children with ASD, for the validation of this socio-emotional stories, the researchers target to make the child with ASD learn the appropriate reaction in the appropriate situation, the results were as follows:
    - VR stories can be used in developing the capacities of children with ASD
    - The program of the study was validated with 75 short social stories using virtual reality technology
    - VR affects the social behavior
    - VR can be an appropriate tool for learning different actions

- VR is becoming an important tool in the psychological therapy field

18. In an article titled "***A Review of the Application of Virtual Reality Technology in the Diagnosis and Treatment of Cognitive Impairment***", in 2019, made by Liu Yao, Tan Wenjun, Chen Chao, Liu Chunyan, Yang Jinzhu, and Zhang Yanchun, from Shenyang university, China, and Cyberspace institute of Advanced Technology, from Guanzhou university, China, Key Laboratory of Complex System Control Theory and Application, Tianjin university of Technology, China, in this study, the technology of VR is used in the treatment of cognitive problems, the sample is elderly people who have cognitive disorders like attention, memory, perception and other cognitive operations, the sample is 29 patients and 29 people as the control group, the main objectives of the study are to evaluate and diagnose cognition, and the second is to treat the cognitions deficit, for example, the person has difficulties in making displacement from place to another place, or to communicate easily with others, the VR can be an effective way to develop the deteriorated functions and delay the cognitive ageing ,(Liu et al., 2019a), the simulation provided by the VR can give non-immersion, semi immersion or full immersion, if the degree of the immersion is elevated, the user feels that himself is more immersed and focused on the thing underwent to it, in plus of the secure environment provided by this technology, the VR content is virtual park to test the memory, in general the results of the study are:
    - VR is a tool that shows effectiveness in developing some behavioral skills
    - VR can be a tool protecting from neuro-deterioration if the VR content is well studied and oriented for that purposes
    - The interactivity in a virtual reality world permits the use of multiple senses to know more details about them (Liu et al., 2019a)
    - The VR gives a promising future for cognitive diagnosis and recovery
    - There is still a need for more studies on VR and its impact on behavior, as the experience to date has had a small number of samples.VR can be used for training doctors in hard situations like surgery
    - VR provides a safe environment without any danger (Liu et al., 2019b)

19. In an article titled " ***Virtual Reality Air Travel Training with Children on the Autism Spectrum: A Preliminary Report***" in 2019, made by Cheryl Y. Trepagnier, Dale E. Olsen, Laura Boteler, B.S., and Corinne A. Bell, in this article, the researchers used a VR-based air travel functional communication activity, the sample is five children diagnosed with ASD, by using an iPhone X and Cardboard device, the VR content was an air travel functional communication activity, the program was used for 4 weeks, 7 days, time of each session is 15 minute, once in the one week for each participant, the three weeks in the first was practiced with VR and the fourth week the children will practice in the real world that conforms with the VR content, the parents were asked to complete a questionnaire about their child air travel skills, the notation between 1 to 5 points, 1 means that the person needs more support, but 5 means that the person doesn't need any support by caregivers, the researchers after notating the evaluation of the

parents about their children with ASD, they underwent these last to the VR content, than they made new evaluation after weeks, the results were as follows:

- All the children improved their air travel skills from pre-to post-intervention except one
- VR can develop skills but some children may confront difficulties
- All the children developed capacities to navigate the real-world airport but one child didn't make any improvement (Miller et al., 2019)
- The VR content must be well-studied before its creation

20. In an article titled" ***A virtual reality system for practicing conversation skills for Children with Autism***" in 2019, made by Natalia Kendra Day, LouAnne Boyd, Stewart Rosenfield, Kathleen Lamkin, Erik Linstead, and Jennifer Re, in this study, the researchers use a scenario containing a shop and a personality called Bob, the shop contains fishes, the content of this scenario, in particular, was created for practising social conversation, and developing skills needed for easy adaptation and secure feeling without fear, in addition to conversational understanding, the sample of the study is formed of 59 children, the VR is used in this study as a supplementary approach to make skill acquisition more easiest and effective, this experiment stimulate attention, turn-taking in conversation, and non-verbal communication like making a gest for attaining an object, this program allow for developing communicative skills, and adjusting any wrong way of communicating, or understanding,(Stewart Rosenfield et al., 2019) the VR content of this study is like a video game, and precedent research confirmed that children with ASD have intense interest about video games and animals(Lisk et al., 2021), the results were as follows:
    - VR is an appropriate technology for children with ASD
    - VR supports social and communication skills
    - VR makes children with ASD feel safe
    - VR content is a game or like games, the child will love it
    - VR was a positive experience for users
    - VR enabled the performance of actions such as moving, looking, imitating and more
    - More studies and large samples can provide a lot of data on the effectiveness of VR with children with ASD in the future.
21. In an article titled "***Clinical outcomes of interactive, intensive and individual (3i) play therapy for children with ASD: a two-year follow-up study***" (Tilmont Pittala et al., 2018)in 2018, made by Elodie Tilmont Pittala, Yann Saint-Georges-Chaumet, Claire Favrot, Antoine Tanet, David Cohen, and Catherine Saint-Georges, in this study, group of researchers created a game labeled it 3i, that is means the first letters of interactive, intensive and individual play therapy for children with ASD, the 3i is a game demand 20h to be intensive, it is organized to three phases, each phases is for a specific age, the age of first phase is from 0 to 18 months, the age of second phase is from 18 to 36 months, the age of third phase is starting from 36 months, in the first phase the child will work on discovering himself, the phase two permit to the child discovering the

outer environment, the phase three enables the child to integrate in the school, the results obtained after the application of 3i with these children who have ASD are the following:

- Play has a positive developmental impact on the child with ASD
- Developmental age is increased at a significant rate
- The developmental age of socialisation is also increased
- Behavioural skills were increased
- A significant number of the sample moved from severe to moderate levels of ASD after undergoing the play.
- The study confirmed the effectiveness of the Play with 3i programme and other programmes in the future.
- Play therapy can have a great positive effect on children with ASD.
- Children with ASD accept play and the play environment as a treatment tool.
- The 3i can be a starting point for more therapeutic techniques of this type.

22. In an article titled " ***Parental Intention to Support Video Game Play by Children With Autism Spectrum Disorder: An Application of the Theory of Planned Behavior***" (Finke et al., 2015) in 2015, made by Erinn H. Finke, Benjamin Hickerson, Eileen McLaughlin, in this study, authors before shew the results of their study they provide many studies that confirm the important role of video games in education, among the conclusions that they mentioned are the following:

- Using video games in therapy is considered an innovation
- Benefits of video games are proved by scientific research
- Educational purpose can be realized by using video games
- Video games motivate the player for learning
- The effectiveness of video games needs more studies

The results of the study were the following:

- The children with ASD have an ambition and a desire to play video games with a different average per week
- Children with mild and moderate ASD prefer orderly play video games
- The parents show a proportional acceptance of the play of their children with video games
- The parents considered that video games develop positively social skills, language abilities, and ability of reading and writing, and even critical reasoning.
- It is confirmed that parents are accepting and supporting the use of video games for curative and pedagogical purposes
- Video games according to parents help in realizing positive behavioral consequences
- Video gaming can improve communication skills
- The parents accept to use of video games in interventions because the study confirmed the importance of integrating video games into the therapy

After the results, the researchers provide some recommendations that are:

- Future research must focus on the effectiveness of video games in the intervention
- Video games can be used inside classrooms with children with ASD

23. In an article titled " ***Television, Video Game, and Social Media Use Among Children with ASD and Typically Developing Siblings***" (Mo & C, 2013) in 2013, made by Mazurek. Mo, Wenstrup C, in this study, the researchers tackled the subject of children with ASD and television, video games, and social media, the ages of the sample were between 8 to 18 years, and two groups were used in this study, a group of children with ASD 202 child, and a group with typically developing siblings of 179, depending on parents reports, the results of the study were as following:
    - Children with ASD spent more time watching television and playing video games.
    - Children with ASD don't prefer to use social media
    - Children with ASD don't prefer to use the internet or video games with other players.
    - The technology of television and video games facilitates social interaction, the latter can be easily developed through this technology.
    - Children with ASD may spend equal amounts of time watching television and playing video games.
    - Children with ASD, boys or girls, don't prefer to use Facebook, email and other social media.
    - The games can be used to develop important skills in children with ASD, especially children with ASD have strong visual perception.
    - Playing video games can be a great support to the care programme and in developing positive behaviour.
    - Children with ASD have a strong interest in computer-based learning applications

    At the end of the study, the researchers mentioned the need to broaden the sample in any future research, in addition to the characteristics of the sample, such as cognitive function and more.
24. In an article titled " ***The Effect of the video game Midnight on anxiety symptoms in Children with an Autism Spectrum Disorder***" (Wijnhoven et al., 2015), in 2015, made by Lieke A. M. W. Wijnhoven, Daan H. M. Creemers, Rutger C. M. E. Engels, Isabela Granic, in this study, the researchers experienced the effect of a game labelled "Mindlight" against the anxiety, the main objective is to observe if this game will have the capacity to decrease the symptoms of anxiety of children who have ASD, the experimental method was used, the researchers provide two groups, one group is the children with ASD who have anxiety symptoms, their ages between 8 to 16 years, and the second group is the control group, both the number of two groups were 60 participants, after using the game for 3 months, the following results were attained:
    - Mindlight has a positive effect on anxiety, including phobias.
    - The game Mindlight demonstrates its ability to reduce anxiety.

- Video games can have a significant impact on reducing anxiety.
- Children embraced the video game Mindlight.
- Games like Mindlight can be incorporated into interventions for children with ASD.
- Much research can be done in the future to further understand the role of video games in developing important skills for children with ASD and other disorders.

25. In an article titled " ***Videogames and Therapy: A Narrative Review of Recent Publication and Application to Treatment*** "(Franco, 2016), In 2016, Gilbert E. Franco conducted a study in which he reviewed previous research confirming that video games can be a helpful tool in psychotherapy. He found that video games can be integrated into therapy, and if a patient or player can connect emotional and intellectual abilities, they may experience positive outcomes. The results of the study were as follows:
    - Video games can be utilized as a therapeutic tool.
    - Video games can be integrated with any therapeutic approach.
    - Video games can motivate players, develop social skills, and increase self-awareness.
    - Video games can be integrated with Cognitive Behavioral Therapy (CBT).
    - Video games help therapists better understand their patients.
    - Video games can be combined with other therapy techniques or used independently.
    - Video games allow for increased interaction between users or players, which can positively impact social development.
26. In an article titled " ***Videogames and Therapy: Does Video Gaming Have Impacts on the Brain: Evidence from a Systematic Review*** ",(Brilliant T. et al., 2019) in 2019, made by Denilson Brilliant T, Rui Nouchi, Ryuta Kawashima, a systematic review was used, the subject of the article is about the benefits and effects of video games on the brain and the neuroplasticity, after revising nine articles, the researchers mentioned the following results:
    - Video games have benefits for human health
    - The effect of the games is in its majority on neuroplasticity and the brain in general
    - The video games put the player in a challenge that can help in developing his skills
    - Video games can improve social behavior
    - Play video games activates an important area in the brain
    - Play video games can stimulate visual attention, short-term memory, and more cognitive functions
    - Play video games change the build of the brain and its task
    - The functional connectivity changes when playing video games
    - The hippocampus and amygdala are affected when playing video games, and each type of game has its type of effect on the brain
    - The effect of a video game on the brain can appear after 16 hours of training

27. In an article titled " ***The Use of Analog and Digital Games for Autism Interventions***"(Atherton & Cross, 2021), In 2021, a systematic review conducted by Gray Atherton and Liam Cross included a large number of studies that demonstrated the positive impact of video games on the development of cognitive, learning, and physical skills. The study focused on using games to help children with Autism Spectrum Disorder (ASD) and utilized a game-based psycho-educational program in the reviewed studies. The results of the study showed that:
    - Children exhibited various types of interactions while playing
    - Playing games helped in the development of skills such as emotional regulation and communication
    - Games could support different types of educational interventions
    - Games with a reward system motivated children with ASD to continue participating
    - Educational games could be a useful additional intervention tool for children with ASD
    - Playing games improved face recognition and socio-communicative skills in children with ASD
    - Games could be a suitable intervention tool for children with ASD.

5.General remark about the mentioned previous studies in this research:

From the previous studies mentioned in this first chapter, it is clear that researchers have not yet been able to create a comprehensive program that can develop or assist in developing all the necessary skills in the life of a child with ASD. It is observed that VR content has been tested for the first time in the majority of studies. This indicates that the focus is more on the viability of the VR program rather than on the effect of its content on children with ASD. Particularly in the initial studies in the nineties, this is logical because researchers have not yet found appropriate VR content that can aid in the treatment of ASD or help in developing communication and social behavior.

Furthermore, it has been proven that children with ASD accept VR, but the effectiveness of the program, game, or content with them remains uncertain. In addition to content, researchers need to determine the appropriate timing for the children's experience with the sample. It is crucial to identify the key time that may facilitate the easy and rapid development of the child's skills. The objective is to facilitate learning for children with ASD, so it is vital to educate them in suitable conditions and at the right time. Along with appropriate VR content, all these factors can enhance the necessary skills for a relatively normal life in society.

Moreover, studies require more samples because a higher number of samples increases the credibility of the study. Additionally, in this research, the planned game will be based on one of the learning theories, namely Skinner’s theory, which was utilized in the aforementioned previous studies. The researcher will rely on this theory, practicing the required behavior or skill, and the child will receive rewards within the VR content as an encouraging technique, providing feedback that helps the child understand themselves better.

Furthermore, the VR programs or games developed for enhancing children’s skills have not made any attempt to reduce stereotypical behaviors, possibly due to the challenging nature of these

behaviors. In this thesis, the researcher will attempt to propose a solution by creating VR content to assess if it can help in managing the child's emotions, especially in reducing anxiety.

Additionally, while the majority of studies have been conducted in the United States, Europe, and Asia, there is a lack of research on virtual reality with ASD in Africa up to this point.

6. Actual studies about the subject of using virtual reality with ASD in Algeria:

According to Google Trends, Algeria still does not have any studies regarding the use of virtual reality in the treatment of ASD. Some studies give importance to augmented reality, but not in the field of psychology. The student researcher also uses the Algerian Scientific Journal Platform (ASJP) to find studies about using virtual reality in the field of psychology, particularly with autism spectrum disorder. The results show that some articles discuss the topic of the virtual world in general, such as social media and the internet, and their effects on user behavior. Other articles focus on virtual reality in the field of medical studies and its use in educating students about health and medicine. Some articles discuss the concept of virtual reality and its use in Algeria, including by Algerians, where virtual can refer to the internet and social networks. The remaining studies mostly discuss the traditional meaning of the word "virtual." Therefore, the current study on using virtual reality with children who have ASD is new in Algeria. For this reason, the student researcher is trying to incorporate development into each aspect, such as providing special exercises for social interaction and communication within the video game.

7.Future perspectives and Study expectations:

Due to the importance of providing a clear vision of the results achieved and their potential contributions to therapies and care for children with ASD, the researcher expects a future numerical program that can serve as a virtual care program for various cases, not limited to individuals with ASD but also addressing other psychological issues. The investment in technology must be expanded, especially post the COVID-19 pandemic, where technology demonstrated its effectiveness in ensuring the continuity of learning and work in various establishments. The concept of a virtual care program may come into existence in a few years upon the completion of this thesis. The main idea is akin to distance learning but in a different form. The researcher believes that care for any case should be easily accessible, cost-effective, promote collaboration between practitioners, parents, and patients, and be provided in suitable conditions.

Furthermore, the researcher notes the increasing impact of social media, the internet, and smartphones on human behavior. A new concept emerges in a different environment from its origin due to the impact of media and the internet, which reflect real-world behaviors. Virtual reality is considered a modern and fertile tool for transcending borders and sharing ideas beyond their country of origin, offering diverse experiences and ideas in a safe environment with high control over variables and user-friendly techniques. One of the aims of this thesis is to enhance the care and treatment of children with ASD, making it more accessible.

While current research supports the use of virtual reality in aiding children with autism spectrum disorder, further studies are deemed necessary to fully understand its potential benefits. Virtual reality can offer a range of therapeutic techniques in a single tool, potentially streamlining child care processes when developed by experts in the field. The ongoing COVID-19 pandemic has underscored the need for proactive measures to ensure continuous care for individuals with psychological issues, such as children with ASD, especially when traditional care centers face closures. This research aims to facilitate easier and safer care amidst the pandemic, addressing the challenges posed by the current situation.

In conclusion, virtual reality stands as a supportive tool for home-based care, although a comprehensive program for parents to use with children with ASD is currently lacking. This thesis may contribute significantly to the field of science and specifically to the care of children with autism spectrum disorder in Algeria. The ultimate objective is to design a game that positively impacts the cognitive development of children with ASD. This research could pave the way for the development of a virtual reality approach in Algeria, focusing on creating educational games to enhance skills and alleviate symptoms associated with autism spectrum disorder.

8.Procedural Definitions

- **Autism**

> **It is a neurodevelopmental disorder characterized by markedly impaired social interactions and verbal and nonverbal communication; narrow interests; and repetitive behavior. Manifestations and features of the disorder appear before age 3 but vary greatly across children according to developmental level, language skills, and chronological age. They may include a lack of awareness of the feelings of others, impaired ability to imitate, absence of social play, abnormal speech, abnormal nonverbal communication, and a preference for maintaining environmental sameness.** (APA, 2015, p 94)

- **Autism spectrum disorder** (**ASD**):

> **"A group of disorders with onset typically occurs during the preschool years and is characterized by varying but often marked difficulties in communication and social interaction. ASD was formerly said to include such disorders as the prototype autism, Asperger's disorder, childhood disintegrative disorder, and Rett syndrome; it was synonymous with the pervasive developmental disorder but more commonly used, given its reflection of symptom overlap among the disorders".**
> (APA, 2015, p 94).

The following terms and phrases are used to identify ASD: Autism spectrum disorders, autism and related spectrum disorders, autism, children with conditions similar to ASD, children on the ASD continuum, pervasive developmental disorders, empathy disorders, Kanner syndrome, children with ASD, childhood autism, infantile autism, classic autism, Asperger syndrome, Asperger's disorder, children with ASD and psychopathology, schizoid personality disorder, high functioning autism, Heller syndrome, disintegrative disorder, and dementia infantilism (Joshi et al., 2002). According to Geschwind (2011), ASD is an attempt to capture the idea that patients represent a clinically diverse population that experiences abnormal levels of variation in cognitive and behavioral domains, rather than a distinct clinical disorder.

ASD includes autistic disorders, Asperger's disorder, and pervasive developmental disorder-not otherwise specified (PDD-NOS) in the DSM classification system, and childhood autism, infantile autism, atypical autism, and Asperger's syndrome in the ICD classification system (Muskens et al., 2017).

- **Virtual reality:**

1. **«a technology that enables users to enter computer-generated worlds and interface with them through sight, sound, and touch»** (Hersen & Sledge, 2002, p. 889)

2. **«an artificial environment that is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment»** (Mesa-Gresa et al., 2018)

3. **«a model of reality with which a human can interact, getting information from the model by ordinary human senses such as sight, sound, and touch and/or controlling the model using ordinary human actions such as position, VR is distinguished from other computer technologies mainly by the high level of interaction and immersion it offers»**. (Bozgeyikli et al., 2018)

- **The virtual screen:**

It is a screen that forces the child to engage in play with virtual characters and themes, in contrast to television screens, which make them a viewer and recipient

- **Social interaction:**

«any process that involves reciprocal stimulation or response between two or more individuals. These can range from the first encounters between parent
and offspring to complex interactions with multiple individuals in adult life. Social interaction includes the development of cooperation and competition, the influence of status and social roles, and the dynamics of group behavior,
leadership, and conformity. Persistent social interaction between specific individuals leads to the formation of social relationships. ». (APA, 2015, p 996)

- Socialization:

Social interaction and integration with peers

- Communication:

Delivering a message that is understood by the recipient

- Development:

The act of promoting growth and improvement in capabilities.

- Skill:

The ability or competence that enables a task or work to be performed accurately and proficiently.

- Emotion:

Expressing feelings due to a stimulus (laughter for something funny

9.The limits of the study:

-Time limits: The study was applied between 2022 and 2023 it took 4 months to apply on the 6 cases

-Human limits: children with ASD in psychological and educative institutions that provide different interventions concerning behavior, social and educative habilitation.

-Spatial limits: Province of Constantine.

The thesis consists of two aspects:

One for the theoretical aspect and the other for the applied aspect:

The theoretical aspect consists of four chapters, as follows:

Chapter One: Presentation of the study

Chapter Two: Autism Spectrum Disorder

Chapter Three: Virtual Reality Technology
Chapter Four: The therapeutic technological approach
The applied part consists of four chapters as follows:
Chapter Five: The Game
Chapter Six: Conceptual Framework of the study
Chapter Seven: Presentation and analysis of the results
Chapter Eight: Discussion of the results

Second Chapter: Autism Spectrum Disorder

-Preface
1-Short history of autism
2-Definition of autism spectrum disorder
3. The symptoms of ASD according to ICD 10 and DSM 5
- The classification of ASD according to CIM 10
- The classification of ASD according to DSM 5

4. Difference between autism and ASD
5. The prevalence of autism
6. Different levels of severity in Autism Spectrum Disorder
7. Etiological hypotheses of ASD
8. The three important axes of ASD
9. Comorbid Disorders with ASD
10. Tests of Diagnostic and Assessment of ASD
11. Therapeutic programs and techniques used to care for children with autism spectrum disorder
12. Autism spectrum disorder in Algeria
13. Ministries' suggestions to improve care and care for children with autism spectrum disorder
14. Efforts to care for patients with autism spectrum disorder

Preface:

The prevalence of autism spectrum disorder is increasing every day, prompting researchers to continue studying this topic due to its significant impact on children worldwide, particularly in developed countries. Autism spectrum disorder can manifest in various delays in a child's life, such as speech and communication. Children affected by this disorder may experience challenges in social interactions, language development, communication skills, as well as exhibit repetitive behaviors and unusual interests. (Wolfe & Mash, 2008, p. 300), parents fear this disorder due to its complexity, ambiguity, and lack of communication, which can make the child with it completely misunderstood or incomprehensible. Therefore, parents must have adequate knowledge and information about it in general, and communities must support efforts that help these children in any way. Additionally, parents have intense fears about their children's future, and studies show that parents of disabled children may face high risks and levels of stress. (Baker-Ericzén et al., 2016)

Studies have shown that parents of children with autism spectrum disorder make great efforts to adjust regulate and control the child’s emotions to enable him to adapt.(O’Nions et al., 2020) , These parents may also suffer from depression because ASD is an additional stressor and may enhance their angry and depressed mood(Benson & Karlof, 2009),they show high levels of stress (Schlebusch & Dada, 2018), It should be noted that mothers of children with autism spectrum disorder are more susceptible to depression(Begum & Mamin, 2019) Parents suffer from decreased effectiveness, increased stress, and mental and physical health problems, especially in the absence of social support for them. Among the problems is also the presence of divorce in families of children with autism spectrum disorder. (Begum & Mamin, 2019).

Autism spectrum disorder poses a challenge for psychologists and specialists due to its unknown causes. Children with autism spectrum disorder often struggle to communicate their emotions effectively. While progress is possible, regression to a lower level can occur in some cases.

Efforts are ongoing to develop technologies and programs aimed at assisting individuals with autism spectrum disorder.

This chapter provides an overview of autism spectrum disorder, also known as Autism Spectrum Disorder in English. It includes a brief history, definition, and symptoms based on DSM-5 and ICD-10 criteria. A comparison between autism in the past and autism spectrum disorder is outlined. The chapter also discusses the current status, prevalence, key aspects, potential causes based on scientific research and explanatory theories. It explores the connection between autism and other disorders, the concept of comorbidity, and various assessment tests and therapeutic programs available.

1. A brief history of autism spectrum disorder:

The term autism was first used in the early 1900s by psychiatrist Eugen Bleuler to describe individuals with schizophrenia who were disconnected from reality.(Bernier & Gerdts, 2010, p. 02) , most authors currently consider Kanner (1943) to be the first to define the concept and term autism, providing a remarkably detailed and clear description and conceptual outline.(Amaral et al., 2011, p. 17), through his observations, he provided important indicators for children with this disorder. Although the first coiner of the term autism is not important, what has been written regarding autism remains the most important thing presented by these past people, as the majority of these signs are still valid and constitute symptoms of autism spectrum disorder in its most classical forms. (ROGE, 2003, p. 7), Leo Kanner (1943) mentioned three main aspects of autism at that time, and mentioned the child's difficulty in social and linguistic skills, and repetitive behaviors. (Bernier & Gerdts, 2010, p. 02),it can be said that these three aspects, which are social, linguistic, and behavioral difficulties, are the most important problem in autism disorder up to the present time.

Dr. Kanner mentioned that the group of children he was referring to were also detached from reality as described by Dr. Bleuler, but they were not afflicted with schizophrenia, because before that autism spectrum disorder was viewed as infantile psychosis, although there are many differences between autism spectrum disorder and Autism and schizophrenia, and he considered it a mistake to consider autism spectrum disorder an early manifestation of schizophrenia disorder. For example, many people with autism spectrum disorder display intellectual disabilities, but autism spectrum disorder in fact differs from general intellectual disability in several aspects, including gender and patterns. Cognitive and social class distribution, head circumference, and neuropathological findings (Amaral et al., 2011a, p. 17)

Returning to Kanner, he gave a detailed description of the eleven children in his landmark paper and asserted that these children had a condition “markedly and uniquely different from anything reported to date.” He borrowed the term “autism” from Bleuler (1911), a Swiss psychiatrist, who also coined the term “schizophrenia.” Since the origin of the word is composed of two parts, the first part is from the Greek word autos, meaning self, and ismos, which is a suffix that refers to doing an action. If the word is combined, it becomes autismos, meaning thought centered around the self. Hence, autism is a term given to self-thinking and clear withdrawal from the social world in which It is performed by children with schizophrenia. It was also a distinctive feature of the children Kanner studied, and gradually the adjective "autistic" led to the well-known term "autism."

After publishing his early study, Kanner continued to work with children with autism spectrum disorder, observing as many as 120 more cases at Johns Hopkins Hospital. In 1956, he and Leon Eisenberg co-authored a paper reviewing what became known as early childhood autism. The authors suggested that the two defining features of autism were “extreme self-isolation” and “obsessive insistence on monotony.” It was thought that autism could be identified with certainty by these two traits alone, and non-communicative use of language and delayed or failure to develop were seen in children with autism. Autism was viewed as a direct result of their lack of connection with other people, and language deficits were viewed as neither an essential characteristic nor a

reliable indicator of autism. Michael Rutter (1978) later argued that language and prelinguistic impairments are core symptoms of ASD, asserting that these should be included as a diagnostic criterion alongside the impairment of social relationships, object obsession, and monotony spoken of by Eisenberg and Kanner. (Matson & Sturmey, 2013, p. 4)

In 1944, Hans Asperger published a research paper in Austria, in which he described four of the children he cared for as 'autistic patients,' who were observed to lack empathy and engage in one-sided conversations, in addition to difficulty making friends, a keen interest in certain topics, and poor general motor coordination. Dr. Asperger went on to describe these children as 'little professors' because of their eager interest in talking a lot about topics, regardless of others' interest in the topic. Toward the end of World War II, Dr. Asperger opened a school to help these children, but unfortunately, the school was bombed, and much of his early and important work was lost. In 1981, British psychiatrist Lorna Wing published an article entitled 'Asperger's Syndrome: A Clinical Report,' which made Asperger's research widely known, as little of his work before that had been translated from German to English. Dr. Asperger died in 1980, and never saw his work reach the fame it has today. (Gallo, 2015, p. 2)

Years later, in 1987, the Diagnostic and Statistical Manual of Mental Disorders, Third Edition - Revised (DSM-IIIR) was published. The prevalence of autism spectrum disorder was thought to be four or five children per 10,000, and estimates of the prevalence of developmental disorders, including autism spectrum disorder and developmental disorder not otherwise specified (PDD-NOS), have been made to range from 10 to 15 cases out of a total of 10,000 children.

In 1994, when the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV) was published, prevalence rates of autism spectrum disorder were between 2 and 5 cases out of 10,000. Therefore, at most it was thought that only 1 in 2,000 children Autistic Spectrum Disorder Asperger's disorder was introduced into the mainstream mental health field at that time, but there was insufficient information to estimate its prevalence rates. Prevalence rates for sweeping developmental disorders are also not provided as they were in DSM-IIIR.

The Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition - Revised (DSM-IV-TR) was published in 2000. (Gallo, 2015, p. 2), the average rate of autism spectrum disorder in epidemiological studies was subsequently noted and estimated at 5 cases per 10,000 total individuals, with reported rates ranging from 2 to 20 cases per 10,000 individuals." Prevalence rates have not been reported for Asperger's disorder or PDD-NOS.

In 2000, the Autism Spectrum Disorder and Developmental Disabilities Monitoring Network (ADDM Network), a project of the Centers for Disease Control and Prevention (CDC) active in eleven countries, found that the average prevalence of ASD in 6 out of 11 countries would be 6.7 per 1,000. Two years later, there were 14 sites in the ADDM network where data were being collected, and a prevalence of 6.6 per 1,000 had been detected (Gallo, 2015, p. 2).

Every country has a different history of autism spectrum disorder. Whether its percentage is known or not, the clear point is that its prevalence has been increasing since it was described by Bleuler and Kanner.

The World Health Organization stated on its website the following:

1) One in every 160 children has an autism spectrum disorder (ASD)

2) Autism spectrum disorder begins in childhood and remains persistent throughout adolescence and adulthood.
3) While some people with autism spectrum disorder can live independently, others suffer from severe disabilities and remain in need of lifelong care and support.
4) Studies-based psychosocial interventions such as behavioral therapy and parent skills training programs can reduce communication and social behavior difficulties, with a positive impact on the well-being and quality of life of people with autism spectrum disorder and their caregivers.
5) Interventions for people with autism spectrum disorder must be accompanied by broader measures to make the physical, social and behavioral environments more supportive, accessible and inclusive.
6) People with autism spectrum disorder around the world are often subjected to stigma, discrimination and human rights violations, and access to appropriate services and support for people with autism spectrum disorder remains insufficient globally. (World Health Organization, 2019)

2. Definitions of autism spectrum disorder:

2.1. World Health Organization definition:

"Autism spectrum disorder refers to a group of conditions characterized by some degree of deficit in social behavior, communication and language, few interests and unique activities that the individual performs and performs repetitively. Autism spectrum disorder begins in childhood and tends to continue into adolescence and adulthood. In In most cases, the conditions are apparent within the first five years of life. Individuals with autism spectrum disorder often have other co-occurring conditions, including epilepsy, depression, anxiety, and attention deficit hyperactivity disorder (ADHD). The level of intellectual functioning in individuals with autism spectrum disorder is extremely diverse, ranging from severe to lesser impairment." (World Health Organization, 2019)

2.2. Autism spectrum disorder according to the American Psychological Association (APA):

"**It is one of the disorders that usually begins to appear during the preschool years and is characterized by varying but often noticeable difficulties in communication and social interaction. Autism spectrum disorder has previously been said to include disorders such as typical autism spectrum disorder, Asperger's disorder, and childhood-onset autism spectrum disorder. Disintegrative and Rett Syndrome. The term was once synonymous with pervasive developmental disorders, but it is more commonly used, due to the overlap of symptoms between the two disorders. Autism Spectrum Disorder is currently considered the official term used in the DSM-5, as it includes these disorders:**
There is no longer a difference between autism, Asperger's disorder, and childhood disintegrative disorder, as these disorders have a single diagnosis, and the disorder also includes medical or genetic disorders that are related to autism spectrum disorder, such as Rett syndrome" (APA, 2015, p. 94)
It is worth noting that childhood disintegrative disorders are also called dissociative psychosis and Heller syndrome (Mughal et al., 2020)

2.3. Autism Spectrum Disorder (ASD):

Autism spectrum disorder is a complex disorder in which the individual is characterized by deficits in social aspects and communication, and he cannot acquire language or loses it after acquiring it, in addition to some repetitive behaviors and excessive and abnormal attachment to things.

Kanner (1943) used the initial term “early childhood disorder” to describe children who showed severe self-isolation, lack of social interaction, language impairment, and insistence on maintaining monotony. As previously noted, Asperger (1944) published a study of children with poor communication and interaction skills, whose language and intelligence were in the average to above average range. The name of the disorder described by these and other researchers changed to the term "autism" during the 1970s and 1980s. The term "spectrum" was later added in the 1990s to define the extent and severity of persistent deficits in the disorder and to define the moderate to profound level. (Roth & Worthington, 2005, p. 272)

2.4. Definition of Wing and Gould:

Autism Spectrum Disorder is a “spectrum disorder” that is diagnosed at the behavioral level according to the triad of deficits at the level of communication, socialization and imagination. (Parsons & Mitchell, 2002)

3. Symptoms of autism spectrum disorder according to the International Classification of Diseases, 10th edition, and DSM 5:

3.1. Classification of autism spectrum disorder according to the International Classification of Diseases, Tenth Revision (ICD 10):

Autism spectrum disorder is classified in the International Classification of Diseases within the group of developmental disorders. This group relates to all disorders that affect forms of interaction, communication, quality of activities, and behaviors. Abnormal behavior predominates in aspects of development for people with developmental disorders. The latter is subject to the 10th International Classification of Diseases code F84 contains the following disorders under the following sub codes:

F84.0- Childhood autism
F84.1 - Atypical autism spectrum disorder
F84.2- Rett syndrome
F84.3 - Other disintegrative disorders of childhood
F84.4 - Overactive disorder associated with mental retardation and stereotyped movements
F84.5 - Asperger's syndrome
F84.8 - Other pervasive developmental disorders
F84.9 - Pervasive developmental disorder, unspecified

F.84.0. Childhood autism:

It is defined in the Tenth International Classification of Diseases (ICD10) as follows:

"A type of pervasive developmental disorder that is defined by: (a) the presence of abnormal or impaired development that is manifest before the age of three years, and (b) the characteristic type of abnormal functioning in all the three areas of psychopathology: reciprocal social

interaction, communication, and restricted, stereotyped, repetitive behavior. In addition to these specific diagnostic features, a range of other nonspecific problems are common, such as phobias, sleeping and eating disturbances, temper tantrums, and (self-directed) aggression"(CIM10,2015, p430)

Autism spectrum disorder can be accompanied by highly variable mental levels, and can be accompanied by profound mental retardation in about 75% of cases. (Rogé, 2008, p. 14)

F.84.1. Atypical autism spectrum disorder:

It is defined in the Tenth International Classification of Diseases (ICD10) as follows:

"A type of pervasive developmental disorder that differs from childhood autism either in age of onset or in failing to fulfil all three sets of diagnostic criteria. This subcategory should be used when there is abnormal and impaired development that is present only after age three years and a lack of sufficient demonstrable abnormalities in one or two of the three areas of psychopathology required for the diagnosis of autism (namely, reciprocal social interactions, communication, and restricted, stereotyped, repetitive behavior) in spite of characteristic abnormalities in the other area(s). Atypical autism arises most often in profoundly retarded individuals and in individuals with a severe specific developmental disorder of receptive language"(CIM10,2015, p430)

F.84.2. Rett syndrome:

"The disorder has so far only been described in girls, and is characterized by apparently normal initial growth, followed by partial or complete loss of speech, walking, and use of the hands, associated with slowed growth of the skull and usually occurring between 7 and 24 months. This disorder is characterized by the loss of voluntary hand movements.", stereotyped contorting movements of the hands, and hyperventilation. Social development and play cease, although social interests are usually maintained. Trunk ataxia and apraxia appear beginning at the age of four, and often choreoathetotic athetosis. The problem almost always leads to severe mental retardation"(CIM10,2015, p430)

F.84.3. Other childhood disintegrative disorders

"A developmental disorder is characterized by a completely normal developmental period before the onset of the disorder, which is followed within a few months by an apparent loss of previously acquired performance in several areas of development.

These manifestations are usually accompanied by a complete loss of interest in the environment, with stereotyped and repetitive motor behaviors, and an autistic-type deficit in social interaction and communication. In some cases, the disorder may appear to be due to encephalopathy, but the diagnosis must be based on behavioral disorders"(CIM10,2015, p431)

F.84.4. Hyperactivity associated with mental retardation and stereotyped movements:

"It is a specific disorder for which the validity of its nosological classification remains uncertain. This category concerns children with significant mental retardation (IQ less than 34) associated with significant hyperactivity and significant attention disturbance with stereotypic behaviors. Stimulant medications are usually contraindicated in are effective (although they may be effective in children with normal IQ) and can cause an unpleasant and severe reaction (sometimes accompanied by psychomotor slowing).

Often in adolescence, hyperactivity gives way to hypoactivity (which does not usually happen in children who have hyperactivity and normal intelligence). This syndrome is also often accompanied by several forms of developmental delay, whether specific or total. It remains unknown to what extent behavioral syndrome is a result of mental retardation or organic brain damage"(CIM10,2015, p431)

F.84.5. Asperger syndrome:

"A developmental disorder in which impairments in social interactions are similar to those found in autism spectrum disorder. Restricted interests in objects and stereotypical repetitive activities are also present. On the other hand, cognitive development and language development are poor. The disorder is often associated with motor clumsiness. "The disturbances persist into adolescence and adulthood. The disorder is sometimes accompanied by psychotic episodes in early adulthood"(CIM10,2015, p432)

F.84.8. Other pervasive developmental disorders

F.84.9. Pervasive developmental disorder, unspecified:

This category is intended for disorders that conform to the general characteristics of developmental disorders but are impossible to classify into one of the above categories due to the lack of information or inconsistencies in the available information. (ROGE,2003, p.15)

3.2. Classification of autism spectrum disorder according to the Diagnostical and Statistical Manual (DSM 5):

The term 'autism' is no longer used in the Diagnostic and Statistical Manual of Mental Disorders. However, as previously explained, the term 'autism spectrum disorder' is currently used, encompassing various types of autism spectrum disorder and other developmental disorders. The diagnostic criteria are as follows :

a. Persistent deficits in social communication and social interaction in multiple contexts, as manifested in the following, currently or from the person's past:

1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.

2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures: to a total lack of facial expressions and nonverbal communication.

3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers. (DSM V,2013, p.50)

B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive; see text):

1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases).

2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat same food every day).

3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests).

4. Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).

C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).

D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual disability, social communication should be below that expected for the general developmental level. (DSM V,2013, p.50)

4. The difference between autism spectrum disorder and autism:

4.1. Autism:

"**A neurodevelopmental disorder characterized by marked deficits in social interactions, verbal and nonverbal communication; narrow interests, and repetitive behaviors. The features and features of the disorder appear before the age of three but vary greatly among children according to developmental level, language skills, and chronological age. The disorder may also include decreased awareness Children's feelings of others, poor ability to imitate, lack of social play, abnormal speech, unfamiliar nonverbal communication, and rejection of change in the environment. Autism spectrum disorder is classified in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) as a developmental disorder. Autism disorder is classified as an autism spectrum disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and is no longer a separate diagnosis. Other names include autistic disorder, infantile autism, early childhood autism, and Kanner syndrome.**

This is what Kanner previously referred to in schizophrenia, where he mentioned the presence of an abnormal preoccupation with the self and imagination, such that there is a lack of interest or an inability to focus on external reality". (APA, 2015, p. 94)

4.2. Autism Spectrum Disorder:

"**A group of disorders that typically begin to appear during the preschool years and are characterized by varying but often marked difficulties in communication and social interaction. Previously, autistic disorder included disorders such as typical autism, Asperger's disorder, childhood disintegrative disorder, and Rett syndrome. It was synonymous with However, it is more common, due to the overlap of symptoms between the disorders. It is now the official term used in the DSM-5, where it includes and includes these disorders:**

Autism, Asperger's disorder, and childhood disintegrative disorder. These disorders are no longer distinguished in diagnosis, and medical or genetic disorders that may be associated with autism spectrum disorder have been identified and distinguished. Also called autism spectrum disorder" (APA, 2015, p. 94)

It can be noted that autism spectrum disorder is broader and more comprehensive than autism because it contains many disorders such as Rett syndrome, Asperger syndrome, atypical autism disorder, and disintegrative disorders (Szatmari, 2003) that affect the child's development, so the authors used the phrase autism spectrum disorder instead of the term autism.

The term spectrum currently means the presence of a wide range of forms of autism disorder at several levels.

All cases of autism spectrum disorder originate before birth, and they all affect brain development. However, their effect can be very different on a developing mind. Hence, a different set of behaviors emerge. (Frith, 2008, p. 4)

5. Prevalence rates of autism spectrum disorder:

Autism spectrum disorder is more prevalent than before (Autism rates by Country, 2019) and more than it was in the recent past, and its prevalence rates vary from one study to another, with rates ranging from 0.7 in 10,000 to 13.9 in 10,000 (ROGE, 2003, p. 45), and the latest studies indicate a change in the prevalence rate as the rate of the disorder has increased, and it has been published in eleven studies conducted since 1989 that the prevalence rate was 7.2 in every ten. This increase may be attributed to advances in diagnostic capabilities and consideration of other disorders within the autism spectrum, encompassing a larger population experiencing social interaction and communication disorders without always providing a comprehensive depiction of autism. However, certain environmental factors (immunological or genetic) can contribute, along with others yet to be determined, to high prevalence rates. This issue remains a subject of extensive debate presently, with answering it and other related questions necessitating further evidence and studies. (ROGE, 2003, p. 45).

Developed countries have more statistics than developing countries, in the entire world, especially in the 1990s (Jick & Kaye, 2003), so developing countries do not have accurate data for this disorder.

For example:

- Hong Kong: 372 children were diagnosed with autism spectrum disorder out of a total of 10,000 children, or one child with autism spectrum disorder out of every 27 children in 2019. (Autism rates by country, 2019)
- In South Korea, 263 children with autism spectrum disorder were counted out of every 10,000 children, that is, one child with autism spectrum disorder out of every 38 children.
- USA 222 children out of every 10,000 children are diagnosed with an autism spectrum disorder, or 1 child with an autism spectrum disorder in 45 children.

Some other countries are mentioned in the table:

5.1. In developed countries:

Table 1:Rates of autism spectrum disorder by country and by population density 2020

(Autism rates by country, 2019)

Number of autism cases			
	Diagnosis in every 10,000	**The number of children with 1 rate**	**population**
Country	**Children**	**ASD diagnosis**	**2019**
Hong Kong	372	27	7,436,154
South Korea	263	38	51,225,308
United States of America	222	45	329,064,917
Japan	181	55	126,860,301
Ireland	153	65	4,882,495
Switzerland	145	69	8,591,365
Canada	106	94	37,411,047
Denmark	69	145	5,771,876
Singapore	67	149	5,804,337
Estonia	60	167	11,539,328
Belgium	60	167	1,325,648
Finland	54	185	5,532,156
Norway	51	196	5,378,857
Holland	48	208	17,097,130
Germany	38	263	83,517,045
China	23	435	1,433,783,686
Taiwan	5	2000	23,773,876
Poland	3	3333	37,887,768

It is important to note that not all countries with a high rate of autism spectrum disorder have been placed in the table, due to the lack of necessary information and data about the rates of autism spectrum disorder in these countries around the world. (Autism rates by Country, 2019)

5.2. In developing countries:

Existing findings on autism spectrum disorder are inconclusive, due to under-diagnosis of the disorder (Sydney Missigman, n.d.), and due to the low rate of data on autism spectrum disorder in developing countries. In Algeria, professionals estimate the rate of autism spectrum disorder at 400,000 cases, or two children per 1,000 with autism spectrum disorder (F. Senoussaoui et A. Loucif, n.d). This is in the year 2019 when these lines were written, but in the year 2023 the rate became 89.40% in Every 10,000 individuals.

In Arab countries, the following data is available regarding autism spectrum disorder:

- Egypt: The number of people with autism spectrum disorder in Egypt is estimated at 800,000, according to the Ministry of Social Solidarity. One in every 160 children shows signs of this disorder (800,000 Egyptians with autism spectrum disorder, 2017)
- In the United Arab Emirates, the prevalence rate was 58 per 10,000, and the presence of autism spectrum disorder traits was associated with males, behavioral problems, and a family history of developmental delay (Salhia et al., 2014). However, in the year 2023, the percentage increased to 112.4% per 10,000 individuals.
- Kingdom of Saudi Arabia: The prevalence rate in the last report estimates that there were 42,500 confirmed cases of autism in 2002 and that many cases were not diagnosed (Sulaimani & Gut, 2019), but in the year 2023 the percentage rose to 100.7% per 10,000 individuals, according to the website of Autism rates by country, 2023.
- Amman: The prevalence rate is 1.4 per 10,000, and the prevalence in males increases by 2.5 times, and the age-specific prevalence was higher among children aged 5-9 years (Salhia et al., 2014), and in the year 2023 the rate became 107.2 per 10,000, i.e. One in every 93 children has an autism spectrum disorder.
- Bahrain: The prevalence rate is 4.3 per 10,000 population, with 4 children on the autism spectrum compared to one girl on the autism spectrum (Salhia et al., 2014)
- Morocco, the number of people with autism spectrum disorder is estimated in 2018 to be between 400,000 and 500,000 children (SAKHI, H. 2018), and in 2023 the prevalence rate was estimated at 88.40 per 10,000.
- Tunisia: There are more than 200,000 people in Tunisia with autism spectrum disorder and this number continues to grow (Ben osman. 2019)

Overall, current estimates of the prevalence of autism spectrum disorder are 63 per 10,000 in the world. (Szatmari, 2003), it is clear that autism spectrum disorder is increasing year after year, and there is no doubt that countries cannot control its spread due to the unknown causes of this disorder. Perhaps they are using methods and techniques that reduce the symptoms, but the final solution and treatment have not been found yet. Some authors have described the prevalence of autism spectrum disorder as an “autism outbreak” (Kaufmann & Silverman, 2010) to refer to autism spectrum disorder.

It should be noted that in 2023, there was an increase in the percentage of people with autism spectrum disorder globally, particularly in Arab countries, where most took the lead in prevalence. This underscores the need for increased attention and prioritization of addressing this disorder to prevent further escalation in the coming years.

The website worldpopulationreview.com mentioned the following:

Qatar: 151.20% the rate of autism spectrum disorder per 10,000 children
United Arab Emirates: 112.40% the rate of autism spectrum disorder per 10,000 children
Oman: 107.20% the rate of autism spectrum disorder per 10,000 children
Bahrain: 103.30% the rate of autism spectrum disorder per 10,000 children
Saudi Arabia: 100.70% the rate of autism spectrum disorder per 10,000 children
Kuwait: 97.70% the rate of autism spectrum disorder per 10,000 children
Jordan: 92.10% the rate of autism spectrum disorder per 10,000 children

Syria: 91.90% the rate of autism spectrum disorder per 10,000 children

Palestine: 91% the rate of autism spectrum disorder per 10,000 children (Autism rates by Country, 2023))

The Arab countries mentioned above are considered the countries where autism spectrum disorder is most prevalent and occupy the forefront of prevalence, as previously mentioned, which requires strengthening and supporting the efforts of researchers, scientists, and doctors to reduce the high prevalence of the disorder.

6. Different levels of severity in ASD:

In the DSM5, three levels of severity can be found for autism spectrum disorder, which are:

6.1. Level 1: The child's condition requires support

This represents a level where the child's condition is not severe, yet they still require intervention and support from others. The primary focus should be on fostering communication and social interaction to better understand the child, as improved communication facilitates comprehension. At this stage, the child may exhibit limited interest and indifference towards conversations and social interactions in general (Association, 2013, p. 52). They encounter difficulties in socializing with peers and may display restricted and repetitive behaviors. Any deviation from their accustomed routine is met with annoyance and rejection.

6.2. Level 2: The child's condition requires significant support

At this stage, the child experiences difficulty expressing themselves verbally or non-verbally, exhibiting a clear deficiency in both verbal and non-verbal language as well as other communicative abilities. This inability becomes apparent in social settings that demand interaction, where the child struggles to respond appropriately, often displaying abnormal or inadequate reactions. Regarding behavior, they exhibit inflexibility and resistance to change, struggling to adapt. Many restricted or repetitive behaviors manifest across various social contexts, making the symptoms evident to observers. (Association, 2013, p. 52)

6.3. Level 3: The case of a child who needs very significant support

The child suffers from severe weakness in all his abilities, communication, verbal language, and non-verbal communication skills. The child appears absent when he is in an interactive situation, or interacts with few responses with others. Behaviorally, the child faces extreme difficulty in adapting to change, and repetitive restricted and stereotypical behavior interferes." "Demonstrated performance in all situations. (Association, 2013, p. 52)

7. The three important axes in autism spectrum disorder:

7.1. Social behavior in autism spectrum disorder:

Autism spectrum disorder affects crucial skills and abilities. Children with this disorder often have unique characteristics that make it challenging for others to understand them. They may have specific rules governing their thoughts, perceptions, and interactions. Their way of feeling and comprehending the world differs from that of others, leading to delays in personality development, language acquisition, understanding of the world, and knowledge. These delays can have negative impacts on both the affected child and their family. The absence of social interaction and play with peers can hinder the child's development, making it difficult for them to integrate into social settings and adhere to social norms. Difficulties in expressing emotions and understanding others can further complicate social interactions.

7.2. Language and communication in autism spectrum disorder:

Language development in children is typically facilitated through social interactions, reading, listening, and speaking. Various cognitive processes, such as memory, word recall, linking words to their meanings, and imagining topics discussed, play crucial roles in language acquisition. Children with autism spectrum disorder may struggle with these cognitive processes, leading to limited language skills or even a complete absence of interactive language. Some children may resort to non-verbal communication methods, such as gestures or cries, to express their needs. This limited language ability can hinder effective communication and social interaction.

7.3. Stereotypic and repetitive behavior in autism spectrum disorder:

Repetitive behaviors, such as rapid finger movements or repeatedly pressing buttons, are common symptoms in individuals with autism spectrum disorder. These behaviors often draw the attention of researchers, psychologists, and child psychiatrists who seek to understand the underlying reasons for such actions and their impact on the individual. Developing strategies to reduce these behaviors is crucial as they can be disruptive to the individual's environment, including parents, teachers, and caregivers. Stereotypical behaviors pose significant challenges for individuals with autism spectrum disorder, affecting their learning, adaptation, and social acceptance. Addressing these behaviors is essential to support positive adaptation in society and prepare the individual for future educational endeavors.

8. Causal hypotheses for autism spectrum disorder:

The etiology of autism spectrum disorder (ASD) can be attributed to either psychogenic or organic factors. Scientists have delineated two main categories to explain the origins of ASD: the psychological-genetic hypothesis and the organic hypothesis. Psychologists offer their perspectives, while neurologists present empirical evidence. Each scientific field dedicated to health delineates its viewpoint and hypotheses.

In the subsequent paragraphs, we will delve into the psychological factors associated with ASD, which include:

8.1. Psychological-genetic hypotheses:

8.1.1. Early deprivation theories:

These theories address cases of early deprivation, where the child does not receive adequate care or compassion, and may not know at all these important elements of normal life. On the contrary, the child may live without any kind of compassion and good care, so he becomes withdrawn into himself. He avoids any contact with his mother or father, or both, or the entire family, and becomes a state of autism. The authors have talked about many types of experiences that a child may experience in his childhood, including:

8.1.2.Early abandonment of the child in nature:

The authors also called them "feral children" (Lenoir et al., 2007, p. 109). These children lived with animals and did not develop any ability to speak, which made them do not have any conversational language, but they did develop some animal sounds to communicate with animals. Other, they have highly developed and powerful senses.

8.1.3. Dealing with excessive deprivation:

In this case, children do not receive an appropriate level of sympathy and tenderness. The mother or caregivers provide a bad type of ill-treatment and affection that may be excessive or the opposite, misuse the amount of attention and affection, or neglect the child completely, which leads to the child withdrawing into himself. He develops autism disorder because the outside world considers him dangerous.

8.1.4. Hospitalization:

It is the absence of a psychomotor response or failure to gain weight or produce purposeful behavior, and has often been thought to be a response to separation from mothers and hospitalization (APA, 2015, p. 504). Through this idea, Rutter considers poor care A condition resembling autism spectrum disorder that develops because the child suffered from maternal deprivation, as Spitz et al., 1965 called it. The child becomes in a state of dependent or deprivation depression because he did not receive appropriate care, or he received negative emotions and wrong behavior from the caregiver, which will lead to a state of self-isolation, and it can be said that this condition is quasi-autistic in general. These classified theories consider early deprivation to be the main cause of autism in childhood.

8.1.5.Theory of B. Bettelheim:

In this theory, Bettelheim described a man detained in Nazi camps. This man was broken, distraught, and had reached an almost autistic state (Lenoir et al., 2007, p. 110). The man was in a state of imminent death, which Bettelheim called an "extreme situation." This situation put the man in a position similar to patients with autism spectrum disorder. From this perspective, people with

autism spectrum disorder were considered to suffer from a fear of abandonment and loss, and they also had psychological trauma (Lenoir et al., 2007, p. 110), This situation forced them to stay alone to protect themselves from the outside world.

Based on the aforementioned theories, the recommended intervention entails separating the child diagnosed with autism spectrum disorder (ASD) from their primary caregiver, typically the mother, and placing them in a specialized care facility tailored to the needs of such individuals. This specialized care should be continuous and aimed at fostering behavioral modification while minimizing exposure to situations that may induce frustration. According to these theories, inadequate caregiving practices are posited as a significant contributor to the development of autism. Bettelheim's perspective, likening the conditions in Nazi concentration camps to the mother-child relationship, suggests that dysfunctional maternal interactions devoid of emotional connection may precipitate the manifestation of autistic traits in the child, ultimately leading to a pervasive autistic state.

8.2. Dynamic theories:

These theories are based on a psychoanalytic approach, and all their interpretations depending on the first stage between the child and his mother in the stage of breastfeeding and emotional exchange. This theory has two directions: (Lenoir et al., 2007, p. 110):

- Unilateral approach means that the mother is solely responsible for any type of problem or disorder that afflicts her infant son. If the child does not receive the appropriate love, tenderness, and affection, the matter will lead to the emergence of disorders at the psychological level, the most prominent disorder that may appear is autism. (Lenoir et al. al., 2007, p. 110)
- The dual direction, which means that the mother and the infant have a defect in interaction and emotional exchange. The root of the problem may be on the part of the mother towards her infant or vice versa, from the infant to his mother. If one of them provides good treatment and creates satisfaction, and the other party does not respond appropriately, then it is inevitable. The consequence is the emergence of psychological disorders (Lenoir et al., 2007, p. 110) and imbalances at the level of the psychological system, which may ultimately lead to autism.

8. 3. Neurobiological theories:

The proponents of these theories generally attribute the emergence of the autism spectrum to imbalances in brain structure. According to DeLong (1978), autism arises from issues within the frontal lobe, particularly implicating the hippocampus, which plays a crucial role in regulating emotions, fears, and language production. Damasio and Maurer (1978) suggest a defect in both the frontal lobe and the dopamine system, impacting the ability to execute tasks and initiate actions. Courchesne (1987) proposes that dysfunction in the cerebellum results in an inability to regulate sensory inputs. (Lenoir et al., 2007, p. 113)

In a study issued in 2012, researchers considered that the cause of autism spectrum disorder is due to insufficient communication between anatomical and functional systems during frontal and posterior cortical processing at the brain level (Just et al., 2012). Other neurologically oriented authors assume that the main cause of autism is due to a defect in the nervous system, and this view is based on the work of Luria (1978), where he believes that the central nervous system contains three important functional units, each unit is responsible for processing information and each unit has a relationship with the other units (Lenoir et al., 2007, p. 114)

- The first functional unit relates to the ascending and descending reticular formation. According to Luria, this unit has a relationship with specific nuclei of the thalamus, the diencephalon, and the central regions of the cerebral hemispheres (Lenoir et al., 2007, p. 114). The function of this unit is Regulating peripheral muscle tone as well as cortical super-excitability, it is responsible for the selection of all sensitive and sensory stimuli, it activates functional units 2 and 3, especially under the control of the limbic system (Lenoir et al., 2007, p. 114).
- The second functional unit can be divided into three subunits called analysis units; These units are:
• The basic analyzer is concerned with integrating sensory perception with a simple level of reception, and localizing information, and this analyzer contains primary cortical areas (Lenoir et al., 2007, p. 115)
• The secondary analyzer corresponds to the monomodal associative regions described by Mesulam. These regions allow detailed and distinct analysis of information (Lenoir et al., 2007, p. 115).
• The third analyzer corresponds to the heteromodal temporal associative areas. This is the area where different sensory or sensitive information begins to be collected and recognized (Lenoir et al., 2007, p. 115).
- The third functional unit corresponds to the heteromodal prefrontal associative areas. It sends descending inhibitory cortical stimulations to regulate the transmission of sensory afferents to the brainstem and then to the perceptual organs themselves. (Lenoir et al., 2007, p. 115)

8.3.1. Subcortical dysfunction theory:

This model is rooted in Ornitz's assertion that autism spectrum disorder stems from a dysfunction in the brainstem, specifically within the vestibular structures. Ornitz posits that the issue lies in the brainstem's inability to differentiate incoming sensory information effectively. This deficiency results in two conflicting modes of processing sensory stimuli, as the brainstem struggles to discern between different sensory inputs entering the brain. (Lenoir et al., 2007, p. 114).These two situations are as follows:

8.3.1.1.Problem of Select alerts:

Hutt (1964) proposes the hypothesis that there is a defect in the selection of incoming stimuli to the brainstem, and that children with autism spectrum disorder have a state of heightened physiological and behavioral arousal (Hutt & Ounsted, 1966). Hutt gave the example of a person who experienced fear, where his eyes are unstable, very active and excited. In this example, it is clear that Hutt considers that children with autism spectrum disorder have a hyperactive physiological state. These manifestations indicate a state of biological response, and gaze aversion is a solution to reduce that state of arousal. It seems The child feels a kind of danger, so he is unable to properly filter various stimuli, such as seeing others that he may consider dangerous, (Hutt & Ounsted, 1966). In addition to the work and studies of Hutt, Cerliani conducted a study in which he confirmed the presence of excessive communication between the subcortical and sensory cortical regions when information comes. Cerliani believes that these regions do not properly deal with different information and thus the result is autism spectrum disorder. (Cerliani et al., 2015), and this is roughly what Ornitz said previously when he wrote an article in the Journal of the

American Academy of Child Psychiatry in which he assumed that the neurophysiological hypotheses about autism spectrum disorder can be divided into two groups, the first being imbalances in brain structures, The second is imbalances in the brain stem and brain structure (Ornitz, 1985), so the child suffers from autism spectrum disorder due to the dysfunction in those aforementioned areas.

8.3.1.2.The problem of excessive alerts selection:

The theory is called "rejection of nerve impulses," as the person shows a decrease in sensory sensitivity and motor activation, and repetitive movements towards certain topics due to the lack of data received (Lenoir et al., 2007, p. 116), as the proponents believe. In this direction, there is a decrease in sensitivity to language, which is clearly visible in people with autism spectrum disorder.

8.3.4.Theory of Mind:

Mind theory means that they can attribute a certain condition to others, so that person can understand and predict their reaction and behavior, (San José Cáceres et al., 2014) The authors believe that children with autism spectrum disorder cannot understand the mind of another person, Controlling it would be inappropriate in interaction and reaction, and it can be said that a person according to these assets has an understanding of the desires, beliefs, perceptions and emotions of others (Colle et al., 2007), but children with autism spectrum disorder cannot do this work, for example . If a normal child understands a joke from his peers, he will inevitably react with joking and laughter, which will be the appropriate reaction to what he received from his peers. However, a child on the autism spectrum will not react to the joke himself, as his responses may be crying, screaming, or indifference.

In addition to the previous theories, there are other hypotheses and reasons mentioned by scientists to answer the cause of the autism spectrum, the most important of which are:

8.4. Cognitive and neuropsychological hypotheses:

Those who advocate these hypotheses considre that the cause of autism spectrum disorder is the presence of a defect and problems in processing information, as the child suffers from a problem in three basic axes: social perception, executive functions, and the idea of "weak central coherence." The authors believe that the deficit in Social cognition is mainly due to interpersonal relationships in the child's early years (Lenoir et al., 2007, p. 114), so this child cannot usually understand or interact with others, and as for executive functions, the child cannot perform perhaps the simplest functions despite their ease. This is due to a defect in the mental cognitive aspects. For example, the child is unable to organize emotional responses and lacks initiative.

8.5. Other possible causes:

8.5.1. Vaccinations and mercury:

Concerns regarding the significant increase in autism spectrum disorder diagnoses among children have led to the assumption that there may be a connection between vaccination, particularly the MMR vaccine (measles, mumps, and rubella), and autism spectrum disorder. Parents are also worried because the rise seems to coincide with changes in vaccination guidelines in the early 1990s, which increased the number of required vaccines and their administration during the first 15 months of a child's life (Chez, 2008, p. 91).

Certain factors are pushing researchers to investigate a potential link between the vaccine and autism spectrum disorder, particularly the timing of when the vaccine is administered. The schedule for the MMR vaccine, previously given between 18 and 24 months, was shifted to between 12 and 15 months. This alteration happened around the same time as the observed increase in autism spectrum disorder cases (Chez, 2008, p. 91). However, it is worth noting that these concerns have not been substantiated by a definitive study.

Despite ongoing speculation about the MMR vaccine's role in causing autism spectrum disorder, numerous studies have concluded that there is no proven connection between the MMR vaccine and autism spectrum disorder (Farrington et al., 2001). For instance, a study titled "Measles, Mumps, and Rubella Vaccine and ECDs: A Case-Control Study" found no association between measles, mumps, and rubella vaccination and an increased risk of developing ECDs later in life (Smeeth et al., 2004).

Researchers in another study have suggested that autism spectrum disorder is a neurodevelopmental disorder primarily influenced by genetic factors such as mutations, gene absences, copy number variations, and other genetic imbalances, all of which are likely contributors to autism spectrum disorder (Landrigan, 2010). Some researchers propose that phenylketonuria, a disorder linked to autistic traits due to the improper metabolism of the amino acid phenylalanine, may also play a role in the development of autism spectrum disorder (Joshi et al., 2002).

8.5.2. Neurotransmitter imbalances:

Several studies suggest an involvement of the neurotransmitter serotonin in autism spectrum disorder, along with genetic factors affecting serotonin metabolism (Joshi et al., 2002). It is observed that children with autism spectrum disorder have elevated levels of serotonin, a chemical transmitter, in their platelets (Joshi et al., 2002). It is important to note that the serotonin transporter influences an individual's mood, and any excess or deficiency in its secretion can lead to health issues and psychological disorders.

8.5.3. Metabolic imbalances:

Many studies have reached results indicating the presence of other biochemical factors that have a role in autism spectrum disorder, and these factors are:

- Amino acids and organic acids
- Analogues of the Krebs cycle
- Melatonin
-Cyclic AMP
-Gangliosides
-Endorphins
-Lactate / pyruvate enzyme
-Glial fibrillary acidic protein
-Catecholamines

Smith-Lemli-Opitz syndrome (Joshi et al., 2002)

Other disorders may be related to autism spectrum disorder, including:

-Histidine in the blood
-Adenylosuccinate Lyase deficiency
-Deficiency in phosphoribosyl pyrophosphate synthesis (Joshi et al., 2002)

A deficiency in magnesium, as well as decreased levels of sulfates or phenols, may also be observed. These latter two factors could potentially exacerbate or contribute to autism spectrum disorder. Additionally, a deficiency in the enzyme p-sulfotransferase may result in the accumulation of serotonin, dopamine, and norepinephrine, which are commonly associated with autism spectrum disorder (Joshi et al., 2002).

8.5.4.Exposure to foreign bodies:

Parents of children with autism spectrum disorder, or the children themselves in the womb, may be exposed to unknown biological substances, and this matter has become more of an interest to politicians. There are several explanations so far, including chance exposure to an unspecified type, a viral epidemic, or exposure to toxins. Research is now focusing on following up on for people who work in professions that require the use of chemicals, and to evaluate the health of their children, this method is considered one of the promising methods for determining the effects of exposure to foreign biological materials. Joshi mentioned in his study that it was observed the presence of high levels of a substance called indolyl-3-acryloyl glycine. -Acryloyl glycine, which is produced to break down the amino acid tryptophan, which precedes serotonin, and has been found in urine samples taken from many people with autism spectrum disorder, as well as farmers who suffer from "sheep dip syndrome" and even many war veterans. People with chronic diseases who previously fought in the Gulf War (Joshi et al., 2002). Perhaps this draws attention to the possibility of the presence of other biological substances that may be involved in the emergence of several mental disorders or birth defects. This calls for intensified efforts to reach definitive results and Supporting research and studies.

8.5.5. Intestinal problems:

Opioid-related substances have been detected in approximately 80% of urine samples from individuals with ASD. It has been suggested that these abnormal compounds result from incomplete breakdown of proteins such as wheat gluten and casein, possibly due to intestinal permeability. Consequently, restricting the intake of gluten and casein in the diet of individuals with autism spectrum disorder (ASD) may be beneficial for some.

The presence of abnormal metabolic byproducts not only affects brain biochemistry but also hampers digestive tract motility, potentially leading to constipation. Statistics indicate that around 50% of individuals with ASD experience constipation. Conversely, severe intestinal impaction can result in diarrhea, which must be addressed promptly as it can pose a life-threatening risk (Joshi et al., 2002)

8.5.7.Genetic and environmental factors in autism spectrum disorder:

The etiology of autism spectrum disorder remains elusive, yet ongoing research indicates a significant genetic component. Previous studies have identified over 100 genes associated with autism spectrum disorder, with rare and widespread mutations present in approximately 10 to 25% of affected individuals (Bourgeron, 2016). Pioneering research by Folstein and Rutter investigated the role of genetics in autism spectrum disorder, notably finding a higher concordance rate among monozygotic twins (36%) compared to dizygotic twins (0%) (Bourgeron, 2016). Subsequent studies involving large cohorts of twins further support this observation, with monozygotic twins showing concordance rates ranging from 77% to 95%, contrasting with 31% in dizygotic twins (Bourgeron, 2016). Another study by Jamain et al. (2003) reaffirmed these findings, indicating a

60% chance of autism spectrum disorder manifestation in monozygotic twins compared to 0% in dizygotic twins.

Researchers have categorized genetic studies into three main types to elucidate the genetic contributions to autism spectrum disorder. Firstly, twin studies comparing monozygotic and dizygotic twins shed light on heritability rates (Geschwind, 2011). Secondly, familial studies explore the prevalence of autism spectrum disorder among first-degree relatives, offering insights into familial predisposition and etiology (Geschwind, 2011). Lastly, investigations into rare genetic syndromes associated with autism spectrum disorder provide valuable insights into potential genetic mechanisms underlying the disorder (Geschwind, 2011).

9. Pathological Disorders Associated with Autism Spectrum Disorder, or Comorbidity:

9.1.Definition of comorbidity:

Comorbidity refers to the co-occurrence of two or more disorders whose presence together exceeds what would be expected by chance alone (Stricker et al., 2003, p. 46). This means that comorbidity involves the simultaneous existence of two diseases or disorders within the same individual. For instance, one may observe obsessive-compulsive disorder alongside anxiety disorder or anxiety disorders coexisting with peptic ulcer disease. In such cases, the symptoms of both disorders may overlap without each one fully manifesting its distinct symptoms.

In this context, children diagnosed with autism spectrum disorder may also experience other disorders associated with their condition, such as epilepsy, ADHD, cardiovascular diseases, and immune system disorders. Psychologists and specialists must recognize these concurrent disorders, as doing so enables accurate diagnosis and appropriate care for children with autism spectrum disorder.

Recent studies and contemporary medicine have shed light on some of the disorders and diseases commonly found alongside autism spectrum disorder.

9.2. Epilepsy:

Epilepsy is defined as the occurrence of more than two seizures due to sudden, disturbed, and excessive nervous discharges (Li et al, 2015). According to researchers, there are two peaks of epilepsy: one in childhood and around puberty, with the majority occurring in adulthood (Bisage, 2017). Today, the relationship between epilepsy and autism spectrum disorder has been a subject of debate. Epilepsy affects 20% of children with autism spectrum disorder, and vice versa—autism spectrum disorder affects 20% of children with epilepsy (Bisage, 2017). Epilepsy can manifest independently or with some symptoms appearing only in conjunction with those of autism spectrum disorder. To understand how and why the disorder appears, genetic and environmental factors must be taken into account (Bisage, 2017). Epilepsy can lead to a decline or loss in the skills of a child with autism spectrum disorder. Children or adults with an intellectual disability are also at risk of developing epilepsy, whereas those without an intellectual disability do not typically develop the condition (Bisage, 2017). Some studies have shown that the prevalence of epilepsy is 21.5% in children with autism spectrum disorder who have intellectual disabilities, but this percentage drops to 8% for those without intellectual disabilities. It is evident that individuals with autism spectrum disorder who have intellectual disabilities are more susceptible to epilepsy.

Therefore, it can be said that intellectual disability significantly increases the risk of developing epilepsy (Bisage, 2017). If IQ is low, it becomes a risk factor for developing epilepsy.

Some authors suggest that epilepsy may cause manifestations resembling autism spectrum disorder (Bisage, 2017). Scientists recommend that children with autism spectrum disorder and epilepsy receive early care and medication to prevent the deterioration of their abilities. Epilepsy is considered independent, associated, and a comorbidity, rather than a symptom. It is rarely a symptom of autism spectrum disorder, but if it does occur, it is crucial to treat it promptly and effectively (Besag, 2017).

9.3.Attention Deficit Hyperactivity Disorder (ADHD):

ADHD, or Attention Deficit Hyperactivity Disorder, is a behavioral syndrome characterized by the persistent presence of six or more symptoms. These symptoms include inattention, such as failure to complete tasks, difficulty concentrating, and impulsivity or hyperactivity, like impatience, restlessness, and excessive talking. Symptoms typically manifest before the age of seven and can impact social, academic, and occupational performance in multiple settings. ADHD has been known by various names over the years, including Attention Deficit Disorder.

Researchers have found that symptoms associated with Autism Spectrum Disorder often emerge in early childhood and can coexist with ADHD. It is important for specialists to address both disorders simultaneously, as studies suggest that ADHD symptoms frequently accompany Autism Spectrum Disorder. Genetic abnormalities, such as the absence syndrome 22q-11 and specific chromosomal abnormalities, have been linked to these symptoms. Certain genetic factors, like the DRD4-7 allele, may increase the likelihood of developing Autism Spectrum Disorder in children with ADHD.

The co-occurrence of Autism Spectrum Disorder and ADHD is common, leading to more severe symptoms when both disorders are present. Addressing both conditions concurrently is crucial for managing the individual's overall well-being and symptoms effectively.

9.4. Anxiety disorders:

Anxiety is an emotion characterized by fear and physical symptoms of tension in which an individual anticipates imminent danger, disaster, misfortune, or the like. The body often mobilizes itself to confront the perceived threat as the muscles become tense, breathing becomes faster, and the heart beats more quickly. Anxiety and fear can be distinguished either conceptually or physiologically, although the two terms are often used interchangeably. Anxiety is a long-term, future-oriented, broadly focused response to a sweeping threat, while fear is an appropriate, present-oriented, and short-term response to a specific threat (APA, 2015, p. 66).

Anxiety is among the disorders that commonly accompany autism spectrum disorder. According to South and other scientists, about 50 per cent of individuals with autism spectrum disorder will experience anxiety that significantly affects their daily lives and the lives of their families. Anxiety reduces quality of life and interferes with education, employment, and realizing potential (South et al., 2017).

One of the causes of anxiety in autism spectrum disorder is a decrease in the volume of the right amygdala (South et al., 2017). In an experiment conducted by Herrington and his colleagues on a group of people with autism spectrum disorder and anxiety disorder as a first group, and on

people with autism spectrum disorder without anxiety disorder as a second group, it was noted later that people with autism spectrum disorder and anxiety disorder as a comorbid disorder had a smaller size on the right side of the amygdala, but the size of the latter was normal for people with autism spectrum disorder who do not suffer from anxiety disorder. Some other researchers see anxiety as a result of the presence of fragile X or is caused by the presence of attention deficit hyperactivity disorder (ADHD), while others believe that mental disability is related to anxiety (South et al., 2017).

9.5. Gastrointestinal dysfunction:

Gastrointestinal dysfunction is common in critically ill patients, and it is important to prevent and control its manifestations (Webster & Newman, 2015). To date, this disease is not well understood (Gorrindo et al., 2012). According to studies by specialists, there is no relationship between gastrointestinal dysfunction and any specific diet or medications in children with autism spectrum disorder, but it is related to linguistic and social impairment. One of the most common types of gastrointestinal dysfunction observed in children with autism spectrum disorder is functional constipation (Gorrindo et al., 2012), along with bloating and diarrhea (Krakowiak et al., 2008). Researchers have suggested that possible causes of constipation in children with autism spectrum disorder are increased social disability and deficiency in expressive language (Gorrindo et al., 2012). This study provided data showing that children with autism spectrum disorder and gastrointestinal dysfunction often have a deficiency in expressive language (Gorrindo et al., 2012). The researchers recommend that healthcare providers evaluate their patients to detect any underlying constipation. It is important to give attention to the experimental treatment of constipation in children who lack non-verbal expressions (Gorrindo et al., 2012). Finally, the study confirms that gastrointestinal dysfunction in children with autism spectrum disorder is an expression of genetic risk factors interacting with environmental components affecting gastrointestinal function (Gorrindo et al., 2012).

9.6. Phenylketonuria:

Phenylketonuria is described as one of the most common disorders of amino acid metabolism (Baieli et al., 2003). Current studies suggest that this disorder affects only a small number of cases. While Phenylketonuria is recognized as one of the contributing factors to autism spectrum disorder, its prevalence is relatively low. According to Baieli et al. (2003), the prevalence remains very low, with approximately one in 10,000 cases being diagnosed with phenylketonuria. These cases have been found to have a significant association with autism spectrum disorder. Friedman collected data from medical literature on over 50 cases where individuals had phenylketonuria and displayed symptoms of autism spectrum disorder. Researchers concluded that delayed diagnosis or untreated phenylketonuria could either cause autism spectrum disorder or be a co-occurring condition with it (DEMİRCİ, 2017). Early detection of the disorder is crucial for successful treatment (Baieli et al., 2003). Gillberg and Coleman, among other researchers, have suggested that the co-occurrence of autism spectrum disorder and phenylketonuria represents a dual syndrome (DEMİRCİ, 2017). Both researchers emphasized that if phenylketonuria is left untreated post-birth, it could lead to irreversible brain damage later on or result in autism spectrum disorder. Untreated forms of phenylketonuria could also contribute to certain behavioral aspects of autism spectrum disorder (Baieli et al., 2003).

9.7. Sleep problems:

Almost every child with ASD experiences high rates of sleep problems, and furthermore, it's likely that every child with ASD or another form of developmental delay will encounter at least one sleep problem (Krakowiak et al., 2008). In a separate study, researchers discovered at least one sleep problem in 78 out of 166 individuals, amounting to 47.0% of the sample (Park et al., 2012). The same study revealed that communication dysfunctions and repetitive stereotyped behaviors are correlated with an increased risk of sleep problems. Sleep issues are intricately linked to both external and internal challenges faced by children with autism spectrum disorder (Park et al., 2012), and some of the causes associated with it include:

- Internal genetic or biological imbalances leading to alterations in brain structure or biochemistry
- Psychological or behavioral traits associated with features of autism spectrum disorder
- Family or environmental factors (Park et al., 2012)

It's important to note that sleep difficulties in children with autism spectrum disorder may exacerbate anxiety and aggression (Park et al., 2012). In other words, sleep problems can intensify feelings of anxiety, aggression, and provoke extreme and severe emotional reactions.

9.8. intellectual disability:

Children with autism spectrum disorder frequently exhibit symptoms of intellectual disability (Bernard Paulais et al., 2019), and these symptoms are the same as some of the symptoms of autism spectrum disorder, such as deficits in social, cognitive, and adaptive skills (Matson & Shoemaker, 2009). Researchers identify this parallel between The autism spectrum and intellectual disability are considered a co-morbidity. In mental disability, symptoms such as stereotyped behaviors and violent and difficult behaviors often appear. Researchers and specialists believe that people with intellectual disability and autism spectrum disorder differ in their needs from people with only intellectual disability or those only afflicted with the disorder. Autism spectrum (Matson & Shoemaker, 2009).

The causes of autism spectrum disorder and intellectual disability can be multiple, such as the final absence of the long arm of chromosome 2, and the functional deficiency of the BKca channel, but to this day, the topic still requires more research and studies, and researchers emphasize the initiative to conduct early and effective interventions to stop the concurrent symptoms and prevent their continuation. (Matson & Shoemaker, 2009).

10.Diagnostic Tests and Evaluation for Autism Spectrum Disorder:

Assessment of autism spectrum disorder is conducted by numerous professionals from various fields, including doctors, psychologists, and educators (Amaral et al., 2011, p. 35). Autism spectrum disorder encompasses several critical aspects that must be thoroughly understood by specialists. These aspects include language, social interaction, communication, and stereotypical behaviors. Additionally, an interdisciplinary and comprehensive approach involving various professionals is essential.

Specialists in ASD assessment should possess adequate clinical experience, skills, and knowledge of individuals with ASD and related disorders (Amaral et al., 2011, p. 35). The authors

emphasize the necessity for practitioners to have sufficient ability and experience in working with individuals with ASD to achieve effective outcomes.

Specialists in autism spectrum disorder employ numerous tools and tests designed to diagnose and evaluate the different abilities of children with autism spectrum disorder and other developmental delays. Professionals recommend screening children for autism spectrum disorder at the ages of 18 and 24 months (CDC, 2020). Many tests have been developed by professionals to identify and evaluate various symptoms of autism spectrum disorder. These tests include assessing the degree of social disability and evaluating communication abilities. Diagnostic methods for autism spectrum disorder may involve interviews with parents or specialists, observations of children with autism spectrum disorder, or a combination of both (Randall et al., 2018). Among the tests and tools used in diagnosing autism spectrum disorder are the following:

10.1. Test "Checklist for Autism Spectrum Disorder in Young Children (CHAT):

This is a test designed to identify children with autism spectrum disorder at the age of 18 months. The test is divided into two parts: Part A and Part B. The first part is a self-administered questionnaire for parents of children with autism spectrum disorder. It consists of nine questions related to various aspects such as rough play, social play, social interest, motor development, pretend play, requests for items, functional play, and display of activities to parents or friends (Quinn, 2006, p. 48).

The second section (Part B) of the test includes five elements focusing on eye contact, tracking objects, imitating or pretending to play, and building structures with blocks (Quinn, 2006, p. 48). It is important to note that these tests should be conducted by qualified psychologists or specialists in this field.

The test was later revised and renamed as the M-CHAT (Modified Checklist for Young Autistic Children). In this updated version, the test comprises a total of 23 questions. While nine questions remained unchanged from the previous version, 14 new questions were added to assess the child's understanding of questions and key autism characteristics (Quinn, 2006, p. 49). A failure in the test indicates possible autism spectrum disorder, whereas success suggests a lower likelihood of developing the disorder, implying the absence of autism spectrum disorder.

10.2. Screening Tool for autism in two-year-olds (STAT):

This test is a tool utilized by clinical specialists for children aged between 12 and 36 months, with the application typically lasting about 20 minutes. Developed in the late 1990s, comprehensive reports regarding its development, reliability, validity, application characteristics, community applications, and ongoing applicability have been available since 2000 (Towle & Patrick, 2016).

The purpose of this test is to aid professionals in distinguishing between autism spectrum disorder and other developmental disorders. During the 20-minute session, the child engages in 12 interactive play activities. These activities are designed to address three primary areas of interaction: mutual pretend and social play, motor imitation, and the development of non-verbal communication (Quinn, 2006, p. 49)

10.3. The Autism Spectrum Screening Questionnaire (ASSQ):

The Autism Spectrum Disorder Screening Questionnaire is a concise and efficient tool used to identify autism spectrum disorder. Comprising 27 items, it is assessed on a 3-point scale ranging from 0 to 2, with a maximum score of 54 (Kopp & Gillberg, 2011). Administered by parents or caregivers, this test is recognized as a valid screening instrument for children and adolescents with normal intelligence or mild intellectual disability (Quinn, 2006, p. 49)

10.4. Gilliam Autism Rating Scale (GARS):

The Gilliam Autism Spectrum Disorder Rating Scale is a scale administered between the ages of 3 and 22 years that provides clinicians with an estimate of symptom severity and can be used by parents, teachers, and professionals (Quinn, 2006, p. 49).

10.5. Childhood Autism Rating Scale (CARS):

This scale provides an assessment of the child's body motor ability, adaptation to change, auditory response, verbal communication, and relationship with people. This test can be applied to children as young as two years old. The scale provides important data about deviation from typical behavior for children of the same age (Quinn (2006, p. 50)

10.6. Autism Diagnosis Interview-Revised (ADI-R):

The Autism Spectrum Disorder Diagnostic Interview-Revised (ADI-R) is a standardized, semi-structured, inquiry-based interview administered by parents and caregivers of individuals with autism spectrum disorder (Kim et al., 2013). The interview comprises 100 items (Quinn, 2006, p. 50) and is utilized by parents, caregivers (Kim et al., 2013), and professionals. This scale is designed to be used with children from early age through adulthood. The interview focuses on four fundamental aspects of the child's disorder: communication, social interaction, stereotyped and repetitive behavior, and age of symptom onset (Kim et al., 2013)

10.7. Autism Spectrum Disorder Diagnostic Observation Schedule - Comprehensive - (ADOS-G):

The Autism Diagnostic Observation Schedule-Comprehensive (ADOS-G) is a semi-structured assessment of social interaction, communication, play, and imaginative substance use by individuals who may have autism spectrum disorder or other developmental disorders (Lord et al., 2000). With individuals of different ages, it provides basic information about social behaviors and communication, as these two elements may be abnormal, or delayed in terms of development, and may be completely absent (Quinn, 2006, p. 50). This table contains a set of activities, Using the latter, specialists can understand autism spectrum disorder, in particular, aspects of social behavior, communication ability, stereotypic behavior, as well as other behaviors related to autism spectrum disorder.

11. Therapeutic programs and techniques used in the care for children with autism spectrum disorder:

11.1. Applied Behavior Analysis (ABA):

Applied Behavior Analysis (ABA) is an intensive, early behavioral intervention recommended as a therapeutic approach to address the core symptoms of autism spectrum disorder. It is the only treatment that has received positive research support to date (Bernier & Gerdts, 2010b, p. 2). ABA is a care program for children with autism spectrum disorder that relies on the behavioral principles of Skinner's theory, also known as procedural conditioning (APA, 2015, p.

70). In this approach, the therapist or experimenter presents a stimulus, observes the response, and then provides reinforcement for acceptable behavior or applies negative reinforcement or punishment to discourage unacceptable behavior (Hergenhahn, 2008, p. 445).

Applied Behavior Analysis (ABA) is generally based on four principles:

- Positive and negative reinforcement, which involve supporting actions that increase the target response.
- Extinction and punishment, which aim to reduce responsiveness (Wolfe & Mash, 2008b, p. 47).

To clarify, the first principle is positive reinforcement, the second principle is negative reinforcement, the third principle is extinction, and the fourth principle is punishment.

The evaluation process in ABA typically consists of five stages:

- Pre-assessment to obtain an overview of the subject's condition and identify potential important areas for intervention.
- 2. Identifying priority goals for behavior change, including behaviors to be reinforced and behaviors to be replaced, reduced, or eliminated.
- Defining and measuring behavior levels before intervening with the targeted behaviors.
- Evaluating the functional relationships between environmental conditions and target behaviors and developing hypotheses regarding interventions that could bring about the desired behavior change.

5. Testing the behavior change hypotheses that have been developed (Matson, 2009, p. 33).

11.2. Educational treatment for children with autism and communication difficulties (TEACCH):

Educational therapy for children with autism and communication difficulties TEACCH is a program that was first created at the University of North Carolina (D'Elia et al., 2014), and can be used for training or research, and was recognized as a government program in 1972 in the United States (ROGE, 2008, p. 147) can be applied with children and adults with autism spectrum disorder, and relates to different levels of all skills (Bernier & Gerdts, 2010b, p. 248). Caregivers use TEACCH to develop the basic elements of a good life, and mainly effective roles in the family and community such as dressing, eating breakfast and other necessary activities in life. Self-confidence can also be developed through it, and competence in different situations can be strengthened (ROGE, 2003). , p. 147), this program also supports collaboration between professionals and parents (Panerai et al., 2009), and can be said to be an approach that provides care from both professionals and parents at the same time.

The TEACCH program allows people without autism spectrum disorder to better understand the child's personality more accurately, and his patterns of thinking and behaviors that characterize him (Bernier & Gerdts, 2010b, p. 248). According to Mesibov and his colleagues, the TEACCH program includes core values that are:

- Understand and value people with autism spectrum disorders and make them a priority
- Commitment to excellence and adherence to high work ethics
- The TEACCH program team is not deceived by its efforts and the improvement it may achieve

The spirit of cooperation and solidarity is what distinguishes the work of the TEACCH team

- Always striving to achieve the best for the caregiver and the one being cared for (Mesibov et al., 2004, p. 16)

11.3. Relationship Development Intervention (RDI):

Relationship Development Intervention (RDI) is a series of sessions designed for parents to support and care for their child with autism spectrum disorder at home. This program is centered around developing the child's ability to communicate effectively even without language (Gupta et al., 2019, p. 32), which is crucial. It aims for the child to maintain contact with society using alternative methods of interaction, such as signals and positive responses, and to enhance their abilities to express needs, intentions, and preferences. The primary objective of this program is to foster ongoing engagement with society, rather than isolation from it, while also promoting the development of social interaction and relationships with the outside world.

11.4. Sensory Integrative Therapy:

Sensory integrative therapy offers another approach to aiding children with autism spectrum disorder. The primary aim of this treatment is to help the child respond appropriately to incoming sensory stimuli, thus facilitating their understanding of the world and its contents (Gupta et al., 2019). For instance, a child may not laugh when witnessing something humorous because they lack the understanding of the appropriate response to such a situation, resulting in a disproportionate reaction. Therefore, it is essential for the child to learn to positively engage with various stimuli and respond appropriately. This, in turn, assists them in communicating with peers and interacting with them more effectively, ultimately fostering the development of appropriate behaviors in suitable contexts.

11.5. EduBoss:

This system has not yet received sufficient attention from researchers due to its perceived ineffectiveness in fostering crucial child development. However, it does aid in the development of certain skills. It is an operating system specifically created and designed for individuals with disabilities and special needs (Gupta et al., 2019, p. 32). The system encompasses numerous applications for teaching and learning, targeting children in primary and secondary schools. It benefits both neurotypical and neurodivergent children, enhancing their cognitive abilities. For instance, the Gbrainy application serves as a platform for memory training and development. Another application, called GCompris, offers a range of tasks and activities, including scientific reading and gaming (eduboss, 2022).

While beneficial for all children, this system particularly supports those with autism spectrum disorder by providing assistance and training at various levels of use. Each activity within the program contributes to the development of skills in children with autism spectrum disorder to a certain extent.

11.6. Electronic technologies for skills development:

Electronic technologies have had an important impact on our lives, and examples of these tools include phones, televisions, computers, etc., and through them, ideas have diversified to a very large extent because they provide interaction at the level of the mind or other that can give the individual a different thinking from the environment in which he grew up, and what is important in This part is how to benefit from it in supporting the child's development in important and different aspects of life. For example, the use of computers, smartphones, tablets, and any other

electronic tools can contribute to the process of learning, playing, and acquiring knowledge. This will be discussed in the chapter on the therapeutic technological approach of this thesis. Discuss the topic more widely.

12. Autism spectrum disorder in Algeria:

Autism spectrum disorder (ASD) evaluation in Algeria presents a complex landscape, as indicated by data from various sources. Official statistics from the Ministry of National Solidarity reported 400 cases in 2020 (Guiroud & Mazouz, 2020), though this figure may not fully capture the scope of the issue. For deeper insights, one can turn to Badra Moatasem Mimouni's work, where historical data reveals an earlier prevalence of ASD. Mimouni's book illustrates this point vividly, citing findings from 1983-1984 indicating 14 cases of autism among 166 children examined. Moreover, Mimouni highlights the correlation between economic conditions and the prevalence of ASD, suggesting a multifaceted interplay of socioeconomic factors (Mimouni, 2005, pp. 66-67).

Considering Algeria's population of 45.2 million in 2021, the reported 450,000 individuals with ASD underscore the pressing need for enhanced care and support (Anonymous, 2023). However, the current infrastructure remains inadequate, with a scarcity of dedicated centers for ASD care across the country. Compounding this issue is the observation that existing centers often lack specialized services tailored to ASD needs. Many centers primarily cater to disorders like Down syndrome, inadvertently neglecting the distinctive requirements of individuals with ASD (Guiroud & Mazouz, 2020).

The challenges extend beyond mere availability, encompassing quality of care and adherence to international standards. Concerns voiced by parents reveal instances of suboptimal care delivery due to a shortage of competent specialists and deficient infrastructure. The dearth of multidisciplinary teams further compounds these issues, hindering holistic treatment approaches (Guiroud & Mazouz, 2020).

Despite these challenges, there are pockets of excellence, such as centers in Constantine, showcasing innovative practices and dedicated care provision. However, such exemplars are not uniformly distributed, with discrepancies observed across different states. Notably, the integration of ASD care within mental health facilities and the geographical concentration of services pose additional barriers to accessibility and equitable care distribution (Guiroud & Mazouz, 2020).

In summary, addressing the complexities of ASD care in Algeria necessitates a multifaceted approach encompassing not only increased resource allocation but also systemic reforms to ensure accessibility, quality, and equity across all regions..

13. Ministries' suggestions to improve care and care for children with autism spectrum disorder in Algeria:

The Ministry of Health and Population in Algeria, in collaboration with other sectors and ministries such as the Ministry of National Education and the Ministry of National Solidarity, has formulated the following proposals to enhance care for autism spectrum disorder:

13.1. At the level of the Ministry of Solidarity and its affiliated institutions:

-Developing systems to benefit individuals with autism spectrum disorder and disabilities.

-Providing education and facilitating the integration of these children into mainstream settings.

-Offering financial support to families of children with autism spectrum disorder.

-Providing free transportation and facilitating access to care in centers and hospitals.

-Supporting activities aimed at assisting individuals with special needs and disabilities, demonstrating solidarity with them.

-Facilitating their participation in important events and beneficial demonstrations.

-Enabling easy access to various locations.

-Integrating individuals with disabilities and autism spectrum disorder into social and professional environments.

-Establishing the National Council for Persons with Disabilities to evaluate pertinent aspects and issue reports guiding appropriate solutions.

-Supporting associations advocating for individuals with disabilities.

-Promoting integration into regular schools instead of specialized institutions.

-Encouraging integration into regular professions, with employers required to allocate 1% of jobs for individuals with disabilities.

13.2. At the level of the Ministry of Education and its affiliated institutions:

-Facilitating coordination between schools and care centers.

-Integrating children with disabilities and autism spectrum disorder into regular classes, provided their cognitive abilities allow.

-Ensuring that facilities for individuals with disabilities and autism spectrum disorder are available across all educational settings.

-Offering extended education periods for those who require additional time.

13.3. At the level of the Ministry of Health and its affiliated facilities:

-Supporting health institutions with regular training on various disabilities and autism spectrum disorder

-Developing care for people with disabilities and autism spectrum disorder by helping researchers carry out their research

- Facilitating the establishment of clinics

- Including the topic of autism spectrum disorder in the annual training program for medical students and nurses in coordination with the Ministry of Higher Education and Scientific Sciences. This training can be beneficial in detecting the child early and obtaining appropriate care. (Autism. Saint, 2023)

14. Efforts of care for persons with autism spectrum disorder:

The Algerian government has unveiled a plan on its website autisme.sante.gov.dz aimed at training healthcare professionals to effectively address the needs of children with disabilities and autism spectrum disorder. Among the initiatives outlined on this platform are measures highlighted in the following statement:

"Including the topic of autism spectrum disorder in the curriculum of initial training programs, particularly in fields such as general medicine, pediatrics, otolaryngology, and neurology. Additionally, ensuring ongoing training for personnel in maternity and child protection services, with a specific focus on midwives, nurses, and physicians." (autisme.sante.gov.dz)

Furthermore, the Public Mental Health Clinical Health Promotion Program, initiated in 2019, incorporates autism spectrum disorder within its scope. Its objective is to bridge gaps in the training

of practising healthcare professionals, enabling them to promptly identify autism spectrum disorder in children and provide high-quality medical and psychological support to adolescents and adults affected by it. (autisme.sante.gov.dz)

From the aforementioned details, the overarching goal outlined by the Algerian government through this concise excerpt from their website is evident.

Consclusion:

Autism spectrum disorder is a significant and impactful condition that requires children to receive daily care and support from parents, peers, siblings, teachers, and the entire community. It is crucial for parents to avoid being pessimistic, depressed, or frustrated, as these emotions can negatively impact their child with the disorder. Parents must strive to make their child feel accepted, as their emotions greatly influence the child's well-being.

In today's society, autism spectrum disorder often instills fear in parents and is still perceived as a mystery by many, including healthcare professionals. Each child with this disorder exhibits unique characteristics and traits that set them apart from others with the same condition. Care providers are tasked with understanding each child, assessing their abilities, and distinguishing between the primary diagnosis of autism spectrum disorder and any comorbid conditions, such as intellectual disability. Tailored care approaches are necessary to address the individual medical needs of each child effectively.

Autism spectrum disorder encompasses a range of conditions beyond classic autism, including Asperger syndrome, Rett syndrome, and other developmental disorders. Caregivers face the challenge of adapting care plans to suit the specific needs of each child with the disorder, as symptoms vary between cases. It is essential for psychologists to carefully design individualized care programs that cater to the unique requirements of each child.

Parents' primary concern is ensuring their child's successful integration into school and society, enabling them to catch up on missed opportunities and receive appropriate education in a timely manner. The goal is for children with autism spectrum disorder to lead fulfilling lives, engage in meaningful conversations, and participate in regular activities like their peers. Collaborative efforts between all stakeholders, including members of society and medical institutions, are crucial in providing high-quality care that yields positive outcomes and supports ongoing research for the advancement of therapeutic interventions for this disorder.

Third Chapter: Virtual Reality

- Preface
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Preface:

Imagine yourself on another planet, where you can see the Earth and can easily interact with this world, you see the sun near you without burning you, you see yourself in the middle of space and the planets are near you, your senses capture this scene as if it were real, but it is a virtual reality designed with computer technology, and this was an example for those who do not have a clear picture of virtual reality and sufficient knowledge of it and its capabilities, the above scenario can be lived in a virtual world that is similar to fantasy and can go beyond the boundaries of physics, virtual reality is also used in various fields, for example, military training, astronomical training, education, medical training.(Kumar, 2020, p. 5)

Like the hypothetical scenario described above, the student researcher will use virtual reality and create content that is a video game to be used with people with autism spectrum disorder to give them a wider and safer environment to interact easily without fear or anxiety, in addition to the fun that these types of technologies provide, this fun that the player feels gives him the desire to play without pressure or opposition and with ease, and this is the complete opposite of what sometimes happens in care and training sessions with tangible games. In this chapter, the student researcher presents virtual reality as a modern technology that can be used to develop the child's skills and reduce the symptoms of autism spectrum disorder. The technology can be used differently with many disorders such as fears and trauma. We will also present some programs and games used to develop the abilities of these children, especially since this modern tool is easy to use and inexpensive (Singh & Nathan-Roberts, 2019) and affordable (Anonymous, 2013). In addition, the most important features of this type of care and support are the fun element that will be provided to a large extent. This will encourage the child with autism spectrum disorder to continue playing until the recommended time. He will also practice each exercise without feeling bored, emphasizing the easy way to use technology. Therefore, this chapter will provide a complete view of the history of virtual reality, its various definitions, types of experiences, its basics, the basic elements of virtual reality, its components, its systems, the programs used to create and develop its content, and some types of virtual reality tools. The fields used in the modern era, and the fields that apply virtual reality in their profession such as education, architecture, etc., in addition to psychological disorders in which virtual reality has been tried as a therapeutic tool, and serious games as educational tools.

1. A Brief History of Virtual Reality:

The history of virtual reality traces back to when humans used walls and caves for drawings (Jerald, 2015, p. 15) to describe their needs, feelings, and surroundings of that era. It can be said that the concept of VR caves today is inspired by the use of caves in ancient times. The VR cave utilizes walls to project images from the VR device onto them, allowing the viewer to immerse themselves in a new virtual environment.

In the 1800s, Sir Charles Wheatstone invented a 3D TV called the stereoscope in 1832. This device displayed two separate images, one for each eye (Gregory, 1978, p. 67). Jerald described the device as using mirrors angled at 45° to reflect images into each eye from the left and right sides (Jerald, 2015, p. 15), marking the beginning of the concept of glasses for viewing purposes.

In 1851, David Brewster demonstrated his kaleidoscope or stereoscope that incorporated 3D elements. In 1928, Edwin and Link created the first flight simulator, which was a commercial success with over 10,000 units sold. Subsequently, many advancements were made in flight simulation, including improvements in graphics, latency, spatialized audio, avatars, and haptics (Jerald, 2015, p. 19).

The idea of virtual reality became more defined in 1935 when science fiction author Stanley G. Weinbaum wrote a short story called "Pygmalion's Spectacles" (Mealy, 2018, p. 14). In this story, he described a professor who created goggles that allowed users to experience and interact with the content around them, engaging all senses including taste, smell, and touch (Mealy, 2018, p. 14). This concept materialized in 1956 (with some references citing 1955 or 1957) with the creation of the "Sensorama," a multisensory vehicle simulator developed by cinematographer Morton Heilig in 1962 (Gutierrez, 2008a, p. 4). The Sensorama enabled users to select and experience various content through a screen, providing a 3D view. Craig et al. defined the Sensorama as a scripted multimodal experience where participants were seated in front of a screen equipped with sensory stimulators (Craig et al., 2009, p. 4).

In 1963, Ivan Sutherland introduced a system named "Sketchpad," which displayed computer-generated visual imagery on a cathode ray tube (Craig et al., 2009, p. 4). He published an article titled "The Ultimate Display," in which he discussed the future potential of computers, envisioning a world where users could access virtual environments. Sutherland went on to create a head-mounted display (HMD) and designed an immersive virtual world viewable through this device, earning him the title of the "Father of Virtual Reality systems" (Gutierrez, 2008a, p. 5).

At Harvard University, a former head of the US Department of Defense's Information Processing Office became an associate professor in the field of electrical engineering (Baruah, 2019). With support from his students, he developed a VR system and an HMD called the "Sword of Damocles" in 1968. While some attribute him as the first to create this technology, the term "Virtual Reality" did not appear until 1989 when it was coined by Jaron Lanier (Penichet et al., 2013, p. 46). Following the innovations of Heilig and Sutherland, extensive research emerged across various domains including universities, the military, and commerce.

In the realm of universities, Myron Krueger conducted experiments on virtual reality systems from a different perspective that he termed "Artificial Reality" (Craig et al., 2009, p. 5). A key

distinction between Sutherland's and Krueger's experiments was that the former focused on a head-mounted display providing a first-person view of the virtual world, while the latter's approach incorporated a display with a second-person view, allowing users to observe themselves within the virtual environment (Craig et al., 2009, p. 5). By the 1990s, the term "virtual reality" had gained widespread usage to describe synthetic environments and virtual experiences (Gutierrez, 2008, p. 1).

Lanier's research has played a significant role in the development of VR peripherals such as HMDs and gloves, enabling the transfer of data from users to databases for study and analysis (Barfield, 2020, p. 45). Today, VR has evolved into an essential tool for learning, entertainment, content consumption, training, rehabilitation, and more.

Among the important projects in the development of research using VR, the fields of medicine and psychology stand out. In the past, psychologists relied on imagination to develop capacities and treat disorders, particularly in cognitive behavior therapy. However, in the 1990s, Strickland was among the first to use VR for psychological purposes. VR's characteristics, such as presence, have been utilized for treating conditions like acrophobia (Rothbaum et al., 1995).

By 2010, VR had garnered interest from various companies and institutions like NASA, MIT, and video game companies such as Nintendo and Sega (Baruah, 2019). Nowadays, VR is being utilized in various fields more extensively than ever before. For example, in Algeria, specifically in the province of Djelfa, inventors have developed a flight simulator system to enhance the training of aviators. Initially focusing on simulating piloting a Boeing 737 plane since 2016, the Faculty of Science and Technology at Djelfa University established an aviation association (Anonymous, 2016). This system has evolved to simulate piloting various types of planes, providing a near-real-world experience due to its adherence to actual piloting rules (ELBILAD, 2020).

In Europe and the United States, research in VR is more advanced, with universities earning reputations in the field. As mentioned in previous studies, there is a plethora of research across different fields such as sciences, humanities, medicine, and military applications. VR is now strongly supported by science and references that promote its use. Noteworthy references that have influenced theses include "Artificial Life and Virtual Reality" by Magnenat-Thalmann and others, "Designing Virtual Reality Systems: The Structured Approach" by Kim Gerard, and more recent publications focusing on VR and its advancements.

2. Definition of virtual reality:

2.1. Virtual reality (VR) may be defined as a set of computer technologies, which, when combined, provide an interface to an interactive, computer-generated world. In particular, VR provides an immersive environment, allowing the user to feel present in a three-dimensional computer-generated world, transported to another reality. The VR application enables users to navigate and interact with a three-dimensional. The computer-generated (and computer-maintained) environment in real-time, with the user’s actions and reactions being experienced in the present moment.(Wiederhold & Bouchard, 2014a, p. 3)

2.2. Virtual Reality (VR) is a leading and wide range aspect of Information Technology (IT). VR can represent a three-dimensional (3D) spatial concept with aid of a computer and other gadgets. It can stimulate a variety of sensations such as touch, smell, vision and

hearing and provide the stimulated output to a user. Using VR-enabled equipment a user can interact, control and manage objects that belong to the virtual environment. In this context, the VR system can be referred to as an artificial and a 3Dspatialworld from a user perception(Gupta et al., 2019, p. 2)

2.3. Virtual reality (VR) is a computer-generated simulation of a visual environment (Tychsen & Foeller, 2020)

2.4. Virtual reality is an interface and 3D devices that allow us a complete immersion, in virtual reality researchers can create plants, trees and animals, and the VR can provide realistic people, faces, and environments (Magnenat- Thalmann & Thalmann, 1994) and a strong feeling of presence (Singh & Nathan-Roberts, 2019) by the user.

2.5. VR technology is one of today's most exciting areas of technology, it is a way of simulating an environment and allowing the users for interacting with the environment, it gives the user the ability to interact with abstract ideas (Sultan et al., 2019)

2.6. VR is a technology that uses computer technology and interactive devices (such as head-mounted displays, handles, gloves, etc.) to artificially create an environment close to the real world, allowing one or more people to interact with the virtual environment and its 3D entities (Liu et al., 2019)

It can be said that the use of the term virtual reality is essential because of the virtual images produced by the HMD display (Vince, 2004, p. 4), the head-mounted display provides the user with a window on a world that resembles the imagination or illusion, the virtual image can be seen by the user but it stays an illusion, Vince gave an example for virtual image, that is when a person sees himself in a mirror, the image reflected in the mirror in called a virtual image (Vince, 2004, p. 4)

3. Type of VR experiences:

VR have many types of experiences among them the following:

3.1. Diorama:

This type of VR is a three-dimensional scene, the user sees himself in this virtual world of a three-dimensional scene, the user can look in every dimension, and the camera is the eyes of the user (Linowes, 2015a, p. 10)

3.2. First-person experience:

The user is freer in this situation, he can walk and watch content by using a keyboard or game controller, or any other device that permits the action in the content (Linowes, 2015a, p. 10)

3.3. Interactive virtual environment:

This kind is very resembling to the first-person experience, but it has more options like for example the interaction through touch with the content.

3.4. Riding on rails:

The content of this type is dynamic, for example, you are on a train and you see the trees and cars pass around you, and you see people moving, the exception in this experience is that you will have some temporary stress because of the scare events that you live inside this type(Linowes, 2015a, p. 10).

3.5. 360-degree media:

This option consisted of an image that can be seen through 360 degrees, that is mean that the watcher can see the image as if he is inside the image with a view of 360 degrees around himself.

3.6. Social VR: this kind of VR permit users to encounter each other's(Linowes, 2015a, p. 10), and social skills can be developed through this technic.

4. VR Basics:

The most important hardware components of the VR system are as follows:

- Powerful computer-generated 3 Dimension world of VR, this computer can be divided into three parts (Grady, 2003, p. 4), it is recommended that the computer have an advanced graphic board, a group of microprocessors that create the three-dimensional images of the VR worlds(Grady, 2003, p. 4), and sound processors that can create sounds in parallel with the image without any delaying, for an optimal experience with VR, lastly the input and output accessories that permit the connection between the computer and content of VR

and the accessories that contain:

- Head-mounted displays: These devices enable users to see images through them (Grady, 2003, p. 4).
- Shutter glasses: These glasses can be used with software, enabling users to have total control of the hardware, namely the glasses.
- Joysticks: These devices enable users to control the content displayed in the glasses, that is, the content of the VR (Grady, 2003, p. 4).
- Wired gloves: These gloves permit the tracking of everything the user does, including hand movements.

5. Four key elements of virtual reality experience:

The key elements in experiencing virtual reality - or any reality for that matter - are a virtual world, immersion, sensory feedback (responding to user input), and interactivity (Sherman & Craig, 2002, p. 6)

We now mention those elements and provide every element with its definition; these key elements are:

5.1. Virtual world:

"**A virtual world is the content of a given medium. It may exist solely in the mind of its originator or be broadcast in such a way that it can be shared with others. A virtual world can exist without being displayed in a virtual reality system (i.e., an integrated collection of hardware, software, and content assembled for producing virtual reality experiences) - much like play or film scripts exist independently of specific instances of their performance. Such scripts do describe virtual worlds. Let's carry the analogy further. We can refer to the script of a play as merely the description of a play. When that description is brought to life via actors, stage sets, and music, we are experiencing the play's virtual world. Similarly, a computer-based virtual world is the description of objects within a simulation. When we view that world via a system that brings those objects and interactions to us in a physically immersive,**

interactive presentation, we are experiencing it via virtual reality" (Sherman & Craig, 2002, p. 6)

5.2. Immersion:

Wilson and Soranzo define immersion as:

"**Immersion is an objective description of the technical capabilities of the VR system that describes the level of detail with which a virtual environment can be rendered**" (C. J. Wilson & Soranzo, 2015)

- immersion is a sensation of being in an environment; can be a purely mental state or can be accomplished through physical means: physical immersion is a defining characteristic of virtual reality; mental immersion is probably the goal of most media creators.

We can mention two kinds of immersion:

-Mental immersion: state of being deeply engaged; suspension of disbelief; involvement.

-Physical immersion: bodily entering into a medium; the synthetic stimulus of the body's senses via the use of technology; this does not imply all senses or that the entire body is immersed/engulfed.

5.3. Sensory Feedback:

An essential component of virtual reality is the provision of direct sensory feedback to participants based on their physical position (Sherman & Craig, 2002, p. 6). While the visual sense typically receives feedback, some virtual reality environments exclusively offer haptic (touch) experiences. Achieving immediate interactive feedback necessitates the use of a high-speed computer as a mediating device.

Sherman say in this context: **"in order to base the sensory output of the VR system on the position of the participant, the system must track their movement. A typical VR system will track the head of the participant and at least one hand or an object held by the hand. Advanced systems may track many of the major body joints. There are a variety of technologies that can be used by a VR system to accomplish tracking. A good definition of position tracking is the computerized sensing of the position (location and/or orientation) of an object in the physical world-usually at least part of the participant's body**" (Sherman & Craig, 2002, p. 6)

5.4. Interactivity:

Interactive fiction can be defined by the user/player's ability to interact with a world by changing locations, picking up objects, setting them down, flipping switches, and so on (Sherman & Craig, 2002, p. 11). This element is crucial for creating a successful virtual system because it empowers the user to influence the virtual world (Kim, 2005a, p. 3). It's evident that through these four elements, VR constructs a new world for users, offering them fresh perspectives and experiences unavailable in the real world.

6. Systems types of VR:

Wilson and Soranzo mentioned 3 types of systems:

-Virtual environment presented on a flat screen

-Room-based systems such as a CAVE,

-Head-mounted display (HMD) (C. J. Wilson & Soranzo, 2015)

This last type is what concerns us in this thesis, and it will be a research tool in addition to the scenario of the game that the child with autism spectrum disorder will play to develop his various abilities.

7. Two basic types or platforms of VR used today:

Today, we are witnessing a technological explosion across various fields, including smartphones, computers, medical equipment, and more. Within the realm of technology, virtual reality (VR) stands out as a significant advancement, presenting two important tools: desktop VR and mobile VR. Let's delve into each:

7.1. Desktop VR:

Desktop VR is a display that can be connected to a PC, this last must have strong capacity concerning essentially the graphics, the desktop HMD is linked to the computer by using cables, and the PC use a different system it can be windows, Linux or Mac (Linowes, 2015, p. 4), the computer can be considered as a central element that supplies the VR content to the head-mounted display, to the viewer or user can watch and control the content elements, the most popular HMD today is the Oculus Rift, Parisi define The Oculus Rift as: "**a stereoscopic display with built-in head motion tracking sensors. It straps to the head, allowing hands-free operation. The Rift is a peripheral: it attaches to a computer: Mac, Linux or Windows; desktop or laptop. The Rift is tethered, with a cable running to the computer. At the moment the Rift is quite bulky- but that will most certainly change with the newer models being designed as we speak**" (Parisi, 2015, p. 20)

7.2. Mobile VR:

This type of VR is displayed provide to the user to make the connection between (Hillmann, 2019, p 9) mobile VR depends on the smartphone, where the user can use cardboard like google cardboard or can use a headset configured with the smartphone Samsung, the configuration is made through software that enables the user to control, watch and interact with contents, the graphism of mobile VR is not strong and clear like the graphism of the PC, but the researcher student in this thesis tries to use low graphism, because according to recent studies, the more details can lead to disbanding in the attention of the child with ASD, or rather the child with ASD focus on subtle aspects of things instead of interesting with the general appearance of anything (Stevenson et al., 2017), in plus of the difficulty in the control of the child and maintaining him stable, moreover, the low cost of mobile VR in comparison with the high price of desktop VR, In addition to the difficulty of controlling the child and keeping him in a stable position, in addition to that, mobile virtual reality is distinguished by its low cost compared to the high price of desktop virtual reality.

However, it is worth noting the possibility of exposure to some kind of semi-pathological condition, as using a Rift device, Samsung device, or other device may cause motion sickness (Davis et al., 2015, p. 29-30). However, there are some suggestions to help the user prevent these symptoms, the most important of which are:

- Before using the Rift, you must ensure that the lenses are suitable for vision, adjust the distance between the lenses and the face, and adjust the straps to ensure that the headset fits perfectly.

-Adjust the lighting level on the mobile phone

-Remove the transparent outer cover after purchasing glasses, because it prevents vision clearly and makes it blurry.

8. Components of virtual reality system:

To craft a compelling virtual reality system, adeptness in two pivotal domains is requisite: hardware and software. These two facets harmonize under the developer's expertise to weave the immersive tapestry of the virtual realm. Hardware encompasses the tangible components, comprising:

8.1.PC:

For permitting to design the program or the game, and execute it later without any problem, it is recommended that the pc must have strong ability in processor and graphic processing unit, these two essential elements will be more explained in the following lines.

8.2.The graphic processing unit (GPU):

This is the second element in the pc that must be able and very competent to process any kind of images that will be used inside the virtual content because it renders two displays (Anonymous, 2020) that are the image of each eye, specialists recommend that the GPU at least must have more than 90 fps rate(Anonymous, 2020).

8.3.Central Processing Unit (CPU):

This element is responsible for the calculations and other operations(Englander, 2014, p. 14), it has an important role in creating and executing the VR application, specialists recommend that the CPU must be a quad-core processor(Anonymous, 2020), like, for example, i3-9100, AMD Ryzen 3 PRO 2200GE, AMD Ryzen 5 2400GE, i5-4590 and others

8.4.Random Access Memory (RAM):

Random access memory is an element fabricated by silicon chips (K. Wilson, 2018), the ram store the data and the instructions of software,the majority of VR demands 8G of Ram, for a better experience, only HTC Vive Pro and HTC Vive Pro Eye demands just 4G(Anonymous, 2020)

8.5.Head-mounted Display:

This display is related to the pc via wire or without wire, the most famous device used in HMD is the oculus rift, this device will be explained on the next page with more details.

8.6. Joysticks or controllers:

These devices facilitate user interaction with VR content, allowing for seamless immersion. In addition to the aforementioned hardware components, such as joysticks or controllers, the inclusion of a smartphone becomes relevant, particularly in scenarios involving smartphone-compatible VR accessories like Samsung VR glasses.

Equally crucial to the VR system is its software component, which encompasses the suite of programs developers utilize to craft immersive virtual experiences. Among these, UNITY stands out as one of the most renowned software currently in use. Further elaboration on UNITY and other software tools such as Amazon Sumerian, Google VR for Everyone, Unreal Engine 4, CryEngine, Blender, and 3ds Max (Anonymous, 2020) will be provided in the subsequent chapter dedicated to gaming

9. Different technics needed for developing VR experience:

VR demands some technics that enable the innovator to create an application, these skills and technics are:

9.1. World scale:

The maker of the virtual world must be able to know about the 3D, the diameter and space, and must know everything about unity software (Linowes, 2015a, p. 10) to develop professional or at least a good application.

9.2.First-person controls:

The player when he sees himself inside the game or the virtual world he can control everything through game controllers, in addition to the capacity of moving in any direction in the virtual world(Linowes, 2015a, p. 10).

9.3. User interface controls:

The interaction with the virtual world based on the touch and vision in the virtual environment, this option is different from the precedent option of PC and mobile, it can be said that VR doesn't need a screen to interact with its content.

9.4.Physics and gravity:

Today programmers and engineers use a lot of software to develop a perfect VR experience, this software permits the engineer to deal with the content and create the natural elements inside the virtual environment, for instance, gravity (Linowes, 2015a, p. 11).

9.5.Animations:

Linowes define animations as "**Moving objects within the scene is called "animation", It can either be along predefined paths, or it may use AI (artificial intelligence) scripting that follows a logical algorithm in response to events in the environment**" (Linowes, 2015a, p. 11).

9.6.Multiuser services: today services are provided through the network of the internet, and anyone can develop his project with help of specialists through the internet(Linowes, 2015a, p. 11).

9.7. Build and run:

To use correctly a head-mounted display device, the developer must have the ability to develop applications and programs that allow controlling virtual reality content, and this requires that appropriate equipment be provided in advance, and that the construction and operation be previously designed in accordance with a specific system such as Windows or Android.

10.Creating a virtual reality system:

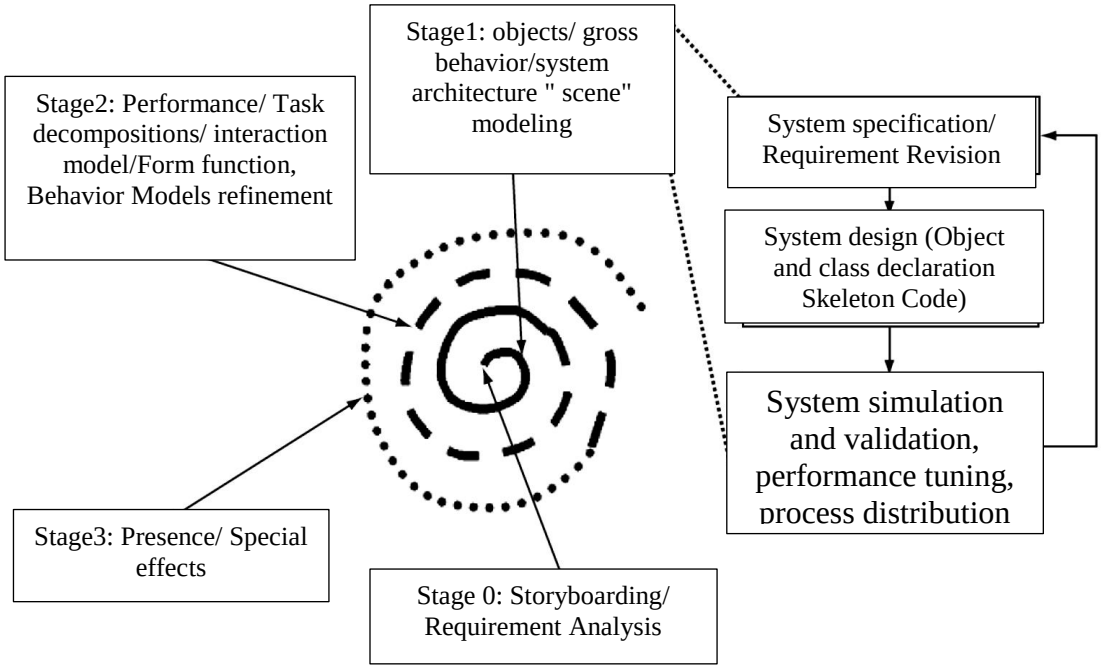
The field of VR is very difficult to access, it demands knowledge in computer science, programming, graphics, a competence in software that help in planning the content and different aspects of the VR's content, for instance, Unity, this software is used widely for developing games, and other programs in VR field, and other fields like PC games, Kim in his book titled "Designing Virtual Reality Systems The Structured Approach", that the essential and major features and requirements that particularly distinguish VR systems from other software systems are the following:

- The real-time performance requirement, while maintaining an acceptable level of realism and presence

- The problem of modelling the object's appearance and physical properties in addition to, and concerning, its function and behavior
- Consideration of many different styles and modalities of interaction techniques, according to different tasks and input/output devices(Kim, 2005a, p. 9)

The author gives the plan to facilitate the understanding of the operation of creating a VR application, this plan is the following:

Figure1: The spiral model of VR system development (Kim, 2005, p. 9)



11.The application of VR in different fields:

VR currently is known for widespread use in many domains, because of the facilitation that Virtual Reality technology can provide, among the domains that give importance to this technology are:

11.1.Video games:

This is the first field that uses VR as a technology for entertainment

11.2.Education:

Because of the capacity of VR in creating an interactive world for learning, the education field uses it frequently in particular in difficult situations (Rizzo et al., 2000), in the university of Hong Kong, researchers use VR as an experienced tool, where the experience is applied with VR on some students in the university, the researchers planned the experience than they undergo a group of student, after that, they apply the exercise in real in the classroom(Dieck & Jung, 2019, p. 164), in other experience, student of pharmacy was undergone to scenarios that are a simulation of a consultation process with both patient and medical team of doctors (Dieck & Jung, 2019, p. 165) for observing the interaction of the student with the new environment.

11.3.Productivity:

Companies today use virtual reality as a technic to show to consumers different productions.

11.4.Tourism:

VR provide users with a living touristic experience in a virtual dimension; the watcher can find a parallel world to the real world that can make him very interested to visit this place in the real world (Parisi, 2015, p. 15)

11.5.Architect field:

Architecture can use VR as a tool to give an initial scene for the project, it can be used as a virtual initial experience that creates an almost real feeling for users (Parisi, 2015, p. 15)

11.6.Enterprise applications:

Today many fields use VR as a tool of formation for instance on the battlefield, where the soldier fights a virtual enemy without any risks, or in confronting fires by firefighters, and more

11.7.Aerospace:

Today VR is used to create interactive content similar to real space, this can give a clear image and an experience to persons who aim to live a feeling in space, in particular during the training of astronauts (Mealy, 2018, p. 293).

11.8.Travel:

VR provides a virtual place that exists in real inducing to visit them(Mealy, 2018, p. 293)., for example, the Himalaya mountains, or a frozen place at the north pole, the image that the visitor sees can make them vet enthusiastic about the place in the real world.

VR will have more usability in the future because of its benefits in lots of domains, in this thesis, a game designed for developing essential abilities will be created aiming to boost the capacities of children with ASD.

12.Advantages and benefits of VR:

- VR provides users with opportunities to learn new technologies and methodologies (Gupta et al., 2019, p. 21).
- VR offers users a new teaching mechanism (Gupta et al., 2019, p. 21).
- VR facilitates access to new scenarios and environments.
- It helps individuals acquire new skills and exposes students to missions classified as dangerous, such as firefighting, or seemingly impossible missions, like traveling to the sun.
- It creates highly realistic games that significantly influence players, particularly through the immersive experience VR provides.
- It allows users to engage with and experience things that are not possible in the real world, such as skydiving or participating in a war (Kim, 2005a, p. 3).
- Users can immerse themselves in new situations and conditions, regardless of their nature or level of risk.
- VR can be an enjoyable tool, as mentioned in the previous study, as children perceive VR games as cartoons.
- Today, VR is widely used in various fields such as medicine, psychology, architecture, and more.
- In psychology, during times of containment due to a virus outbreak or other catastrophes, VR can serve as a supportive tool for therapy and care for children in treatment centers, acting as a temporary alternative to prevent therapy interruptions during containment measures.
- VR has the potential to shorten therapy durations if psychologists and scientists can develop an effective virtual program to enhance the necessary skills of individuals with Autism Spectrum Disorder (ASD), which is the objective of this thesis.
- VR can be seen as a self-therapeutic tool, and in the future, this tool may undergo special developments that could lead to new research opportunities.

13.Difficulties of using VR:

The VR like other devices, have some difficulties in the creation of its content, or difficulties in the technical creation, these difficulties are:

13.1.Latency:

It is a term that means that there is a delay between the vision of the user and the graphics targeted with his vision, where the graphics don't be clear at the same time as the vision of the user, where it becomes clear after a few seconds, the difficulty of latency cause a limit in the interaction inside the game or the content.

13.2.Juddering and Smearing:

This is similar to the first, but in this problem, when the user sees with his eyes to an image, sometimes it breaks from time to time, in VR, this is a matter because it prevents the user from the move, or seeing the content perfectly in particular that the virtual reality focuses on the eyes with glasses.

13.3. The Screen Door Effect :

This name is used for this problem or challenge because of its similarity to the real situation when a person is looking through a door hole, you will see a small image surrounded by a black colour, your peripheral view is black, and you see just a small image in the centre.

13.4.VR Sickness:

This means that VR can cause some health problems, but these problems are not dangerous, they just happen when the user uses the glasses and watches the virtual reality world, in general, the user feels as if he is losing his balance, and other types of illnesses.

13.5.VR Space:

In this challenge, the space or the area of play is limited, so the player can't move freely, when the VR game, for example, is a football, the space in reality doesn’t permit to play such a game, because of the limited area in the real world, but, some developers are trying to develop a tapis called Omni One (Sitraka,2020), this machine will give to users a wide place for moving freely without obstruction, for example: if a game contains a desert, and the player run in this desert, the machine Omni One provides the ability to run in reality in parallel with the virtual world without stopping, free movements, and ability of vision in 360°degrees

Omni One
(Https://omni.virtuix.com/)

13.6.Location-Based Entertainment:

This is not a big problem or a difficult challenge, but virtual reality technology needs some gear for using it, in the past, VR demanded more gear than today, but till now it stays demand for devices for using them.

13.7. Tracking Infinite Spaces:

The components of virtual reality previously were difficult to use, on account of the devices needed for tracking the persons who use the VR, now, in these few years, developers developed devices of virtual reality more easily to use, like Oculus rift, this permitted the simple use and best manner for tracking the users.

13.8.The motion:

This challenge is like what is mentioned above in VR space, but here the concerned thing is the movement made by the user, and its manner, its volume, and more, the problem with the motion happens mainly when the content is wide and contains, for example, a large place in a virtual place, this means that the user will move more in the real world because of the large space in the virtual world, but in reality, he can't do that, for the reason that the place is narrow in reality, this challenge made the manufacturer create some devices that help in overcoming the problem of limited movement, like for instance Cybershoes. (Murray, 2020, p. 12)

13.9.Body pursuit or tracking:

For developing video games actually, some types of cameras provide a technic for recording the movements of the actor who act the movement to be part of the movement of the hero inside the game, and making them inside the game, for instance, in an action game, the movements of a soldier can be recorded through the camera and some wires, then it is used later in creating the movement of the hero in the game, this technic gives to the game the reality appearance, and the movements in the game is very similar to the movements of a person in the reality, this is the main idea of the using of trackers, where the players feel as he is play with a real person, there are exists many types of tracking technics, like motion capture suits, hand tracking, eye tracking and more. (Murray, 2020, p. 12)

13.10. Sensation with VR:

Virtual reality provide a sense of physical thing in a manner different from what is in reality, for example: if you touch a book in a virtual reality world using the controller, you feel a vibration in your hand, which means that you are interacting with a material object, in another meaning, if you touch in the real world a chair, and you feel the nature of wood, in a virtual world, you will receive a vibration as a feeling with the wood, but not its nature in the real world, it is observable that the important thing that VR creator want to make is to create an idea that the difference between tangible and intangible is a vibration.

It is worth mentioning what concerns the challenges and difficulties of using VR, it is clear that everyday technology is developing, so, the challenges can be less in the future or the contrary, it can be more difficult to limit it, but in general, the human mind develop the applications and material according to ergonomic sets, for example at the beginning of the creation of virtual reality

glasses and helmet, they were heavy for some users, especially the children, but with the passage of decades, the technology was becoming easier for use.

14.Virtual Reality in education and learning:

The education today has many advantages. Among these advantages is the use of virtual reality in educating certain specialties. For example, you can explore the inside of the body using virtual reality or take a journey to visit archaeological sites. For instance, you can virtually visit the Egyptian pyramids and gain a clear idea about the civilization of the pharaohs. Every aspect of education can be created in the form of virtual reality content. The technology of AR and VR is often referred to as the "fourth wave" in technology platforms (Dieck & Jung, 2019b, p.148).

The main idea behind learning through VR technology is that you can stay in your place without changing your location or position. VR comes in many types, with one commonly used type being 360VR. This provides a clear image that replaces the imagined one. This means that if your teacher talks to you about a place situated in Algeria, such as the bridges of Constantine, you are not obligated to imagine a place that may not be real or accurate in your mind. Instead, through virtual reality technology, you can experience the same place that exists in reality. The only difference is that you are geographically distant from it, but you have a correct image of the bridges of Constantine and the province in general in your mind. Even if you were to visit it physically, you would find that you already have a preconceived idea about it.

Thus, the education of our era offers numerous facilitations, and it is crucial to utilize modern technologies in education. For example, in a dangerous mission such as dealing with a fire inside a hospital, you can confront your fears by training with virtual reality simulations. After the virtual experience, you will feel as if you have gained real-life experience in facing a fire. Virtual reality has been scientifically validated, as mentioned in previous studies. Therefore, it is highly advantageous to utilize it extensively in education or training, and perhaps even in psychological treatments.

15.Virtual Reality in psychological therapy:

Many psychological disorders can be treated using virtual reality because it offers a high degree of immersion and presence. For example, phobias can be effectively treated using gradual exposure therapy (Gutierrez, 2008b, p. 168), rather than using exposure in vivo, where the person confronts the pathogenic stimulus in a real situation (Noordik et al., 2010), or in vitro, where the person confronts the pathogenic stimulus in their mind through imagination. Among the disorders that use VR as a therapeutic tool are:

15.1.Fear of flying (Aviophobia):

A persistent and irrational fear of traveling by airplane or another airborne vehicle (APA, 2015, p. 414) can be effectively addressed using virtual reality (VR). Scientists and psychologists create scenarios containing the pathogenic stimulus, such as simulating flying on a plane (Wiederhold & Bouchard, 2014b, p. 65).

15.2.Fear of insects (arachnophobia or spider phobia):

A persistent and irrational fear of spiders, where situations involving spiders are often avoided or endured with intense anxiety or distress (APA, 2015, p. 1017), can be

addressed by scientists creating scenarios where individuals confront spiders to simulate real-life circumstances.

15.3.Fear of heights (acrophobia):

An excessive, irrational fear of heights, leading to the avoidance of elevated places or causing marked distress when unable to avoid such situations (APA, 2015, p. 12), can be addressed by scientists creating scenarios involving high views to induce the fear state in individuals.

15.4.Claustrophobia:

A persistent and irrational fear of enclosed places (e.g., elevators, closets, tunnels) or of being confined (e.g., in an airplane or the backseat of a car) is characterized by situations where enclosure or confinement may be encountered, often resulting in avoidance or intense anxiety and distress (APA, 2015, p. 191). The focus of fear typically centers around panic symptoms triggered in these situations, such as feelings of being unable to breathe, choking, sweating, and fears of losing control or going crazy.

15.5.Panic disorder:

A recurrent unexpected panic attack is characterized by an abrupt surge of intense fear or discomfort that reaches its peak within minutes. The essential symptoms of this disorder, according to DSM-5, include palpitations, accelerated heart rate, sweating, trembling or shaking, sensations of shortness of breath or smothering, feelings of choking, chest pain or discomfort, nausea or abdominal distress, feeling dizzy, unsteady, light-headed, or faint, chills or heat sensations, paresthesia, derealization, fear of losing control or going crazy, and fear of dying (Association, 2013, p. 208). Virtual reality (VR) is used today to treat this disorder by creating virtual scenarios that induce feelings of fear, allowing practitioners to help individuals confront and manage their fear.

15.6.Agoraphobia:

An excessive, irrational fear of being in open or unfamiliar places, leading to the avoidance of public situations where escape may be difficult, such as standing in line or being in a crowd (APA, 2015, p. 32), can be effectively treated through virtual reality (VR). VR allows for the creation of scenarios involving pathogenic situations or stimuli to address this disorder.

15.7. Driving phobia:

An abnormal fear of driving any mode of transportation can be treated using virtual reality (VR) by planning content related to transportation, such as driving a car or operating a bus.

15.8. Social anxiety:

Fear of social situations in which embarrassment may occur (e.g., making conversation, meeting strangers, dating) or there is a risk of being negatively evaluated by others (e.g., seen as stupid, weak, or anxious) is known as social anxiety. It involves apprehensiveness about one's social status, role, and behavior (APA, 2015,

p. 991). Individuals suffering from social anxiety can benefit from undergoing virtual situations, such as engaging in conversations with strangers or going to public places.

15.9. PTSD:

Post-Traumatic Stress Disorder (PTSD) is a disorder characterized by reliving an extremely traumatic event, accompanied by symptoms of autonomic activation and avoidance of stimuli associated with the trauma (Guelfi, 2003, p. 493). Through VR technology, events similar to traumatic experiences can be recreated, inducing the feeling of reliving the traumatic event alongside other stimuli (Orta, 2016). Various techniques are then employed to treat the disorder. It's worth noting that research confirms individuals who have experienced trauma can be retraumatized through exposure to similar events, whether through imagination or by using virtual reality (Wiederhold & Bouchard, 2014b, p. 214).

15.10. Generalized anxiety disorder (GAD):

Generalized Anxiety Disorder (GAD) is characterized by excessive anxiety and worry about a range of concerns, including world events, finances, health, appearance, activities of family members and friends, work, and school. This anxiety is accompanied by symptoms such as restlessness, fatigue, impaired concentration, irritability, muscle tension, and disturbed sleep. For a formal diagnosis of GAD, the worry is often experienced as difficult to control, and the various symptoms that accompany the worry and anxiety occur on more days than not for a period of 6 months or more (APA, 2015, p. 453). The treatment approach varies for each individual, with practitioners utilizing VR as part of the treatment plan tailored to each subject.

15.11. Obsessive-compulsive disorder (OCD):

A disorder characterized by recurrent intrusive thoughts (obsessions) that prompt the performance of neutralizing rituals (compulsions). Typical obsessions involve themes of contamination, dirt, or illness, such as fearing that one will contract or transmit a disease, and doubts about the performance of certain actions, like a preoccupation that one has neglected to turn off a home appliance. Common compulsive behaviors include repetitive cleaning or washing, checking, ordering, repeating, and hoarding (APA, 2015, p. 725). The treatment for this disorder involves similar techniques and methods used for treating phobias and trauma. The key aspect here is that VR allows individuals to experience the pathogenic stimulus and elicit almost the same reaction as experienced by individuals suffering from the disorder.

Lastly, it's worth mentioning that in recent years, there has been a growing interest in the use of VR in the field of Autism Spectrum Disorder (ASD). This interest stems from the advantages offered by this technology, as mentioned in previous studies. VR provides numerous benefits in controlling stimuli, ensuring safety, and facilitating the development of important abilities in individuals with ASD, all at relatively low costs.

16.The use of serious games as a learning tool:

The use of playing through PC, Android, or VR is becoming increasingly popular. This technology offers many conveniences as it only requires an internet connection, allowing for versatile usage in various situations. These technologies rely on applications to be functional. For example, PC games require specific gaming applications, while Android devices offer a wide range of resources available for download from platforms like Google Play Store, Blackberry World Store, and Microsoft Phone Apps Store (McIlroy et al., 2016). VR applications are also accessible through these platforms, each with its unique features. For instance, AAA VR Cinema is used for 360° videos, Apollo 15 Moon VR allows users to experience virtual space and visit the moon, Google Expedition is an educational tool, and InCell VR provides insights into the human body, showcasing cells, organs, and systems (Silem, 2018). There are numerous other applications that can be explored on Google's website.

In this thesis, the researcher suggests that VR games or playing in a VR environment can be a valuable tool for developing the abilities of children with Autism Spectrum Disorder (ASD), especially since these children often prefer solitary activities. When used judiciously, in moderation, with planned and monitored content, video games can be an effective educational tool. Research indicates that children with ASD spend more than two hours per day playing video games (Mazurek et al., 2015). Games can be educational when designed based on psychological theories and appropriate virtual world techniques. Peachey et al., in their book "Video Games from the Perspective of Adults with Autism Spectrum Disorder," note that games can mimic reality closely, providing a sense of immersion and interaction (Peachey et al., 2012, p. 22).

While many studies focus on the negative aspects of gaming, such as its impact on academic performance and social behavior, including potential links to violence and aggression (Lenhart et al., 2008; Yao et al., 2019), other research suggests that gaming, when used appropriately, can have positive effects. Some studies show that gaming can enhance working memory and cognitive abilities at a moderate level (Martinovic et al., 2015). Strategic video games can improve cognitive flexibility (Pallavicini et al., 2018) and serve as tools for understanding the mental processes of individuals with ASD, such as the Stag Hunt game, which helps elucidate comprehension patterns and cooperative strategies (Craig et al., 2017).

Games can be utilized as therapeutic or exploratory tools and have emerged as a novel therapeutic approach in recent years (Garrett et al., 2018). People with ASD and disabilities have actively participated in the design and development of virtual content (Politis et al., 2019), underscoring the importance of serious games in understanding individuals with ASD, enhancing cognitive skills, and fostering personal development when used under the guidance of psychological specialists.

17.An example of a virtual reality clinic:

Since 1997, the Virtual Reality Medical Centre (VRMC) was founded in the United States, utilizing virtual reality technology to assist both practitioners and patients. The aim was to provide practitioners with additional tools to help patients suffering from anxiety disorders. The use of VR can offer some independence in treatment, reducing the reliance on imagination to treat phobias. Instead of traditional exposure techniques or therapy through imagination, practitioners employ exposure therapy in a virtual reality space. This therapy involves systematic and repeated confrontation with a feared stimulus, either live or in the imagination, as defined by the American Psychological Association (APA). The VR environment contains complex and interactive 3D stimuli.

Observations by scientists and practitioners have shown the therapy to be effective. The clinic has designated rooms for treating various phobias, such as public speaking, equipped with tools to help patients develop their abilities and reduce fear levels through VR. The therapy combines the expertise of three key individuals: the therapist as a guide and advisor, a competent programmer in computer sciences and VR, and the user or patient undergoing VR content for disorder treatment.

It is essential for the VR content to be user-friendly for therapists and not overly time-consuming, allowing the therapist to focus on the patient during sessions. Practitioners have noted success in reducing symptoms of disorders and recognize VR's potential in cognitive fields like attention, memory, planning, and motor control. However, VR is seen as a supportive tool rather than a replacement for real treatment. To maximize the benefits of VR, practitioners must be knowledgeable in cognitive behavior therapy, proficient in using computers and advanced technology, and understand human physiological responses to stress and relaxation.

The advantages of VR, such as immersion, presence in an environment, and interaction within that environment, make VR experiences highly effective in the psychological field when planned and executed by competent individuals. Coordination among these experts is crucial. Additionally, simplicity in game design is recommended for its role in motivation and facilitating interaction, particularly for children with Autism Spectrum Disorder (ASD).

Consclusion:

It is noted from the above that games and playing using virtual reality are widely used, as interest in it began decades ago, and the scope of interest in it has expanded more in recent years due to the ease and spread of the Internet, and games with their many advantages have begun to attract millions of players around the world, especially via the Internet, and the most prominent technological tools that have become the focus of interest and passion of many are virtual reality technology; Because it provides interaction and enjoyment, the most important types are computer and telephone. This chapter shows that telephone is less expensive and easier to use, and its user must have the physical means that allow him to interact with the virtual content. Also, psychologists who have the desire to integrate this technology must have a certain level of training and qualification, especially in dealing with virtual digital content, which has proven its importance and impact thanks to several studies and experiments conducted in American, Chinese, Malaysian and European universities. This technology can have many benefits if researchers try to determine the positive use of games and interaction through the Internet and the virtual world. Companies have created different types of games, for example: strategy games, action games, simulation games, learning games and many other types, but what is important in this thesis are learning games, which constitute the basic element that interests the student researcher.

It can be said in the end that virtual reality as a tool for practice in clinical psychology has been approved by researchers and authors and supported by writing and composition about it, and it is clear that the content of virtual reality remains the most important thing that makes the change happen in the user's personality, and many attempts to develop more effective content are still ongoing today.

Fourth Chapter: Therapeutic-Technological Approach

Preface:

For decades, humanity has sought welfare and an easy life, although humans still haven't realized what they are seeking. The human mind contemplates everything in every field to find solutions for every problem or phenomenon. Science has the goal of understanding the laws that govern the universe to be able to control them in the interest of humans. To achieve this goal, some types of materials and tools are needed. In ancient times, for instance, humans created tools of rock to defend themselves and their families, for animal hunting, and to protect their tribes. They expressed their emotions and habits by drawing on walls, using symbols, ideograms, and more. After the primitive era or prehistoric times, different civilizations appeared and disappeared, each expressing itself in a different way. However, what is common among them is the techniques used in every era. For example, in Egyptian civilization, the use of mummification was a high-quality method of protecting the bodies of the dead. In the modern era, technology is characterized by different kinds of technologies, such as computers, televisions, Android devices, numerical files, applications, and more. Actually, technology is used in different fields, like education, sports, medicine (Venkatesh et al., 2022), military training, and more. The most important field that will be discussed in this chapter is the role of technology in psychological treatment. It is worth mentioning that since Pavlov, the use of modern tools has been evident. After Pavlov, Skinner continued the work on psychological processes using technology that he created for his own experiments with his mind and efforts. In clinical psychology and psychotherapy, many psychologists use technology in their care and therapy with patients. Some centers in the United States have developed many tools for caring for patients. For instance, psychologists use virtual reality to help treat PTSD in combatants who have experienced warfare. The results have shown that VR is very effective with persons with PTSD (Gottsegen, 2019). Researchers at the USC Institute for Creative Technologies are working on using virtual reality as a treatment tool with soldiers (USCICT, 2014). In some therapeutic approaches like Cognitive Behavior Therapy, therapists previously used imagination to help patients recall stressful situations. This method is still widely used, but some researchers have explored the role of a virtual reality world in recalling situations that provoke phobias. For example, men who fear using elevators can be exposed to a virtual experience that contains an elevator. Instead of relying on imagination to create conditions of phobia and anxiety, the virtual content can easily provoke these conditions. The therapist can observe the patient's reaction, symptoms, time occupied during the condition, and other important factors needed for a better understanding of the psychological disorder. Another example of the integration of technology in treatment and care for patients with psychological disorders is in the United States, where a center uses some applications and games to develop the abilities of children with ASD. It is clear that today, technology has become very important in helping treat many psychological disorders. In this chapter, the researcher will introduce the chapter with definitions of technologies, the technological tools of this era, psychotherapy with technology, different classical theories that used technology in their era, modern technology in psychology and psychotherapy, PCs, Android devices, virtual reality, applications, virtual programs, and conclusion.

1. Definition of technology:

1.1.Scientific knowledge used in practical ways in industry, for example in designing new machines: science and technology, recent advances in medical technology. (Hornby, 2006, p1520)

1.2. Technology is referring to modern tools developed for different needs, it makes human life easier and more sophisticated, technological tools can be found in every profession, for example, education, learning, sport, treatment, and more

2. Psychotherapies with technology:

2.1. It is a therapy that depends on technology tools and machines, for example, a psychologist can use numerical applications on his PC for memorizing the cases of patients, or some virtual contents are created for provoking the phobic situation in order to help the patient confront his fears, without forgetting the total change that happened in psychology, where the psychologist can make an online interview with his patients, creating a group of patients to support each other online.

2.2. The therapy with technology is the use of modern tools to help patients who have a psychological disorder, this type of care is becoming widely used in developed countries because of its facilitation the care and treatment without interrupting the prosses, and to make the patient in a comfortable situation.

3. Some technological tools used in psychological therapy:

3.1.Computer：

It is a machine that contains many parts, each part has an important role in the whole machine, these parts are the screen, the central unity, the mouse, and the keyboard, the psychologist uses the computer for registering the name of patients, their disorder, in order to easily remember them in the next session.

3.2.Phone：

It is necessary to have a phone number for the clinic in order to facilitate the making of an appointment or to answer any inquiries by the clients and patients.

3.3.Digital programs：

Psychologist needs in their profession many programs in computer because to organize the work, a group of programs must be installed.

3.4.Ergonomic Materials：

The practice of consulting needs ergonomic and healthy materials, and technology has an influence on the quality of the material and furniture, for instance: the chair is moving in an easy form.

3.5.Virtual reality: This type is the most developed technology, in precedent times it was used for entertainment, but now this technology is being used in medicine and psychology, particularly cognitive psychology, and in cognitive behavior therapy.

4. Precedent Theories that integrate technology:

There is no doubt that previous psychologists had their own techniques, which they worked to develop and create appropriate environments for their use. These techniques and environments were considered technologies at that time, and among the psychological and neurological theories that incorporated technology are the following:

4.1.Pavlov Theory (1849-1936):

In the past century, Ivan Petrovitch Pavlov, the physiologist, conducted experiments on dogs using various technological tools. The first tool was a device for measuring the volume of secretions from the dogs, and the second was a bell-like sound-producing device (Rehman et al., 2022). Additionally, other devices such as a buzzer or one that produced electric impacts were also used. Pavlov's experiments involved a number of tools that were considered technological advancements in that era. Without technology, the experiment may have been difficult or taken much longer. It is worth mentioning that nowadays, any tool or device, such as an Android device, or any sound or image that provokes neurological responses, can potentially produce classical conditioning**.**

4.2.Thorndike Theory (1874–1949):

The fundamental aspect of this theory is the discovery and study of behavior, and the method of learning with animals in order to understand humans. Initially, Thorndike did not accept the classical interpretation of human-animal behaviors. So, he started studying some animals. His viewpoint was that animals do not have any thinking, but trial and error according to this theory is the way to acquire or change behavior. Thorndike used instrumental conditioning (Beeler, 2012). He also had a box, but his box was made of wood. In a way, it was considered an innovation at that time because it facilitated a better understanding of animal behavior and actions. It was a technological tool that helped in discovering the mechanisms of behavior functioning and learning.

Skinner Theory (1904–1990):

After Pavlov, Skinner conducted experiments on rats using some technological tools available at the time. His theory is called the theory of operant conditioning or instrumental conditioning. Skinner aimed to study his perspective: if a reward is given to the rat, the behavior will be repeated; this is called reinforcement. If instead of a reward, an electric shock or any other negative consequence is given, the behavior will eventually disappear. The most prominent technological tool developed by Skinner himself is the experimental box, commonly known as the Skinner box or operant conditioning chamber (APA, 2015, p. 735). This chamber is used to study operant behavior. It allows the user or experimenter to control variables and different stimuli outside the environment. The components of the box include a lever or key used by the animal to obtain the reward, such as food or any other element that can reinforce behavior. Skinner's use of technology is evident in this experiment; although it is simple, it enables the animal to interact with it.

4.3.Cognitive-Behavior Therapy and Modern Technology:

This last approach is modern and the most widely used method in helping treat anxiety, OCD, phobias, depression, and more. The essential aspect at this point is technology, where psychologists can use devices to help treat disorders, especially if patients face difficulties such as lacking confidence to visit a psychologist or other problems beyond our subject. Some psychologists try to integrate technology with cognitive-behavioral therapies (Wolters et al., 2017), particularly in treating obsessive-compulsive disorders. These technological programs permit patients and psychologists to conduct online interviews and engage in online self-help therapy (Wolters et al., 2017). The technological tools include video conferencing and Android applications. Studies have confirmed the positive effects of these technologies on the therapy process, especially the programs used for this purpose. Researchers have found that technology integrated with cognitive-behavior therapy can have a greater effect in controlling conditions, and therapy with integrated technology can yield the same results as therapy without technology. Generally, digital tools and applications like Zoom, Skype, recorded video, or audio, among other options, preserve patient confidentiality and facilitate quick access to therapy sessions. Some patients prefer this type of online session because they feel their privacy is more secure than in face-to-face sessions with society individuals. Presence sessions can also be enriched by using technology (Wolters et al., 2017).

Furthermore, the problem of distance does not exist if the therapist uses video conferencing applications to conduct CBT sessions. Some therapists have developed technology to reinforce CBT sessions for depression with adolescents. For example, internet-based applications remind adolescents of their homework, provide online training, and teach patients new skills (Kobak et al., 2015). In recent years, augmented and virtual reality technology has become more prevalent in many fields, including psychology, specifically in CBT. Some psychologists, instead of using exposure with imagination, use exposure in virtual reality worlds because it provides an experience similar to reality. Engineers who create the content can design an imaginary world with many stimuli and various types of positive feedback. Patients navigate through this new imaginary world with the help of a psychologist. For instance, in the treatment of agoraphobia, engineers can design a large space that evokes feelings of fear in sufferers. Many scenarios can be created based on the patient's case. Psychologists can use virtual worlds to help treat phobias related to animals such as cats, insects, and reptiles.

These theories were important in using technological tools in previous years and decades. It is worth mentioning that the technological tools that existed in previous decades are not considered technology now. However, at that time, they were innovations pioneered by psychologists like Skinner or technological tools used in new fields by physicians or psychologists. For instance, Pavlov used a bell or other electronic stimuli to provoke dogs.

5. Modern technology in clinical psychology:

In this era, it is observed that technology has become a part of everything and every field. Clinical psychology, too, has embraced technology. Many psychologists in the USA and Europe are using technology and applications to stay updated with their clients or patients. In this part, the most used technology in the psychological field will be mentioned. The tools are:

5.1.Email:

This is a massaging system that help the patient send some needed feed-back to his therapist.

5.2. Chats:

This is another type of conversation between the patient and his therapist, it is very useful in case of urgent advices, additional orientations, and recommendations.

5.3.Videoconference:

This is a technology that decrease the need for mobility, it is very effective as if the patient is present in the session of treatment, but it can not be an alternative way of the presence, it is just used in case of illness, incapacity to attend the therapeutic session, or the presence of some viruses that can hit the person like Corona.

5.4.Voice recording:

This method helps the patient to well remember the recommendations of the therapist, the recording can be made with Android, device for recording, PC, or any other device help in that function.

5.5.Virtual environment:

This the most advanced technology used to day, and it is till now under the test about its effectivity in help in treating some psychological disorders (Riva, 2004, p. 193), the student researcher explained well its role in the second chapter of the thesis, and how it is becoming an important tool with some disorder for instance phobia, and anxiety.

6. Psychotherapy and Android :

The life of human today is depending on many types of technologies, among the wide used technology in this era is Android, it facilitates the contact with the family members, connecting to internet, taking photo, watching videos, discovering new places, follow new events, shopping on some commercials websites, and more, but the Android in that era is becoming more used in medical and psychological field, in psychology and psychotherapy, the person can record his ideas, and discussing it later with therapist, according to many studies, the intervention by using Android have a promising results (Miralles et al., 2020) especially regarding the easiness of this technological tool, the person can use his Android anywhere, so he will receive everyday care and support from his psychologist or therapist, in a study of Lara and other researchers about using Android in combining psychotherapy with phone application therapy, the results of the study confirmed that the use of Android is accepted by the patients in help in treating panic disorders (Ebenfeld et al., 2020), in particular the approach of internet-based interventions depending on CBT or as it is labeled (iCBT), the mobile support this approach, where in the past the use of PC

is the more known method, some universities try to develop applications for therapy of some disorders, in the coming lines, an example of an application developed in the university of Stockholm.

7. An example for help in treating social anxiety by using the mobile application:

Scientists from university of Stockholm in Sweden developed an application for help in help in treating social phobia, the application is labeled challenge app, it is on play store, based on the idea of online assistive therapies that is its name internet based cognitive-behavioral therapy (ICBT), according to some researches, the help in treating of anxiety by using internet proved an effectivity, and it is similar to session vis a vis in improving the case and developing it, and decreasing the symptoms (Miloff et al., 2015) , the challenger app have a method of work that is give a challenging works and tasks, the patient do this challenges gradually, till he is arriving to see himself well developed, and he consider that his disorder and its symptoms are notably decreased, the challenge app have a form of a serious game (Miloff et al., 2015), where the user feel himself doing the challenges in a fun manner, the challenger app provide 27 skills, these skills are a goals for attaining them, when they are attained, the case with social anxiety feel better, for instance, in the skill of social skills, the patient will learn different types of interactions in normal life, the evaluation will be used as in the games when gaining more points in an enjoyable manner, predominantly, the Challenger app has some underlying foundations that are:

7.1.The theories:

The theoretical foundations are CBT, the user has many exercises to do, each one has precise objective, this last support an important element in his personality, the CBT in precedent time is practiced in therapy sessions, but in actual time, the development and the use of applications is widely used worldwide, this will smooth the care and therapy, and any other activity (Miloff et al., 2015).

7.2. Rules of games:

The creators of game broadly use in there game system some psychological elements that make the player finds great fun while play, some of these elements are rewards, stimulations, feedback, and more, all these mentioned elements are existing in challenge app (Miloff et al., 2015).

7.3.Personal freedom in choosing objectives:

The challenge app allows the patient the freedom to set his objectives, for instance: if the patient wants to develop a special skill, he has the choice to select on the application which objective or skill he seeks to acquire or develop it. (Miloff et al., 2015).

7.4.Feed back to the designers of application:

Through the application, and the register of activities of the users, the designers can make amelioration on the application, every comment, note, remarque, and opinion can have a positive act on the app.

7.5.Psychological and educational advices:

The designers of Challenge app uses a feedback for supporting the efforts of patients to achieving his goals, and lot of information about psychology and disorders, the form of feedback is a parachute providing the support, suggestions about how decreasing fears, rising encouragements, when the patients achieve a goal, and acquiring new skills, a parachute as feedback will come to show the patient how guarding the new skills and averting the loss of them (Miloff et al., 2015) , the user also have a support from whole the society as feedback.

It is important to mention that many applications now are staying under experience, the case is the same with app challenge, many articles are written by researchers about the effectiveness of applications and virtual content in help in treating or decreasing psychological symptoms, developing skills, learning new competencies, and making therapy easier and faster, app challenge have its complete version which make it valid for testing, the most important character of digital tools is the update, the designers every month or more send notification for updating any program, this provide to the program an advancement and protecting it from becoming not useful over time.

8. Some Applications used in psychological field:

The use of applications and digital tools in psychology is experiencing development every day, mainly in the field of organizational and work psychology. However, applications are also being used in clinical psychology, where psychologists organize their work in an appropriate manner. They input the full identity of the patient, their disorder, their problem, the level of improvement, and more. These programs effectively aid in the management of counseling, evaluation, analysis, and publishing the results or diagnosing the mental case of the person. For example, the following applications that will be mentioned are used by psychologists:

8.1. Applications for iPhone and iPad:

8.1.1. Quenza:

It is an application available on Appstore and play store, permit to psychologist to pursue the progression (Quinza, n.d) of their patient outside the therapy session, this application is very useful in controlling and encouraging the patients, these last feels that their self is more supported and the process of therapy is very effective, the essential roles of the application are:

- Gathering the important information about the patients/clients for instance the name, marital status, the order among the brothers and sisters
- To make the patients/clients interact between session of therapy
- Reserve more time, through using less papers in the work
- The interaction with patients/clients is more in digital form
- Promoting the practice as psychologist or counselor
- Utilizing homework exercises with patients and clients
- The exchanging between the psychologists and the patients/clients some important video, audio, texts for continuous support
- Creating questionnaire for assessment and evaluating the development of the patients/clients

- Gathering opinions about precedent sessions, where the psychologist can demand feedback from patients/clients
- Inspiring your patients/clients with positive content, like short video, that is useful in motivating the person in his life, for instance, a person who suffered in the past from depression talking about how he confronted it, and how his life became after the treatment.
- Get the signature of your client online and in digital form
- Present to your patients/clients their improvement through graphics, illustrative circles, and any other types of graphics

8.1.2. Live OCD Free:

It is an application on the Appstore, it is compatible with iPhone only, this application is exactly designed for help in help in treating obsessive compulsive disorder, the application helps the patient confronting the obsessive ideas without the help of therapist, the patient depends on his ability from a side, and on the help of the application from other side, the method of the application is to put the user or patient in an situation where he is in exposition to the stimulus that provoke the obsessive ideas, or as it is called by experts Exposure and Response Prevention(Live OCD Free, n.d.), this application can provide to the patient a continuous treatment, but the different between treatment with therapist and by using the application is that when he use the Live OCD he must have the followings:

- Have iPhone or iPad
- Have the internet
- Ambition to confront the symptoms of depression
- To use correctly the application
- The will to continue the treatment outside the sessions with therapist
- The enough knowledge to use the application and to send the data to therapists

It is worth to mention that the application also is designed for children, the same function is existing in the version of adult, but the difference is in the design, where the child feels as he is play a game, some personalities are used for encouraging the child, an owl is the coach, it boosts the child for doing the work and finding the solution to decrease his fears, the idea of use play during the care with the children is very helpful, this is why this thesis is focusing on the play, and an application similar to a game.

8.1.3. Loop for Social Anxiety:

It is an application on the Appstore, it is compatible with iPhone only as the precedent application, it is designed for confronting the fears of being judged (Loop for social anxiety, n.d.), the method of the work of this application is as follow:

- Taking a short quiz of social anxiety before starting the use of the application
- Define the symptoms that you suffering of them to treat them by using the application
- Determine the objectives that you want to do them
- The possibility of choosing if the objectives will be done singly or collectively
- The user can control and follow his progress
- The patient can observe his progression after few weeks (Loop for social anxiety, n.d.)

8.1.4. Fear Tools - Anxiety Aid:

This is another application designed for iPad and iPhone, in addition to MacBook, the difference with the other mentioned application is that fear tools are totally free and the creator society don't have profit intentions, the role is to help the patient to engage against the anxiety with its different types, and phobias, this application contains some techniques that help the patient to progress and make improvement, some of these techniques are the followings:

- Registering the ideas for confronting and changing them later
- Exposition to the situations provoking the state of fear or anxiety, and deal with it according to CBT approach and its precepts
- Relaxation techniques where the application show to the user the correct method to do it
- The patient can receive the information about his anxiety type, and some orientations
- The application can permit to the patient to make a test for his anxiety or fear (Fear Tools - Anxiety Aid.n.d)

8.1.5. Anxiety Relief by Mind Ease:

This is an application for iPad and iPhone, it is designed for decreasing the anxiety, more exactly the ideas and the feelings that make the patient in a stressed situation, it has a library that provide the patient or the user with many activities that support the improvement and any positive idea for the patient, this application is also designed for help the patient in making progress against the anxiety and depression, and mood disorders, the technique used in this application in general are the followings:

- The patient or the user can size his mood
- The patient or the user can make exercises for reducing the anxiety or depression
- The patient or the user can discover his positive method against his anxiety
- The patient or the user can observe his improvement each time he wants (Anxiety Relief by Mind Ease, n.d)

After using this application, the patient or the user will see that his sleep is became more stable, easy, and without problem, in addition to some positive change that will happen in his personality.

8.1.6. TalkLife:

This is a free application, it can executed on iPhone, iPad, The central idea for designing this application is to make people who are suffering from a mental disorder not feel themselves alone, everyone with psychological problem have another who have the same problem, each one can help the other, the patient can use the application in any moment in particular, when he feels that his self is needed instant help, the patient or the person can do the following through this application:

- Descript some life events that he lived them in the past, or lives in actual time
- Everyone can speak about his experiences, problems, and difficulties without fear the judgment from the others (TalkLife, n.d)
- Encouraging some patients to participate in conversation and talk about their problem

- Every user can stay in an anonymous way on this application according to his choice
- The patient can open personal conversation with other persons

8.1.7. Breathe2Relax:

This is a free application, it is available on iPhone, iPad and Android, it is designed for help the person to treat his stress, the majority type of exercise in this application is practical, where the person will follow every step to reach a state of complete relaxation, the use of application can be in conjunction with the therapy with psychologist (Breathe2Relax, n.d), it a good idea for a continuous care outside and inside the house, so the application provide the following services:

- Information about stress and its causes and how to control it
- Method to control stress and manage it
- Watching tutorials that show to user the correct method of breathing and relaxation
- Learning and practicing diaphragmatic breathing
- Controlling the anger
- Stabilizing the mood
- Managing the anxiety in an easy way
- The user can combine between the use of the application and the therapy session without any problem

8.2.Applications for Android:

The use of Android is becoming more widely in the world, with its use there are a lot of applications and options in that worldwide technology, the patient can use many applications in order to help himself in addition to the treatment of psychologist, some applications are the following:

8.2.1. Mindshift:

This is an application designed for Android, it is available on Google play, this application is created by the Canadian association of anxiety, the approach used in this application is the CBT, half of million person downloaded this application, this last help in the following:

- Help in treating the self without lot of help from a therapist
- The application is designed for self-care where the patient depends more on himself
- It can control the anxiety (MindShift TCC, n.d), confront negative ideas, and stay focus on his positive thinking
- The use of the application helps in preventing the anxiety to becoming worse
- Any time the patient or the user can use the application
- The application depending on the CBT approach help in changing negative schemas to positive schemas and more effective (MindShift TCC, n.d).

  It is worth to mention that the application protects the privacy and any information concerning the patient, this last can demand the deleting of any information about his disorder.

8.2.2. CBT Thought Record Diary:

This is the second application of Android, it is available on Google play, this application has a learning objective in addition to treatment, the user in the learning process can learn how to use

the CBT technics, it is similar to Mindshift in its departing ideas, they depart from cognitive behavior theory, and the anxiety or depression or any other type of disorder can be having a limited influence if the patient uses correctly this application.

8.2.3. ModMath:

This is a free application, it is available on iPhone, iPad, it is under creation in android and PC (ModMath, n.d) , it is for helping children with dyslexia and dysgraphia, in addition to help them in learning mathematics, this application can help everyone have physical disabilities, it is provide to user the support in writing in digital form, the user may have difficulties in writing, so the writing in digital form make him overcome difficulties, the application provides several services and assistance which are the following:

- The user can write on the device directly where he overcome the difficulty to write with a pen
- The writing on the iPhone or other device help in registering correct information
- The user can do any mathematical process
- Storing any lesson or homework and find it later
- Dealing with any mathematic activity

8.3. Applications for Android and iPhone:

8.3.1. PTSD Coach:

This is an application for iPhone and Android, it free and help in help in treating, decreasing and managing the symptoms after exposing to trauma, according to the governmental American website ptsd.va.gov, this application was downloaded by 460.000 time around the world, from 115 countries (PTSD Coach, n.d), the application can help in providing information also to those who didn't lived a traumatic event, this character help in creating a collective conscience about trauma symptoms, the creation of the application was made by national center of VA for PTSD and the department of defense (PTSD Coach, n.d), it is very recommended to mention that the application must not be considered as an alternative therapy with professional or therapist, its function is limited in help the patient and not to help in treating him, the application PTSD Coach help in the following:

- Information about PTSD and its symptoms
- Information about the treatment of PTSD
- The patient can pursuit his symptoms even though he doesn't have session of therapy
- The patient can control his symptoms in an easy manner
- The patient can demand in any time the help from services concerned

8.3.2. NOCD:

This is a free application, it is available on iPhone, iPad and Android, the most important character in this application is that is created by persons who have obsessive compulsive disorder, and experts of help in treating it, the application provide to the patient direct videos session with therapist like in session with him without digital support, the NOCD facilitate the interview with the therapist in any time, the application in general help in the following:

- Making online interview through video
- Encountering psychologist and therapist easily online
- The patient can receive texts help in decreasing the effect of OCD
- The patient has chances to find people with his same disorder, and same situation
- The patient has possibility to change the plan of his treatment or personalizing it (NOCD, n.d).

8.3.3. Acceptance and Commitment Therapy Coach (ACT Coach):

This is a free application, it is available on iPhone, iPad and Android, ACT is designed for helping people with negative feelings or thoughts, and made their ideas more neutralized, the patient or the person can use the application in addition to his session with therapist, the creator of this application is the center of VA for PTSD, the ACT can provide the following services:

- Help the patient in accepting his personality as it is
- Guide the user to make his feeling and thoughts under his control not the inverse
- The patient has ability to make many actions in order to feel with the value of himself
- The user can find information that concern the acceptance (ACT Coach, n.d).
- The patient or the user can make exercises for becoming more better

8.3.4. Cognitive behavioral therapy for Insomnia (CBT-i Coach):

This is a free application, it is available on iPhone, iPad and Android, it is designed for persons with insomnia and sleep disorders, its theoretical basis is cognitive behavioral theory, (CBT-i Coach, n.d), the central work point is to recover from difficulties that are concerning the sleep without using any medicament with the patient or person in general, the person can receive many plans, for example: he can limit the time of his activity in 21:00 in the evening, go to bed in 21:30 after doing some breath exercise in his bed, it is an application created under supervision of professional, but it must not replace therapy with therapist mainly if the problems of sleep were severe and demanding professionals, in general, the application has the following functions:

- Helping the persons to develop their plan for improving their sleep habits
- Controlling the progress every day
- Learning relaxation (CBT-i Coach, n.d)
- Understanding more about problem of sleep due to PTSD
- The patient or person can assess his insomnia severity
- The patient or person have the possibility to record his previous sleep and how it was
- The patient or person can receive suggestion for time of sleep, exercises

8.3.5. PTSD Family Coach:

This is a free application, it is available on iPhone, iPad and Android, it is designed for persons with PTSD and their family, the members of family will find through this application the necessary of information concerning the PTSD and its symptoms (PTSD Family Coach, n.d), the user will receive help about his PTSD or if a one from his family have PTSD, the application will guide him to deal truly with this one whether a child, an adult, or old man, the application provide the following services:

- The user or the patient can manage his stress with 24 tools available
- The user or the patient can manage the hard emotions and ideas

- The user or the patient can track his stress level every time
- The application provides scientific assessment about the disorder
- After some days, the user or the patient can receive feedback about his improvement or improvement of the member family (PTSD Family Coach, n.d)

8.3.6. Moodnotes - Mood Tracker:

This is a paid application, it is available on iPhone, iPad, it is designed for persons with mood problems, these persons have negative thoughts that effect on their mood, the role of the application is to help the patient or the person to improve, ameliorate his thinking that will with its role improve the mood(Moodnotes - Mood Tracker, n.d), the user will have ability to pursuit his mood in order to make it better, the application provide to the user the following services:

- It is for self-care for best consequences
- Helping in the improvement of thinking for to adjust the mood
- The user can follow his mood each time and every day
- The user can diagnostic his mood what helps to understand it well
- The application provides scientific diagnostic and assessment
- Learning more about the self and the mood
- The person understands well the problem of mood

8.3.7. VetChange:

This is a free application, it is available on iPhone, iPad, it is designed for persons who live in difficulty with drinking and stress, it is more dedicated to ancient combatants who worked in the army, it is developed by US Department of Veterans Affairs for helping the American soldier who stay suffering of stress, or addiction to some substance in particular the drinking, the application helps in the following:

- Help in treating the alcohol abuse
- Help in treating or decrease the stress
- Planning a goal to achieve it the near days
- Suggesting alternative solution against the need to drink
- Expressing your emotion through emoji in order to make your feeling clearer in the application and to get appropriate feedback
- Providing some interacting tools (VetChange, n.d)
- Motivating the self
- Encountering others with the same symptoms and problems
- Providing information about alcohol abuse and PTSD
- Helping in rebuild the self in what concern the bad habits of drinking
- Controlling any progress under using the application (VetChange, n.d)
- In case of the need to urgent intervention the application facilitates your call for help

It is worth to mention that this application is targeting the ancient veterans and who worked in defense sector, but it may be used by persons who didn’t work in that sector.

8.3.8. Life Armor:

This is a free application, it is available on iPhone, iPad, and Android, it is designed for persons with anger, PTSD, sleep problems, anxiety, depression, family problems, it is more used among persons who were in military service (Life Armor, n.d), the application provide 17 topics, these topics concerns many psychological disorder and problems, in general the application provide the following services:

- Learning about many psychological problems and disorders
- Dealing with different type of psychological problems and disorders
- Providing information about psychological problems and disorders
- Helping in easy intervention and support the therapy with therapist

8.3.9. SlowMo:

It is an abbreviation for Slow down for a moment, this is an application for Android, the difference between the precedent applications and this application is that this last is designed for psychosis disorder, the application is now still under experience by researchers and designers, the application is for limiting and slowing the fast thinking of the patient with paranoia, it helps him confronting the negative ideas, these ideas are in the mind of the patient (SlowMo Therapy, n.d), the application have a theoretical base called "Causal interventionist" (Ward et al., 2022), in general the application provide the following services:

- The application improves the thinking of patient with paranoia
- The application can be combined with treatment with a psychologist
- The application changes the fast thinking to moderate or normal
- The application helps in observing and controlling the negative habits and worries of the patient
- The application helps the patient in managing his fears and wrong expectations
- The application helps in the intervention for psychosis cases

8.3.10. Recovery Record (RR): Eating Disorder Management

This is a free application, it is available on iPhone, iPad, it is for help in treating eating disorders like anorexia, bulimia nervosa and more (RR, n.d), the application can be useful for persons with weight problems, in addition to negative habits of addiction and consummation of tobacco, this application helps in the following:

- Registering the ideas and emotions
- Registering the foods and any other substance the user consumes
- The user can observe his progress
- The user can find persons with eating difficulties or disorders
- The user can receive or send feedback to the team of his same case (RR, n.d)

8.3.11. Cozi Family Organizer:

This is a free application, it is available on iPhone, iPad, also on Android, this application is not created for a special persons with psychological problems, it can be used by anyone even though he don't have health problem, in this context the application is mentioned because it helps well persons with mental retardation and disabilities, it is providing a service for the whole family, the one member for example can organize himself by creating the times of getting up, taking dinner, …etc

The person with mental disability can support himself by using this application, generally Cozi Family Organizer help in the following:

- The parents can see the activities of every member of the family
- The user can create appointments, assignments
- The user can use the calendar to organize meetings, works, and more (Cozi Family Organizer, n.d)
- Creating lists for easy remembering like: visiting a place, writing a page in your book, reading a book, shopping
- Organizing any activity, where the use may have many activity in the same time, by using the application he can overcome any confuse and administer easily the priorities.

8.3.12. Autism Xpress:

This is a free interactive application, it is available on iPhone, iPad, and Android, this application from its name the objective directly can be understood, it is designed for help the children with ASD to understand emotional expression (Autism Xpress, n.d), the child through a cartoon images can learn to understand emotions and expressions of the other persons, it contains 12 images, each one have particular emotion for instance: sad face, happy face, angry face…and more, this application in general helps in the following:

- Understanding the emotional aspect of the child with ASD
- Educating the child with ASD to express his emotions easily
- Brings fun to the child with ASD
- Educating the child with ASD to understand the emotions and facial expressions of others and interact in an appropriate manner (Autism Xpress, n.d).
- The application combines between fun and education
- The application can provide help to parents, teachers, and caregivers (Autism Xpress, n.d).

It is important to mention that these are some applications used in the field of psychology and mental health, but of course, they are not all the existing applications. For example, ReMindCare is an application developed by the Psychiatry unit at the Clinical Hospital of Valencia in Spain, in collaboration with the Polytechnic University of Valencia. The application helps gather information about individuals with psychotic disorders. Psychologists receive a daily or weekly report about any behavioral changes concerning their patients. ReMindCare is an effective tool for controlling and observing patients from a distance (Anonymous, 2019). The information provided by the application is confidential. It can also be said that ReMindCare helps in discovering any

suicidal intentions. Although ReMindCare hasn't had wide use, it serves as an example of efforts in this matter.

The student researcher aimed to mention applications that concern the most prevalent disorders, especially neurosis, to show that psychologists and designers are still working on using technology and mobile devices in the clinical field.

9. The risks of using the application in uncontrolled manner:

Many scientific publications alert about the excessive use of digital tools. The World Health Organization has recognized addiction to digital tools as a new disorder (Dresp-Langley & Hutt, 2022). The latter claims the need for intervention. It is worth mentioning that when digital tools cause a disorder or addiction, it is very important to use them with individuals suffering from psychological disorders with total caution. Digital tools can have negative effects on mood, akin to the effects of drugs. The U.S. Naval Institute has referred to them as the new drug, meaning digital tools. In cases of addiction in individuals without prior psychological disorders, but where the use of these tools becomes excessive, in addition to the presence of psychological disorders or problems, the situation becomes more complex. Therefore, psychologists must carefully manage the use of digital tools and applications for the patient. Some recommendations can be given in that context:

- The time of use must be limited
- The time of use must be similar to the time of therapy with the therapist
- The use must be in an organized manner
- If the patient feels with urgent need to use, it preferable to inform his psychologist
- If any negative effects appear it is necessary to inform the therapist, for instance the sleep problem, urgent desire to use the applications all the time
- Avoiding to make the applications as the essential therapist, it is just a system of help and support
- The patient sometimes may feel that he found the help with the application more than the therapist, in this case it is important that the therapist send him some mentions
- The patient may make comparison with others who made good results with their psychological problems, in that case the patient may feel frustrated at not being able to achieve what they have achieved so he must contact his therapist about any negative feeling or ideas
- The creators or designers of the application must control any negative contents, ideas, falseness
- The patient or the user need to make a cyclic visit with his therapist informing him with any new negative behavior or feeling that may be the results of applications
- It is very important to undergo to educational courses on the safe use of applications and digital tools in general
- Studies confirm that any entity can stimulate the person have probability to lead to addiction (Dresp-Langley & Hutt, 2022), in the case of applications it can stimulate the

patients, so it is very important to use them under supervision or at least with high control in order to avoid later any type of addiction.

In addition to the risks of using the application in uncontrolled manner, it is worth to mention that there are some dangers that can thread the user, among these dangers are what is mentioned by the American Psychiatric Association:

- **«By offering incorrect or misleading information to patients.**
- **By claiming to offer therapeutic interventions or services but actually be ineffective, leading to belief the patient is treatment refractory.**
- **By not being secure, or improperly disclosing or allowing access to the personal health data.**
- **By selling patient collected data but not obviously disclosing this information to users.**
- **By not actually collecting clinically useful or actionable data.**
- **By being a new technology whose use in a clinical setting is still not fully understood»** (APA, n.d)

Conclusion:

It is clear that the main character of this era is the domination of technology in every field of life, like in science, education, military, and more, the technology is used because of its facilitation the learning, the research, the technology in the clinical psychology makes easy the gathering of information, the interviews, the support of patient outside the therapeutic sessions.

When the technology is mentioned, it is very important to talk about the positive influence of the technology on the profession, in the past, psychologists used simple possibilities in that previous era, but now, the technology became more sophisticated and very advanced, it provided huge tools as above-mentioned, this influence technology on the therapy may be wide in the near future, this can lead to the developing and the appearing of new approaches which wasn't existed before.

The most important element in the therapy also is the patient, he is became more conscious in the actual time about the different illnesses and disorders due to the technology, this last provide the information in few minutes, he can gain feedback from others have the same condition, he will know that he is not alone in this life with his disorder, if the patient have ability to compare himself with others who live harder condition than him, he will feel better, and he will perceive that his disorder is not the end of the world.

The actual technology in clinical psychology is clear when it is observable the use of mobile and Android, these two devices provided many services for now, anyone can find a digital service, the psychological intervention in this form is very easy and available for the individuals in any society as long as he has the adequate knowledge about using the mobile, and the method how to use the internet with it.

It is worth to mention that the modern technology facilitated any profession among them the profession of psychologist and therapist as above mentioned, , in particular with persons who hesitate to visit psychologist and demand the help, some cases for example in Algeria consider that the demand of help from psychologist means that the person is insane, many are ashamed to reveal that they have gone to a psychologist or they receive help from him, in this situation, the use of Android can be very helpful and effective in encouraging the patient to asking for help, but the application till this days stay not well known, in addition to the surface languages, where the Arabic language is not provided in the majority of applications, the developing of applications concerning the psychological intervention stay not existing till this days, this confirm the need to give technological tools the adequate importance, to enlarging the studies about their role, their importance, and their effectivity.

The future of technology in clinical psychology can be expected through actual time, the use of PCs, mobiles, tablets, for facilitating the treatment and the TV for spreading awareness and knowledge, the appearance of virtual reality and artificial intelligence have great concern by psychologist, technicians and researchers, it can be said that the classical technics demands certain efforts, in this time the care became easier by using technology of VR like the use of exposition in CBT therapy instead of using imagination.

It is very important that psychologists undergo to a formation about technologies, and they must have enough knowledge about how to use them in favor of pushing the treatment towards greater success from another side, the new research about the role of applications and virtual reality

programs and games must get the attention of teachers, psychologists, and practitioners, because in their majority it can be enjoyable in addition to the therapeutic care, this means that the new technologies help in particular in combining among the serious work and the pleasant contents, in that manner, the probable refuse or the boredom can be prevented.

Practical Side

Fifth Chapter: Game of the Study

- Preface
1.Definition of a game
- Definition of the games by the student researcher
2.Definition of a serious game
3.Definition of the VR game
4.Some software used in the development of virtual reality and games
5.Characteristics of a virtual game
6.The program used in the study as a research tool

Preface:

Play using different tools today is largely done by children and adults, for example: play with the PC or PlayStation, or using a smartphone. Play with these devices provides players with some fun and enjoyment, and makes the player subordinate to them. The program may be useful or it may be harmful. If it is used without any supervision by the parents because the children do not know their own interests and do not have the ability to determine the good program and the bad program, and those responsible for this are the parents and specialists, they can determine the level of use of the game, in order to avoid adverse results, as it is said in Arabic wisdom. : "If something exceeds its limit, it turns into its opposite," so play for entertainment may be fun, but it must be under supervision as previously mentioned, and it should not replace some other important things such as study or work. It is assumed in this The thesis is that designed and thoughtful play can be useful in developing various skills for children with autism spectrum disorder, and reducing some behavioral problems such as violent reactions or strange sounds. A game was used to help children with autism and evaluate their abilities and subsequent growth. The game is a thoughtful scenario that allows the child to interact. The game may also be an ideal solution for discovering the player's mind, because these programs can be used as tools that reveal many different aspects of the players' personality, but these the study uses the cognitive method to support the child's abilities. For example, the child suffers from a problem in going to the kitchen and eating. In the game, a kitchen was designed to interact with its content, and attention was paid to providing a preferred environment for the child that resembles cartoons and is close to reality to give the child a real or semi-real vision. Realistic to life, because his interactions will be with people such as teachers, companions, siblings, or animals, and the child with autism can also interact in different places such as home, school, and stores. The goal is to create the many experiences that a child with autism spectrum disorder goes through in order to form a preconception about who he is. Existences that are unknown to him in the real world, for example the child ignores or refuses to be with other children, an experience that was created for this reason to facilitate the interaction of this affected child.

With autism spectrum disorder to stay with other children for a long time, as pre-images are formed in the mind of the child with autism spectrum disorder so that he does not feel any threat in his relationship with others. The researcher can then subject the child with autism spectrum disorder to a real situation similar to the experience he went through before, It has been shown in previous studies in the introductory chapter that many researchers have used virtual reality as a treatment tool for children on the autism spectrum, and this game is an attempt to develop important skills such as cooperation, according to Craig, as he considers that some programs encourage cooperation (Craig et al., 2017). The program can also provide interaction between players (Craig et al., 2017). In this thesis, we will rely on multidisciplinary methods used by specialists in caring for children with autism, and these techniques are present in the game using virtual reality VR. In more detail, the program will be applied Reality applied to children with autism spectrum using virtual reality glasses. It is worth noting that the power of the game lies in its system of positive rewards that stimulate the brain area responsible for positive emotions called the Nucleus Accumbens (Ko et al., 2009), in addition to other brain areas that the first of them is related to play

during play, such as the amygdala, the anterior cingulate cortex, the orbitofrontal cortex, and the caudate nucleus. The student researcher will also work to isolate the factors that can make the player exposed to addiction or an urgent desire to play, as the play time will be controlled, because what matters is The game should provide the child with a feeling of enjoyment resulting from the game and the stimuli in it, so it can achieve any goals related to developing this child's abilities. It is very important to point out that online games have a stimulating effect on the same areas that are related to addiction, and this requires specialists to carefully study any project related to addiction. By creating or using the program in treatment, it is also necessary to provide a game that develops the child's abilities and not the other way around (Al-Hariri, 2014, p. 29). In an article written by Grossard and other researchers in 2017, they talked about the Serious Game and autism spectrum disorder, and how it affects Positive impact on the mind of a child with autism spectrum disorder, and the tool that will be used in this thesis is a program that was created specifically to develop the abilities and skills of these children with autism spectrum disorder, as the game will be in the form of duties that the child is asked to perform and learn from, so that its effectiveness will appear later in the real world.

1. Definition of game:

1.1. American Psychological Association definition:

"**It is a social interaction, organized play, or transaction with basic rules, laws, and regulations**" (APA, 2015, p. 446)

2.1. Definition of the student researcher:

The game is an unreal world, containing objects, stimuli and characters that resemble the real world, created using many programs, in addition to some technologies that record the movement of a real human being to integrate them within the virtual game. The game world is governed by the rules of reality in an important part because the cause and effect are the same, except if the game is in the science fiction category, the latter is not subject to any real rules. A stimulus within the game can trigger a nervous reaction in the same way as a certain stimulus in the real world. For example, the rate of adrenaline increases when play a horror game. It can be the thrill of driving alive When driving a car in a game, it is obvious that the game elicits psychosomatic reactions such as: rapid heartbeat, trembling, sweating, and other physical manifestations.

2. Definition of serious game:

Charsky (2010) defines a serious game as fun activities, with or without a computer, that possess certain basic characteristics. These characteristics may include competition, goals, rules, challenging activities, choices, and elements of imagination.

A serious game can be a computer-generated virtual environment or a tangible object designed for a specific purpose. The virtual environment is typically created by individuals with skills and expertise in virtual content creation and computer science. While the content of these games often mirrors reality, they are termed 'virtual' due to their unreal nature. For instance, games designed for educational purposes are referred to as simulation games, game-based learning, educational games, or edutainment (Pourabdollahian et al., 2012)

3. Definition of virtual reality game:

In a virtual game, the user or player can immerse themselves in a world that closely resembles reality. They can easily interact with this world using tools such as glasses, joysticks, or gloves. Any action the player performs with their body, such as moving their hand or picking up an object, produces a corresponding result within the virtual scene. It's essential that the game ensures compatibility between virtual reality and reality. For example, if a player pours water from a bottle in the virtual world, they should observe the bottle becoming empty, just as it would in reality. This feedback loop between actions in the virtual environment and their consequences reinforces the sense of realism and engagement.

In psychology, virtual reality scenarios can have practical applications. For instance, if a child practices social interactions with strangers in a virtual environment and receives appropriate responses, they may gain confidence in similar real-life situations, potentially reducing anxiety.

The key distinction between entertainment software and software used for training lies in their objectives. Entertainment software is primarily designed for enjoyment and leisure, whereas training and learning software, as outlined by Wattanasoontorn et al. (2013), aims to develop specific skills. This latter category, often referred to as serious games, is tailored towards achieving educational or training goals

4. Some programs used in developing virtual reality and games:

The creator of the program previously utilized various programs to develop their own program, such as Deep Blue. Nowadays, designers and innovators of games use numerous programs to expedite their projects, aiming to generate profits. Examples can be cited of games that achieved significant success in the past, particularly in the 1990s, like Tetris and Mario. Game companies continue to reap profits annually. For instance, a game that has recently garnered substantial revenue and widespread success is PUBG or Call of Duty. These games employ strategies to generate income from players, enhancing the gaming experience daily, which is both intriguing and economically beneficial. Any program or application can yield benefits for its creators and the owning company. Free programs are also available. The following are among the programs commonly used in game development:

4.1. Definition of the Unity program:

Unity is "a game development software that uses an integrated development environment and cross-platform 3D graphics" (Davis et al., 2015, p. 143).

Another definition of Unity: Unreal Engine and Unity are two of the most popular game engines available to the general public and have been used to create everything from simple mobile software to desktop software to highly sophisticated game titles" (Mealy, 2018, p. 185)

Unity emblem
(https://unity.com,2021)

4.2. Definition of Unreal engine 4 software:

Unreal engine is a program for developing and creating the program, it depends on assets and codes for making the game compatible with any platform(Kumar, 2020, p. 12), through this program or engine, the maker can create virtual environment, in addition to images and color and more option provided in it, the program depend on coding,

Unreal Engine emblem
(www.unrealengine.com,2022)

5. Characteristics of virtual games:

- The feeling of being in an imaginary and unreal world
-Forgetting the tangible world
- The possibility of using the whole body to interact with this imaginary world, such as: walking or touching things
- Feel the deep joy in this virtual game
- Provides a large 360-degree angle for the player

The virtual game depends on interacting with its content by using glasses for the user to see the content and interact with it.

- The player's mind has an interaction similar to the interaction that occurs in the real world

6. The game designed as a research tool for the study:

Over the years, the student researcher designed the game. After reviewing previous studies and noticing the gaps in some of them, the student researcher worked on trying to create a new game, and addressed the elements that are considered a gap in previous studies mentioned in the thesis. The name of the game is Free Me and in English: Free Me The purpose of giving it this name is to free the child from autism spectrum disorder, or at least from its symptoms, and to teach him the basic skills in life that make it easier for him to adapt with the least possible thing. Below will be presented the specifications of the game Free Me:

Table 2: Characteristics of virtual reality game

label of the game	**Free me**
Genre of the game	**Educational game**
Objectives of the game	**Developing basic skills for a child with autism spectrum disorder** **Its general content: The game revolves :around three axes** - **,Self-skills focus: eating washing, and performing simple life activities** - **The focus of social interaction is initiating dialogue, signals** - **,Communicating and listening receiving instructions, and expressing needs linguistically** - **Teaching to regulate and control emotions as much as possible** **Each axis includes a set of exercises performed by the child, and each exercise aims to develop a specific skill related to the axis, such as social interaction, such as performing a specific task such as calling a person by name, expressing joy, and in communication, he learns to initiate dialogue and talk to other people**
Devices needed	**Virtual reality glasses and Smartphone**
Target group	**Children with ASD**
Durationof play	**From 5 to 6 minutes**
Gameplay Mechanic:	**watching contents, and repeating words**
Suitable for smartphone device	**Scenes and pictures**
Game operating system	**Android**

7. Stages of making the game:

7.1. Writing the game:

The game was written and modified several times over the course of months. The content of the game was designed based on two theories: Skinner's theory and Albert Bandura's imitation theory, in addition to some exercises mentioned in the book "Homework Outline for Child Psychotherapy." Three exercises were also classified according to Each axis in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), and each axis deals with a specific disability. For example, an axis specializes in deficits in social interaction, the second axis specializes in deficits in communication, and the third axis specializes in stereotypical behaviors. The student researcher in this axis has worked on designing exercises that help in Controlling emotions to reduce these behaviors. Each exercise is concerned with developing a skill. Examples include: To develop communication, an exercise was designed where the child sees a tree in virtual reality and then is asked to name it. This is followed by positive reinforcement after he performs the request.

7.2. Using Unity:

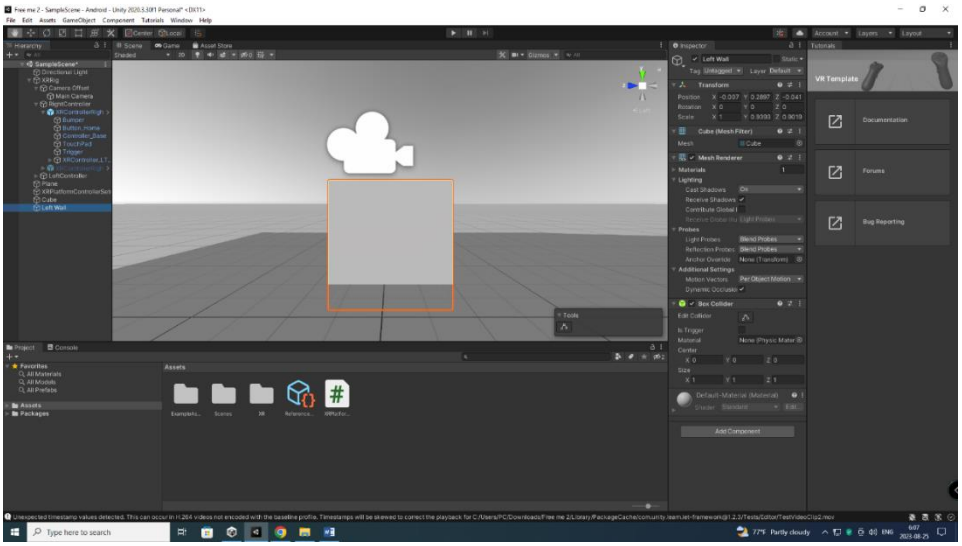
The game was designed using the Unity program. At the beginning of the chapter, it was introduced and information about it was provided. The student researcher adopted it in its free version intended for non-professionals such as students and hobbyists.

7.3. Design the game with pictures, audio, and videos:

Unity was relied upon in the design and manufacture of the game, and it was sufficient. The student researcher did not attempt to create a game with high-quality images due to the low requirements of the smartphone and its limited capabilities to run games with high-quality images. Many elements of the game were collected, such as trees and houses. People and several other sites specialize in providing things in Obj or Fbx format, and these formats are suitable for the Unity program. For example, some trees were downloaded from the free3d.com website, and they were used in the game, in order to save time and save effort.

The Unity program provides some ready-made scenes and contents, such as spaces, lands, cameras, etc., where it is possible to start from a pre-prepared model, and then make modifications to it. For example, in the picture shown, there is a model of a ready-made site and a camera, from which the rest of the contents can be created.

Starting of the game with Unity



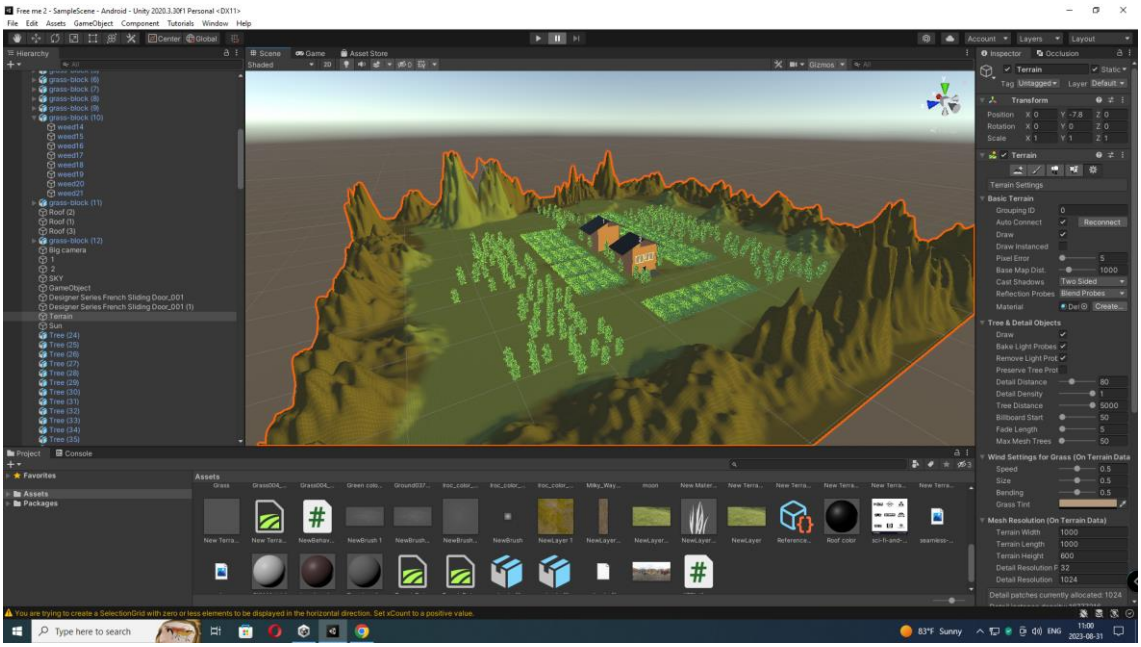
Ready-made objects can be downloaded, as previously explained, from several sites that provide these objects, such as www.123free3dmodels.com, www.cgtrader.com www.sketchfab.com, or www.turbosquid.com , and many other sites that provide the service of images and models in 3D.

7.4. Designing an initial experimental game:

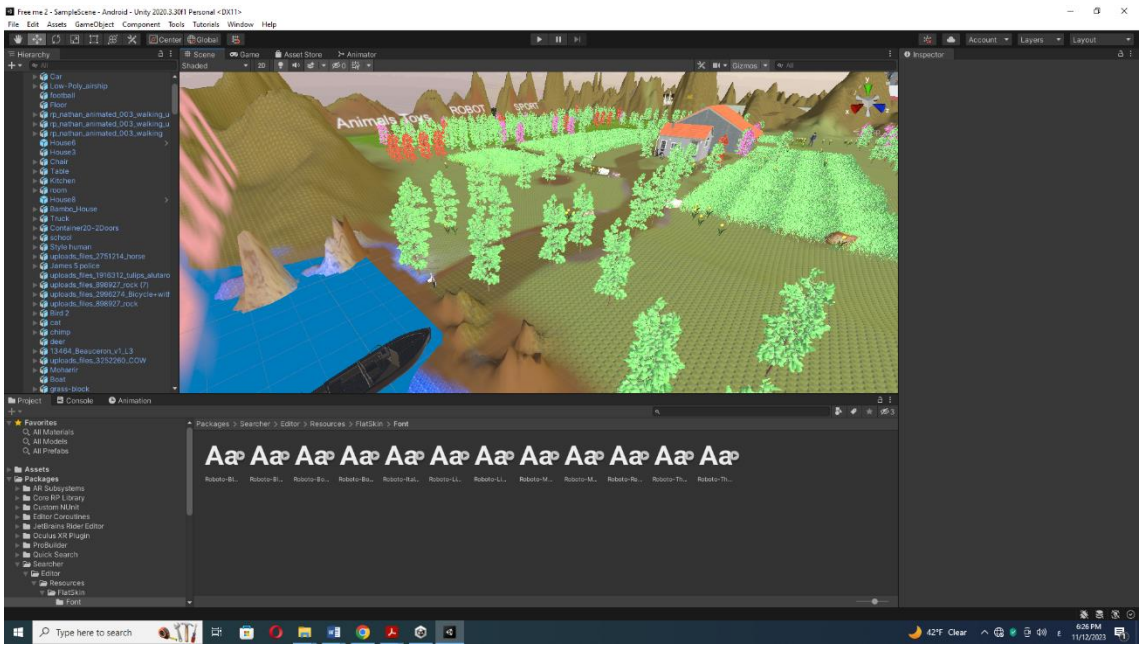
The student researcher designed a model for an initial experimental game, in order to get an idea of the obstacles that he might encounter in designing the final game. It turned out that the design requires time on the one hand, and that obtaining ready-made things from some of the sites that provide them is not free, which necessitates purchase or purchase. It was made using other programs, such as Blender, and it can also be designed using Unity, except that it is more complex than other programs in some aspects, and this leads to the necessity of adopting the simplest and easiest programs in design. It should be noted that the student researcher relied on YouTube in his manufacture of the experimental prototype. Especially the educational pages that teach how to use the Unity program or Blender, in addition to using Chat GPT to learn the steps of creating the game. The experimental model was designed with the following specifications:

A natural landscape with mountains, houses, green spaces, the sea, and people

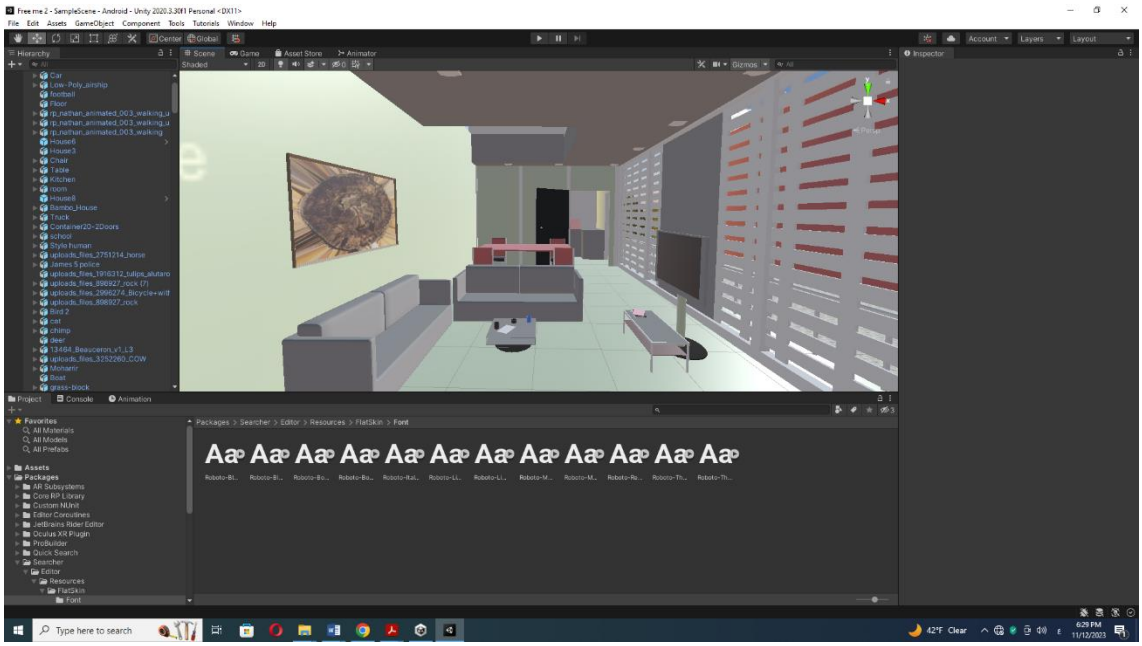
Pictures from the demo game



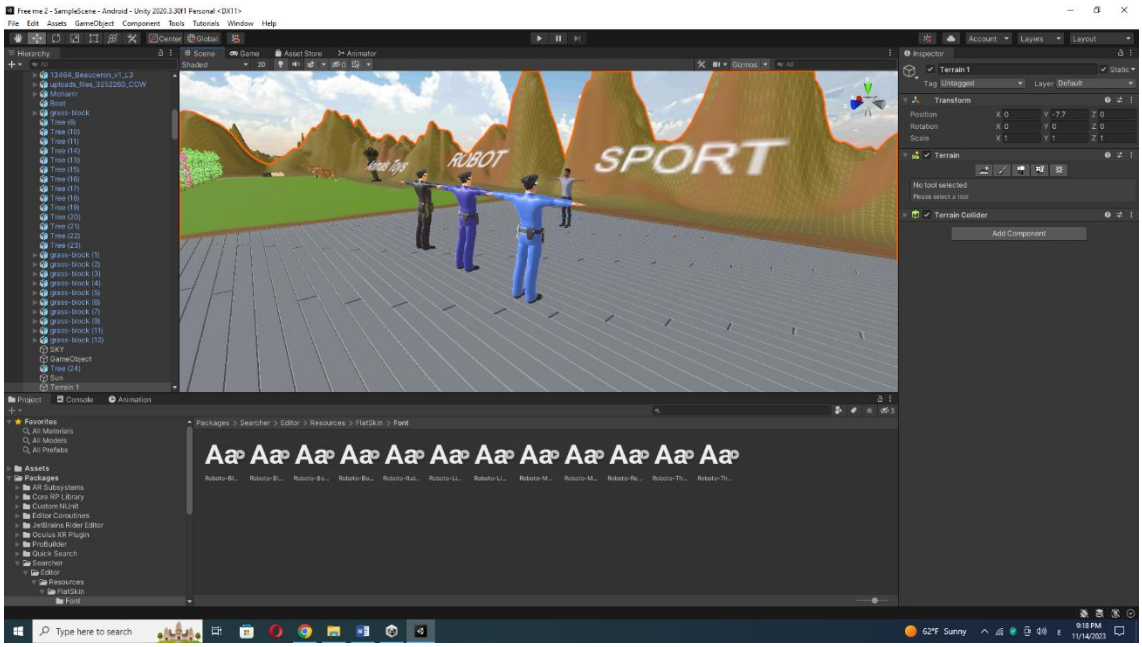
Landscape images in the experimental game



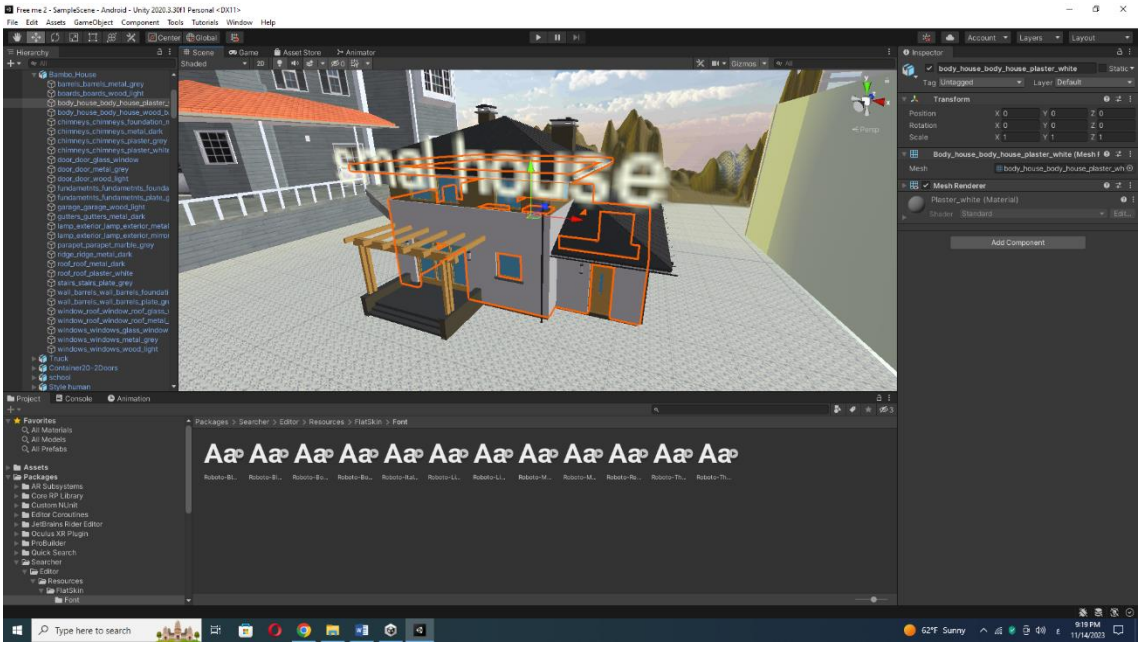
Pictures of a room with TV and armchair



Pictures of some characters uploaded in Fbx or Obj format



Pictures of some houses



7.5. Designing the final game:

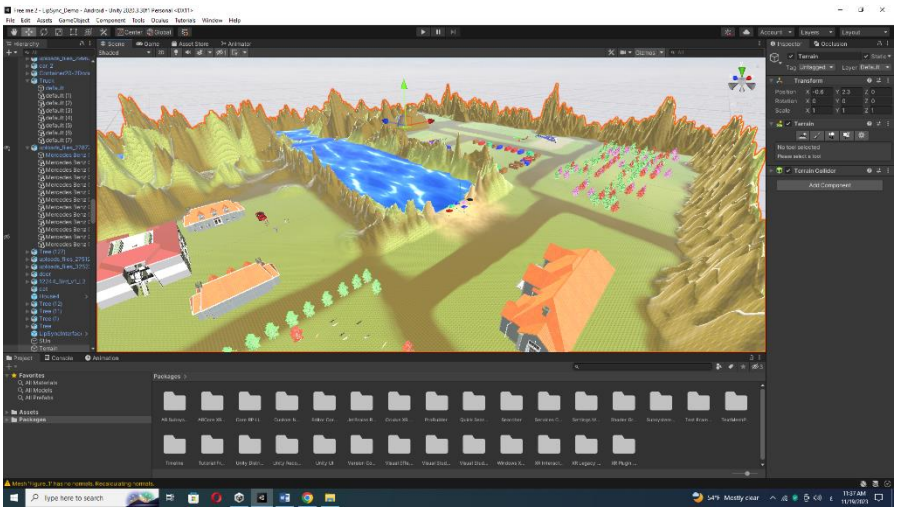
7.5.1. Game text:

Introducing the game Free Me to the child

This is a game for you. You can hear things named and imitate that, or imitate people and sounds you hear. Enjoy your time

Game contents

The game consists of six different scenes, each featuring various objects labeled in front of the child. The child is then encouraged to imitate the sound associated with each object. For instance, if shown a picture of a tree, the child would imitate the sound of a tree. Afterwards, they are asked to select a tree with either red or green leaves.



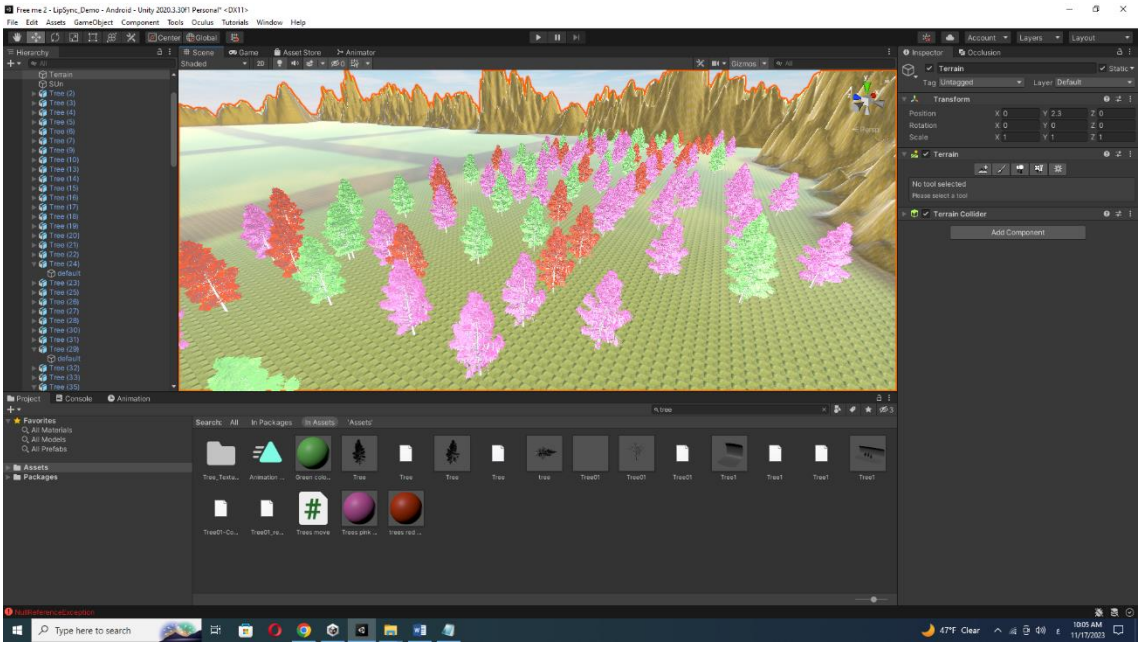
Site 1:

This square contains trees in three colors: green, red and pink

Application here: Teaching the child to name trees and colors

The child hears a sound and a reference to a tree with the meaning “tree.”

Then he hears a voice saying green tree with a reference to the green tree

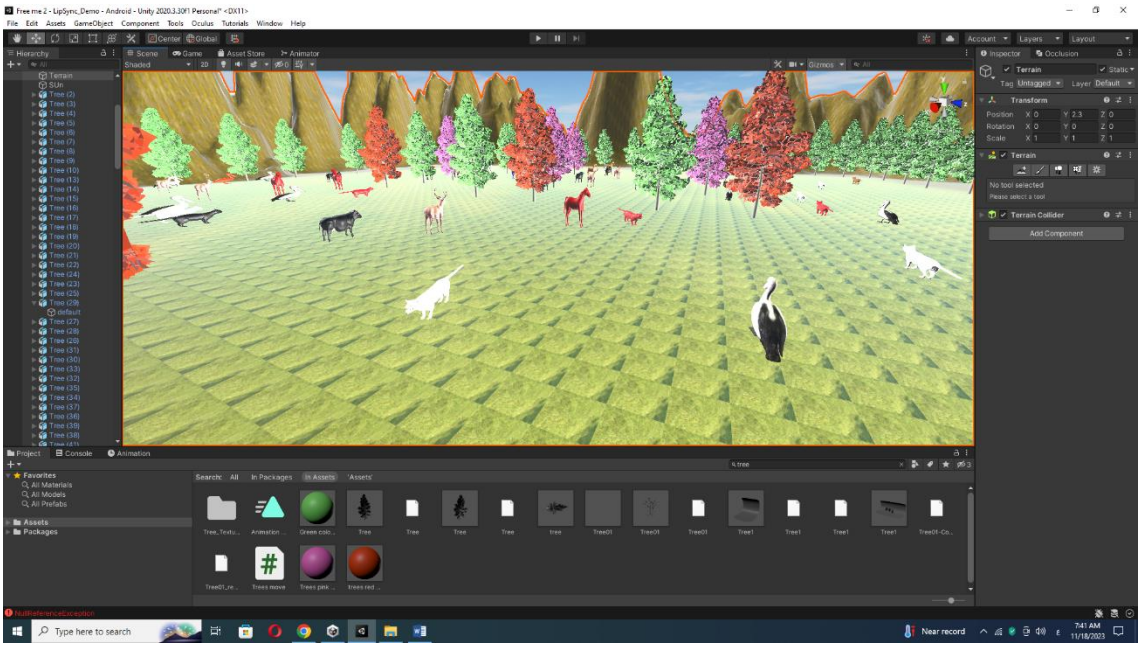


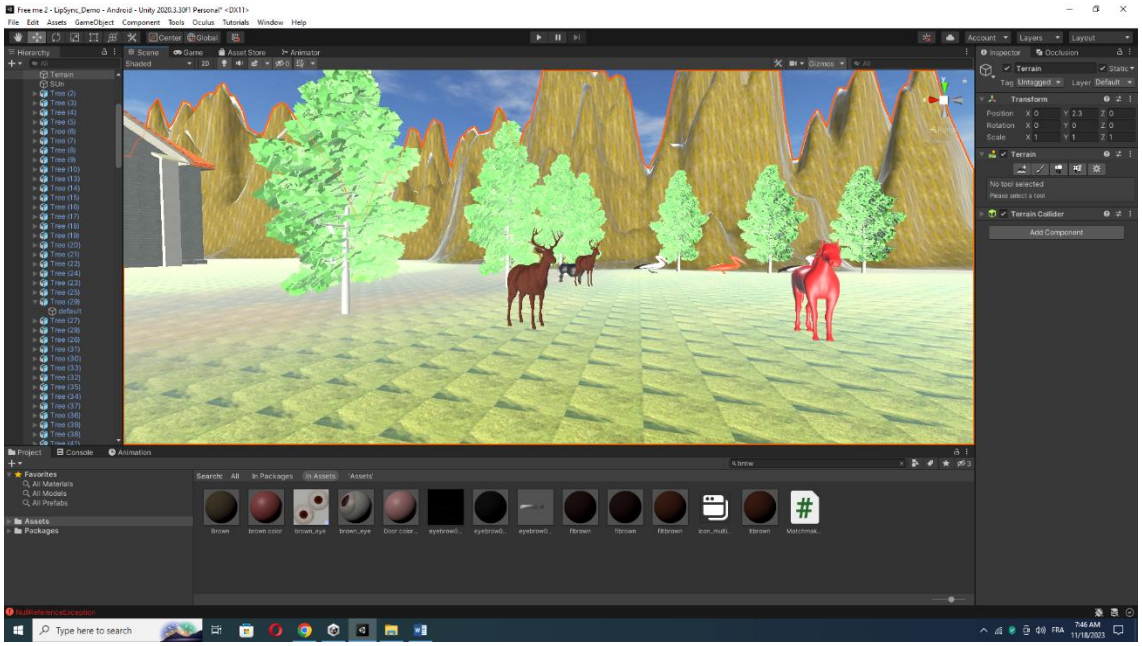
Site 2:

Designed for animal dolls in four colors: red, white, black, and brown

This site contains some types of animals

Application here: Teaching the child to name the animal doll, then asking him to look for the red doll, or the black cow-shaped doll.





Site 3:

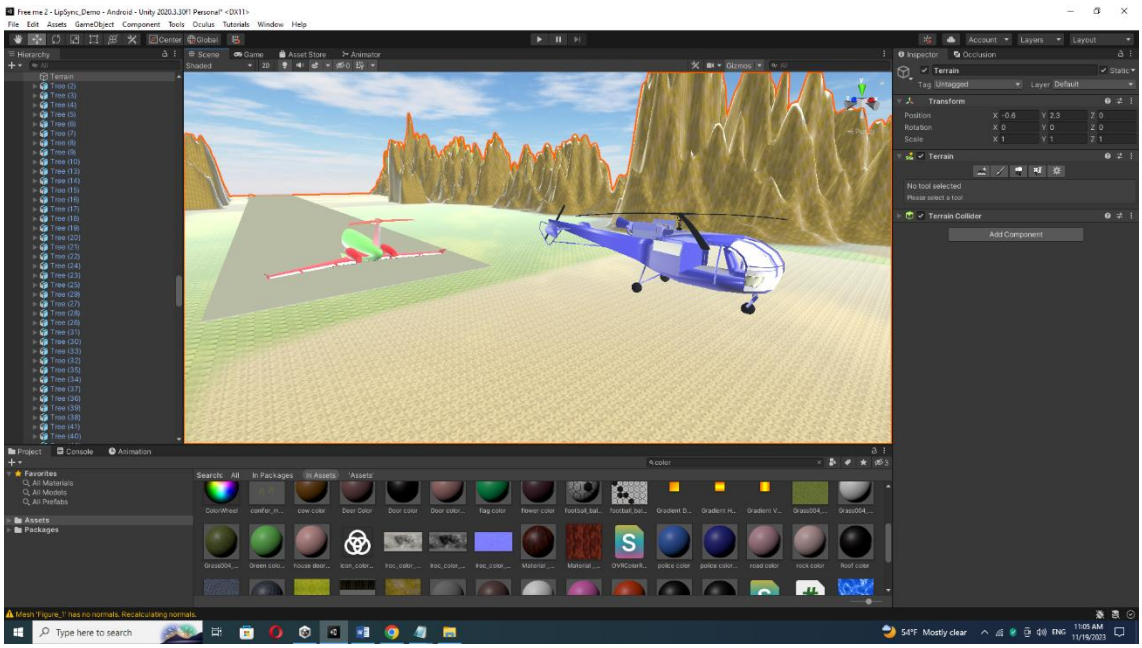
Designed for transport tools of car, bus, bicycle, motorcycle

Using different colors, the child is asked to name each means of transportation by color

For example: Where is the red motorcycle? Or, for example, the red bike is pointed to and asked, "What is this?"

Site 4:

Designated for aircraft and helicopters, this space is in the shape of an airport

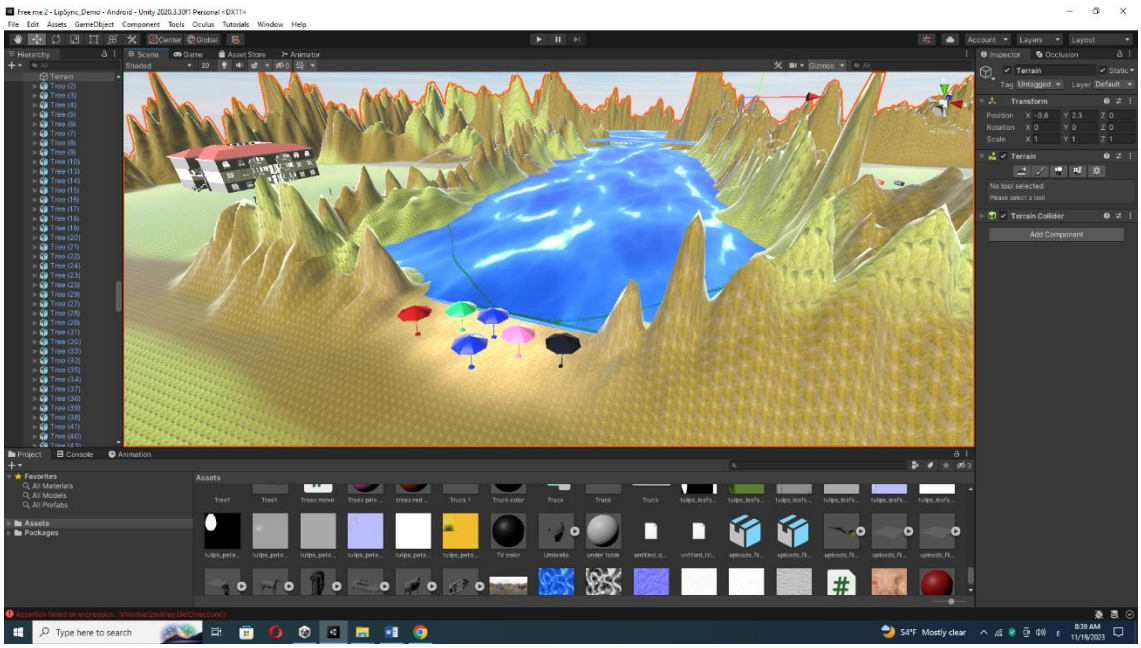


Site 5:

Dedicated to a small sea beach

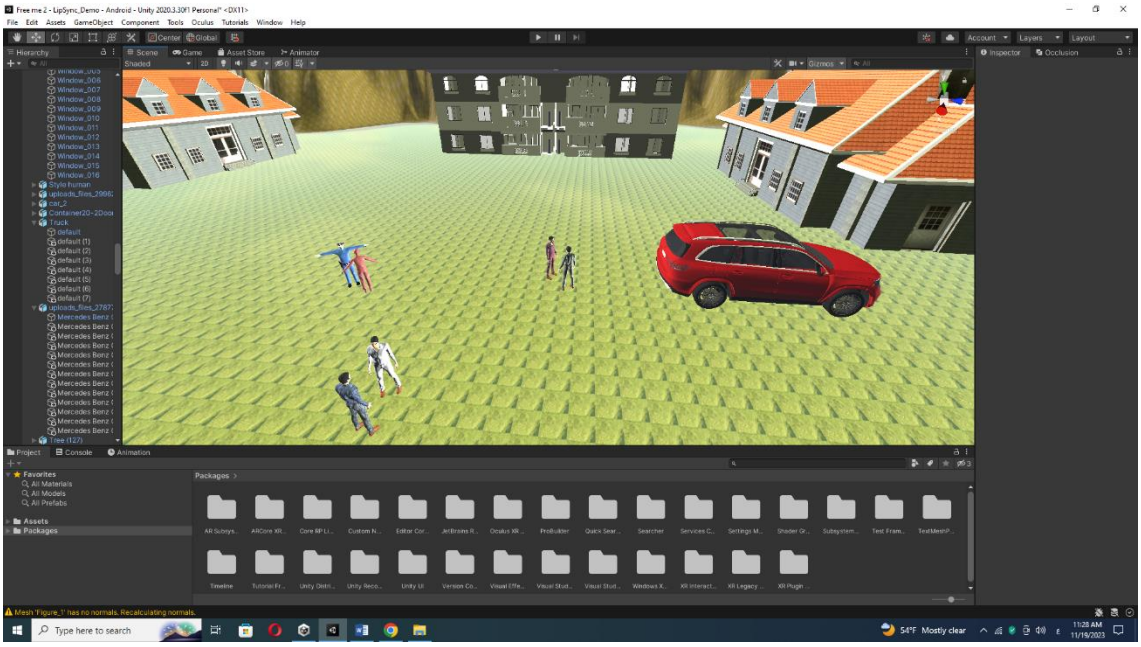
This yard contains multi-colored umbrellas, which are five colors in total. Application here: Teaching the child to name the umbrella and its color. For example, this is an umbrella. The child hears a sound and a reference to the umbrella with the meaning “umbrella.”

Then he hears a voice saying green umbrella with a reference to the green umbrella, or if he hears a red umbrella, the reference should be to the red umbrella.



Site 6:

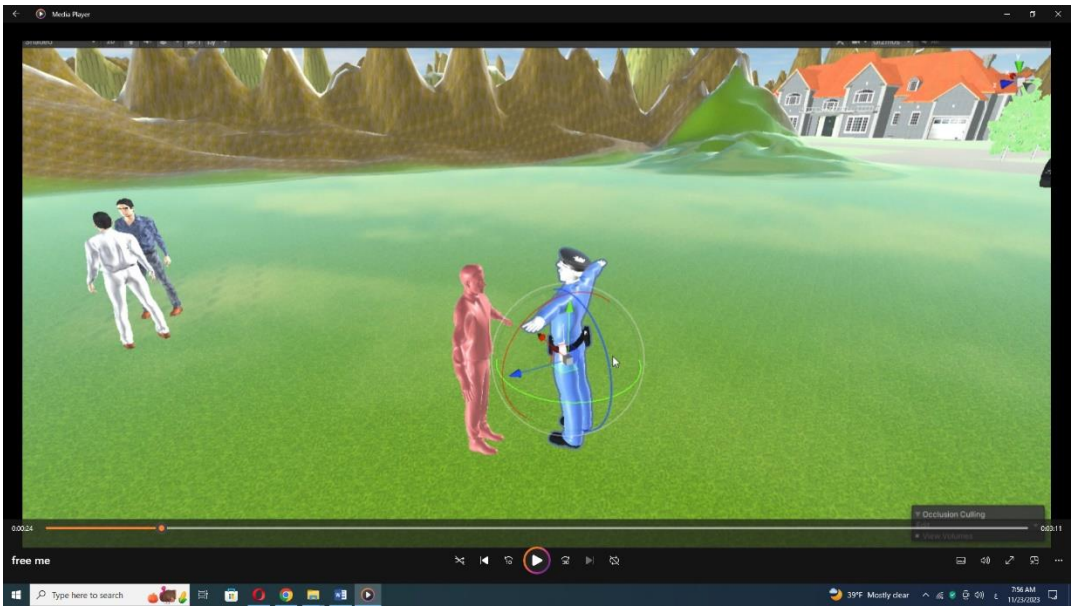
Designed for people with multiple professions, for example a policeman, a professor, in a residential neighborhood with a car, a house, and two towers



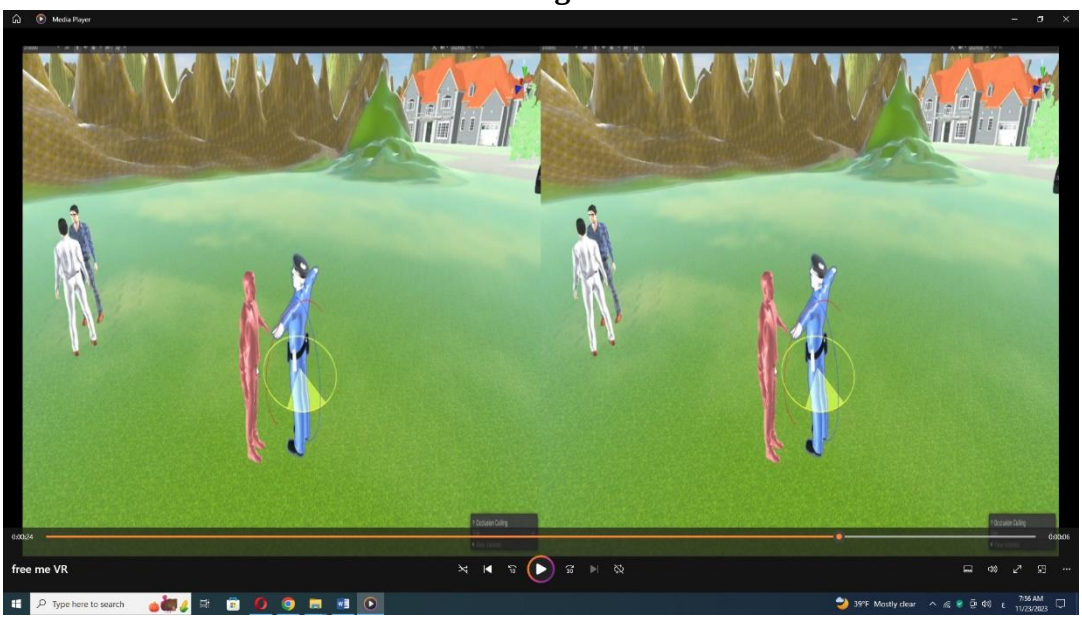
7.5. Initial test completion of the game:

After completing the design of the game, many video software programs were used, such as Video Solo and VideoProc Converter AI. However, these programs were not at a sufficient level to suit the needs of the researcher, in addition to being distinguished by their complexities. In the end, the researcher adopted the Wondershare 3D program. Ani3D, through which the video was converted from a WMV file into a virtual reality video format, where the content becomes compatible with the virtual reality glasses that the child puts on his eyes. Thus, it was an initial experiment for the final game, and it appeared in the form shown below, with two examples in the pictures.

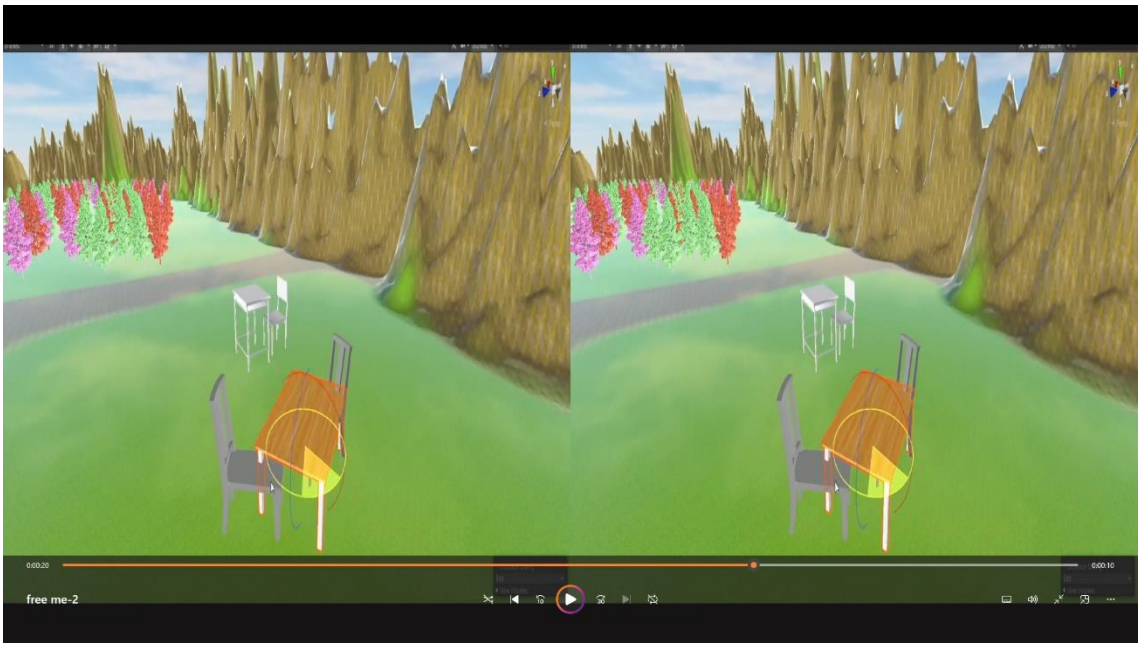
A video of the game after it was converted into a glasses-friendly VR format



A video of the game in its normal form



A video of the game after it was converted into a glasses-friendly VR format



It must be noted in this aspect that the difference between the first and second videos is that the video before it is converted is in one form and one image and is not suitable for use with glasses, but after using the program Wondershare Ani3D, it becomes two simultaneous images with one simultaneous content. This feature allows the video to be used in virtual reality glasses.

7.6. Generalization to reality:

At this stage, the game is not played virtually, but rather providing scenes similar to those in the game, then asking the child about things that exist in reality, and observing whether he answers right or wrong and if his answers are similar to those in the game, in order to know whether he can generalize. In this case, you can even use videos from the Internet and invite the child to watch them on the computer or mobile phone, to know the effectiveness of the game and its impact in teaching the child different skills.

7.7. Rewards system in the game: (moral/virtual/material rewards)

We relied on rewarding the child after play with a realistic reward, and the aforementioned rewards were supplemented with food that the child loved. This was after asking the educators about what foods their child liked and which the specialist in child psychiatry allowed, so it was approved as a material reward.

8. Hardware and software required to use the game video:

8.1. Smartphone:

The user of the video game, Free Me, must have a smartphone that is compatible with virtual reality glasses. The student researcher used the Samsung S9 phone because it has a slightly small size and is compatible, as mentioned above, with glasses, and it also has high image quality, especially in colors and images.

Smartphone

8.2. Laptop or Desktop computer:

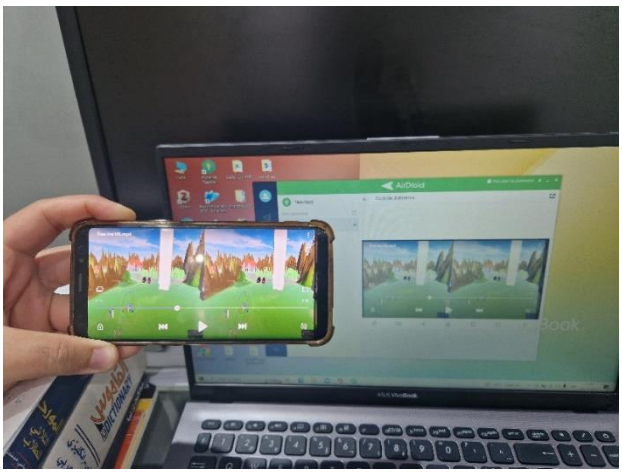
The game must be applied on a fixed or portable computer in order to install the programs that the researcher needs. The main reason for the need for a computer in this case is to monitor the child's activity and control the game remotely using software designated for this matter, such as: AirDroid. It should also be noted that the computer the mobile phone facilitates the researcher's movement to any place he wishes to apply and conduct field studies.

Laptop

8.3. AirDroid:

It is a program whose primary mission is to enable remote control of the phone, or to monitor it. It also provides the ability to download everything on the phone, deal with all the files on the phone and transfer them to the computer, and also provides synchronization between what is happening on the computer and mobile phone levels.

AirDroid and its synchronization between the computer and the phone



8.4. Virtual Reality Glasses:

They are glasses that allow viewing virtual content in an almost realistic way, and they have a front box designated to contain the mobile phone that makes the game and video work. The mobile phone is opposite the lenses of the glasses, and the latter in turn gives the screen a large size and a feeling of presence within the game.

Virtual reality glasses

Front box for glasses

Virtual reality glasses lenses

9. Steps to use the game video:

After the video is output with its virtual content by computer, it is transferred to the mobile phone, after which the latter is placed in the virtual reality glasses box, securely secured with adhesive cloth tape so that the phone does not move, because any movement confuses the vision, makes the field of vision distorted and does not transmit the complete image. Or it is blurry, so there is no possibility of interaction completely.

Placing the phone inside the glasses box

After placing the phone inside the small glasses box, and attaching it well, it is necessary to test the field of vision and see if it is adequate and does not have problems with vision. If there is a feeling of incompatibility between the right and left lens, the lenses must be adjusted through rotating buttons on the top of the glasses.

Blurred vision through glasses

After making the necessary adjustments using the rotary buttons for adjusting the screen, the user can see everything almost realistically, and feel present in that virtual environment, and this facilitates interaction more.

Screen clarity after adjusting with rotary buttons

After these steps are completed, we move to the synchronization stage between the mobile phone and the computer, using the AirDroid program, which was described and explained above. It should be noted that it is necessary to provide an appropriate atmosphere and at least relative calm, so that the child can hear the sounds within the game, and memorize or imitate the names of things, especially since the experiment and the experimental method require isolating the variables as much as possible.

10. Reasons for making the educational game Free Me:

The reason for making this game is because:

- Combining learning, education and fun, which is sometimes not found in educational programs for children on the autism spectrum

Video or virtual reality games include more excitement and interaction than other commonly used games

- Most children prefer video games and using smart phones

The game can combine several aspects, including education, such as pronunciation, social interaction, and communication

- Facilitating visual interaction through the use of virtual reality glasses such as: Shinecon VR, Samsung VR and other existing brands.

- Knowing the possibility of a child on the autism spectrum making up for what he missed in his previous years, such as acquiring language

11. Cautions before using the game, device, and glasses:

Before subjecting the child to virtual reality technology, he should test the extent of his acceptance of it, especially glasses. Therefore, it is recommended to place the latter on his eyes and observe any discomfort, fear, or intolerance. In the event of problems, he should be adapted to the technology gradually if he does not express objection to it, or a complete rejection.

Conclusion:

In this chapter, serious games were defined along with their goals that serve both the individual and society. The programs used in developing such games, such as Unity or the Unreal Engine, were explained. The chapter also discussed playing in virtual reality using serious games and mentioned models of reality. The game's content, various features, digital means used in its production, and the technological materials required to use it were described. Describing the steps involved in creating the game and its content is important for the reader's understanding, especially in fields like psychology where contemporary technologies play a role in psychological treatments and educational methods.

The Free Me game is educational and aims to provide children with necessary life skills. However, it still requires additional modifications in the future. In this thesis, the game was presented in video form, but the student researcher plans to develop it into a standalone programmed game that allows for automated interaction. This marks the beginning of a path towards more advanced virtual educational and therapeutic games and programs in Algeria. This chapter contains important details regarding the Free Me game, which the student researcher aims to use to support or refute the hypotheses presented in the introductory chapter of the thesis.

In the following chapters, the results of using the game with several samples of children with autism spectrum disorder will be revealed. Additionally, the use of virtual reality technology in teaching children necessary skills, particularly in social interaction, communication, and emotion reduction, will be discussed, highlighting the enjoyable aspect of the game.

Sixth Chapter: Field Procedures of the study

1. **Used method in the study**
2. **The Sample of the Study and the sampling**
3. **Study tools**
   - **Childhood Autism Rating Scale (CARS)**
   - **Educational game video**
4. **Pre and Post-measurement with CARS**

1. **The thesis hypotheses**

General hypothesis:

The Play with virtual reality technologyhave effectiveness in developing the skills of children with autism spectrum disorder

Partial hypotheses:

- The Play with virtual reality technologyhave effectiveness in developing the social interaction of children with autism spectrum disorder
- The Play with virtual reality technologyhave effectiveness in developing the communication skills of children with autism spectrum disorder
- The Play with virtual reality technologyhave effectiveness in developing the emotional skills of children with autism spectrum disorder

2. **Exploratory study:**

The exploratory study was conducted at the level of the care center for the Laaroubi building in Constantine 2, and after reviewing the various techniques used in the center, it became clear that modern technology is not used much in care, but care is dominated by the use of traditional methods in most of them, and this was what motivated the application of the study and Testing the effectiveness of virtual reality technology with children with an autism spectrum disorder. The sample was selected according to certain characteristics, the most important of which is the ability to repeat words or speak, close in age, subject to the same training centre and receive sponsorship of the same amount and level. The samples are divided into two parts. Dedicated to children on the autism spectrum, each section includes 6 or fewer or slightly more children

3. **Study tools**

In this thesis, we relied on a game designed with Unity software, in addition to a tool forassessing the abilities of a child with autism spectrum through the " Childhood Autism Rating Scale" CARS , this is due to the latter's ability to reveal the child's abilities and provide sufficient information regarding them. and the importance of identifying abilitiesof different variables for the child before undergoing to video game experiment using virtual reality technology called Free Me to know each ability and its percentage accurately, so that the student researcher can know the changes that occur afterexperimenting by using the play , and from it it is possible to answer on the problem, prove or deny the hypotheses, notice the improvement if any, write down the results and comment on them.

3.1. Clinical Observation:

,The student researcher worked on observing the sample members for a period of two months in order to determine the type of autism spectrum disorder they had, and so that the diagnosis of the specialists at the center was not limited only to it. It was noted that there were co-morbidities such as mental retardation. The prolonged observation also allowed for knowing the various aspects of the sample members' personality, and Their reactions, and the most important symptoms that appear on them, whether related to social interaction and relationships with others, or communication, speech, or emotions. Observation also allowed for insight into the level and quality of care at the center, and the most important things that children with autism spectrum disorder receive, especially the sample members, in addition to the methods Available and used

by educators, it has been noted that there is a difference between the members of the research sample, but they share the aspect of social interaction, communication, and stereotypical behaviors, as they are disciplined and understand instructions, which allows the use of virtual reality technology with them.

3.2. Researchal Observation:

The researchal observation allowed to see the level and quality of care at the center, and the most important things that the children with autism spectrum disorder receive in the centre, especially the sample members, in addition to the methods available and used by the educators, it was noted that there was a discrepancy between the members of the research sample, but they shared the aspect of interaction Social, communication, and stereotypical behaviors, as they tend to be disciplined and understand instructions, which is what allow to use virtual reality technology with them.

3.3.Researchal interview with the psychologist:

Interviews were conducted with the psychologist to find out the most important characteristics of the sample members, the symptoms they have, and the extent to which they can be subjected to the experiment. Her suggestions and opinions were also listened to about the nature of the experiment that would be carried out with them. The conclusion was reached that the specialist supports the idea of developing therapeutic and supportive means due to Due to the need ,for this, the specialist also expressed positively about the effect of the experience on the children ,especially after attending the children's sessions while watching the video of the educational game ,as it was often impossible to motivate the children with several supportive or educational means but the virtual reality game had a special interest among the sample members. It caught their attention and gained their attention completely, to the point that the child waited patiently for approximately 10 minutes to watch the video and interact with it. The psychologist also expressed her observation of symptoms that had not appeared previously, such as stubbornness and refusal to deal with educators in a solution. The child did not get his role inplay She also noticed that . they became They are more positive and interactive after the experience of watching the video game, as stereotypes are absent for most of them, and they show great calmness that they did not have before.

3.4.Researchal interview with the educators:

Interviews were conducted with the educators, in addition to those attending during the sessions for caring for and teaching children with autism spectrum disorders at the center various skills using available means. The educators noticed the extent of the advancement of the technological tool for research represented by virtual reality glasses and its educational virtual content. They also expressed its positive impact and its motivation for children in an unparalleled way. This is unprecedented, especially since the child feels himself in a state of immersion while watching with the glasses, as he forgets the real environment in which he is present on many occasions. Educators have explained while observing the experiment that it is a new technology for them and that they had never known before, and they noticed the change in the children's behavior while watching the glasses and how it It gained their attention, and even those who were

not among the sample were keen to put it on and watch the game. Educators also reported a difference in the behavior of some of the sample members, as they noticed that many people were ,attached to the technology to the point of impatiently waiting for the student researcher to come and refusing to receive sponsorship until the glasses were obtained when they arrived. Some of them, according to them, reported negative emotions among some of the sample members, which may be due to the new technology used. They also noticed a strong desire among the sample members to use glasses and their attachment to them, and to interact positively with their virtual content, and some of the sample members even refused to dialogue or imitate speech except If they used the glasses and their educational content, and one of the sample members memorized the names of the things found in the game video, such as the word " trees , " and he would repeat it while waiting for his turn to put on the glasses. The educators expressed that there were individuals from the sample who pronounced the word as eloquently as they heard it exactly, and even with its weight, as it was devoid of its weight. Of any unclear pronunciation, which may be an effective way to improve pronunciation as well, and this is what the Artfouniya specialist also expressed She noticed the desire of one of the sample members to imitate the words he heard while watching the game video, but because he did not have a clear language, he was expressing with ,sounds. Of his own, he did not issue it completely before submitting to watching the game video that is, during the previous sponsorship.

3.5.Childhood Autism Rating Scale (CARS):

The Childhood Autism Rating Scale, which is abbreviated in the English language as CARS , meaning Childhood Autism Rating Scale is one of the ,it the most widespread measures. It consists of 15 items, where 14 items are based on evaluating the behaviors that appear in the child and are related to autism spectrum disorder, and item 15 is a An item to determine the degree of possible autism according to the specialist(Chlebowski et al., 2010) and the scale also allows , knowing the most important aspects of the child's personality and evaluating social or communicative behaviors,t ,he scale was applied after an observation period exceeding two months and the application was conducted through interviews with the specialist and educators, and ,without the presence of the parents, given that the parents often refuse to attend, or are not punctual or because they refuse to cooperate with the center, so it was limited to the work team. At the center only, the test lasted for a week on all members of the sample, taking into account the previous observations made by the researcher In the application, digital copies were used instead of written copies to facilitate the work, using a laptop computer and a digital copy of theCARS test and scoring is done using the ,Adobe Reader program where it is possible to specify the , .correct option in each item easily by coloring the option or placing a specific mark in front of it By creating digital files and assigning each file with the name of one of the sample members concerned with undergoing the experiment, then placing the copy of the test containing the answers in each file for the sample individual, and using them later easily in calculating and extracting the pre-test results that precede the use of the virtual reality tool.

3.6. Virtual Reality Tool:

It is a game called **FreeMe** in English , and it was designed by the student researcher. It contains scenes similar to what is realistic in the real world. The child can see these scenes through

virtual reality glasses, which were previously revealed in the fourth chapter. It consists of various squares, each square contains educational stimuli through which the child is taught, by imitating names, identifying colors, or otherwise.

Free me required A laptop or stationary computer, a smartphone compatible with glasses, and the Air Droid program which allows the ability to control the phone through the computer, in addition , to a Wi-Fi network or at least the Internet available through the phone so that coordination between the phone and the computer can be done using the **Air Droid program** . It is worth Pointing out that the video used in the experiment is part of a comprehensive game that the researcher called Free Me. The video is educational, and is a first experience of a version that will later be completed and may be more motivating and allow greater interaction with its content.

4.The Sample of the Study:

4.1. Sampling:

The sample was chosen according to the purposive method because it directly serves the objectives of the research, and the age and ability of children on the autism spectrum were taken into account, especially those who have the ability to speak and the ability to use virtual reality glasses, and those who have a medium or low level of stereotyping that allows them to be subjected to the experiment, because the presence of movement is more than This may interfere with the process of watching the game video and hearing the names of things, or not accepting or tampering .with the glasses from time to time

4.2. The sample:

The number of members of the sample is 6, all of them male, and they share the characteristic .of being able to pronounce and speak, or at least verbal expression, even if it is not understood ,Their ages in general range between 5 and 12 years. They are all from the state of Constantine and they receive the same care at the Constantine Center. 2. The ages of the sample members are shown in the following table 3.

Table 3: Shows the ages of the sample

A.M	I.A	B. Y	A.B	L.M.T	M.T
9 years	years 10	years 9	years 8	years 7	years 12

5. The Study Approach:

In this thesis, reliance was placed on the quasi-experimental approach, where the student researcher conducted a pre- and post-measurement using the Childhood Autism Rating Scale. After conducting interviews with psychologists in order to know the child's condition, his level of disorder, and his abilities, the child was subjected to For testing, then for experimenting with virtual reality technology, then after more than two months, it was subjected to testing again to observe the differences related to social interaction, communication, and emotions, which allows for answering the problem at hand and proving or denying hypotheses. It should be noted that the quasi-experimental approach is suitable for the humanities in particular. It is impossible to carry

out the entire experiment for ethical or performance reasons, and it should be noted that the quantitative and qualitative approaches were combined, that is, a mixed approach was adopted in this thesis in order to obtain the greatest amount of information about the cases so that it is easy to .isolate the largest amount of variables, and provide sufficient information about each individual Sample members, especially since the sample number is 6 individuals, all of whom are male.

6.Application of Virtual Reality Tool:

The student researcher began designing the game years ago, and faced many difficulties due to the need for training in the program that he would use However, here in Algeria there are no institutions that provide this type of training, and therefore the reliance was placed on educational sites and others that provide educational videos, such as YouTube, in addition to... To artificial intelligence, which now provides great assistance in learning, several videos were also uploaded and short-term training was followed in the program, and learning its most important basics, which allows the creation of a simple game that enables the researcher to test his hypotheses, and virtual educational content was designed within a matter of several months, except The software obstacle was the obstacle to issuing an interactive game in computer language, but thanks to the Unity program, the virtual content was designed and produced in the form of an educational video using virtual reality technology, and its duration is 5 full minutes. Other modifications were made in another video similar to the first, which is 6 minutes long. 49 seconds, and finally, the child's ability to generalize naming to real objects is tested. For example, he is asked about something he ",had previously seen in the game video, such as a chair, for example. He is asked, "What is this to test the extent to which he generalizes the naming that he learned while watching the game video.

It should also be noted that the statistics used do not in any way reflect the statistical approach, and are only to determine the direction of subjectivity and approach objectivity in diagnosis (Wilcoxon Test).

Seventh Chapter: Presentation and analysis of the results

1.Data Presentation

A.Premeasurement data

- Analyze and comment on the results
- Sessions using virtual reality technology

B. Dimensional measurement data

- Analyze and comment on the results

2.Comparison between the results of the pre- and post-measurement

- Comment on the results through the table and compare the pre-measurement with the post-measurement

3. Presenting the results related to the first hypothesis and testing it

4. Presenting the results related to the second hypothesis and testing it

5. Presenting the results related to the third hypothesis and testing it

1. Data presentation:

A. Presentation of pre-measurement data using the Childhood Autism Rating Scale(CARS):

To observe the effectiveness of play using virtual reality technology, the student researcher used a video of a game he designed himself that can be viewed using virtual reality technology. The Childhood Autism Rating Scale (CARS) was applied to the sample members before subjects were subjected to watching the video, and the results were as follows:

Table 4: Pre-measurement results using the CARS

CARS Childhood Autism Rating Scale														
Sample	Contact with people	Simulation	Emotional response	Use of the body	Use of objects	Adaptation to change	Visual response	Auditory response	Taste, smell, touch and use response	Fear or nervousness	Verbal communication	Non-verbal communication	Activity level	Intellectual response	General impression
M.T	4	4	3.5	3	2.5	2	2	2	2	2.5	4	3	3	3	3
L.M. T	3	1.5	3	2	2.5	3	1.5	3	2	3.5	2	3	2	2	2
A. B	3	3	2	4	2	2.5	2	2.5	2	2	4	3	4	4	3
B. Y	3	2	3	3	3	3	2	2.5	2	2	3.5	2	3	2	3
I.A	3	2.5	2	3	2	2.5	2	3	2	2.5	2	2	2	3	2
A.M	2.5	2	2	2	2.5	3	2	2	2	2	3	3	2	3	3

- **Analyze and comment on the results:**

Through the data obtained in the table for the pre-measurement using the Childhood Autism Rating Scale (CARS):

The Childhood Autism Rating Scalescale was applied to the eight sample members, and the first thing that appears from the preliminary results obtained is the convergence in the results of each individual concerning each of the items. This is one of the most important things that was considered in selecting the sample, as the student researcher was keen on convergence. between all individuals in the sample and providing as much conformity between its individuals as possible to isolate the largest number of variables that may later affect the results of the study, and since the most important thing that must be worked on is social interaction, it can be observed that the results of the pre-measurement to evaluate childhood autism (CARS) were mostly 3. Except for two samples, it was 4, and for the other, it was 2.5. This result can be strengthened through the observations that were made on the sample members, as most of the sample members were of a mild and moderate level of autism, and with regard to social interaction, especially the item of contact with people, most of the eight sample members were of a moderate degree. Except for one sample, as it appears that they are not connected to the external environment and those around them, and it may take days and months to establish a relationship with them, especially to gain their trust, which ultimately facilitates working with them, applying the standard, and subjecting them to virtual reality technology. As for the simulation, the results were varied between... 1.5 to 4, which indicates the diversity of the sample members' abilities in simulation and the ability to imitate others. As for the third item, which is emotional response, the ratios ranged between 2 and 3.5, which indicates that the sample members mediated in their emotional responses, and this was also observed during the sessions and conducting the experiment. Rather, they show joy and enjoyment while play, with regard to the item related to the use of physical skills. Most of the sample members obtained grades indicating that they were able to use the body in a moderate and not extreme way, and they did not have many stereotypes, with the exception of one sample that was very active and difficult to control in many cases. It is sample A.B. With regard to the item on the use of things, it is noted that most of the sample members have a level that shows that they do not relate to things very much or strongly. The scores were between 2 to 4, as they deal with it moderately and without excessive attachment, except for two individuals from the sample who were shown to be attached to a specific type of game, and yet this is not severe enough to cause a continuous obstacle in taking care of it. With regard to the item on adapting to change, half of the sample's results were 2 and 2.5 and a half. The rest of them scored 3, which indicates their ability to change their activity despite their adherence to it many times, and it is also easy to distract them from it later, while the remaining half whose results were 3 indicate that it is difficult to change their activity on several occasions, and they may sometimes exhibit violent behaviors that constitute an obstacle to taking care of themselves. Taking care of them in the group, and they pose a difficulty for others because of their behaviors that express exaggerated agitation and rejection of anyone dealing with them. As for the visual response item, all the scores are identical for all members of the sample, which are 2 except for one sample,

the visual response was 1.5, and these scores It indicates that they have the ability to look into the eyes of other people, although they avoid doing so sometimes, especially with people to whom the child on the autism spectrum is not accustomed, such as some samples that refused to look at the student researcher while conducting the exploratory study. In general, the visual response was almost normal, especially thanks to the care provided. Which they receive at the center at the hands of highly qualified educators. With regard to the auditory response item, two individuals from the sample had scores of 2, two others 2.5, and the rest 3, which indicates that they do not respond to the sound the first time and this was actually observed, and they may ignore the call or hearing Their names sometimes require calling them repeatedly, and they also appeared to close their ears sometimes when a child with them engaged in violent behaviors such as screaming or violently hitting tables. For two individuals from the sample, their results were 2 due to their ability to respond appropriately from time to time. Calling does not require repeating except rarely, and they are distinguished. Also, with calmness and the absence of manifestations of stereotypical behaviors in most cases, as for the response item to smell, taste, smell, touch, and use, the results are all identical, which are 2. As for the item of fear and nervousness, three of the sample members had results of 2, as they actually appear to be nervous that is not prevalent or dominant most of the time. In fact, it may not appear for a long time, unlike two other individuals, where they sometimes appear nervous and fearful, and this appears through fear of changing places in particular, or not feeling safe with strangers in particular. Their score was 2.5, and another sample's score was 3.5 due to the nervousness that appears from time to time, and this is clearly noticeable. As for the verbal communication item, which is one of the most important items in this thesis due to its connection to language and communication skills, the results were varied from 2 to 4 among the sample members. For two individuals from the sample, their results were 2, meaning that they had the ability to imitate and pronounce almost all words, with sometimes incomprehensible words, or failure to use pronouns correctly, especially with the sample L.M.T. They also appeared to be preoccupied with certain topics, especially if there was a new person among them. , or a specific toy, or attention to lighting or side sounds. For two other individuals, their results were 3 and 3.5, which indicates mediation in verbal communication, as the conversation may or may not be intelligible, and there remain two other individuals from the sample, whose results were 4, which is the first thing that is noticed. What they suffer from is the inability to express themselves in speech, making incomprehensible sounds, and not acquiring the language and even almost the simplest words. Regarding the non-verbal communication item, the results of four individuals from the study sample 3 were, which means that they are unable to use non-verbal expressions, nor understand the signals of others, This is what was actually observed by the student researcher, as interaction with them must often be accompanied by language. With regard to the activity level item, the results of the sample members varied, from 2 to 4, and this means that the sample included several clinical manifestations, including a child who suffers from laziness and slowness. To the one who has uncontrolled and continuous activity that affects even those around him, which sometimes constitutes an obstacle in providing appropriate support for him or others, especially in a group. With regard to the level of intellectual response and its consistency,

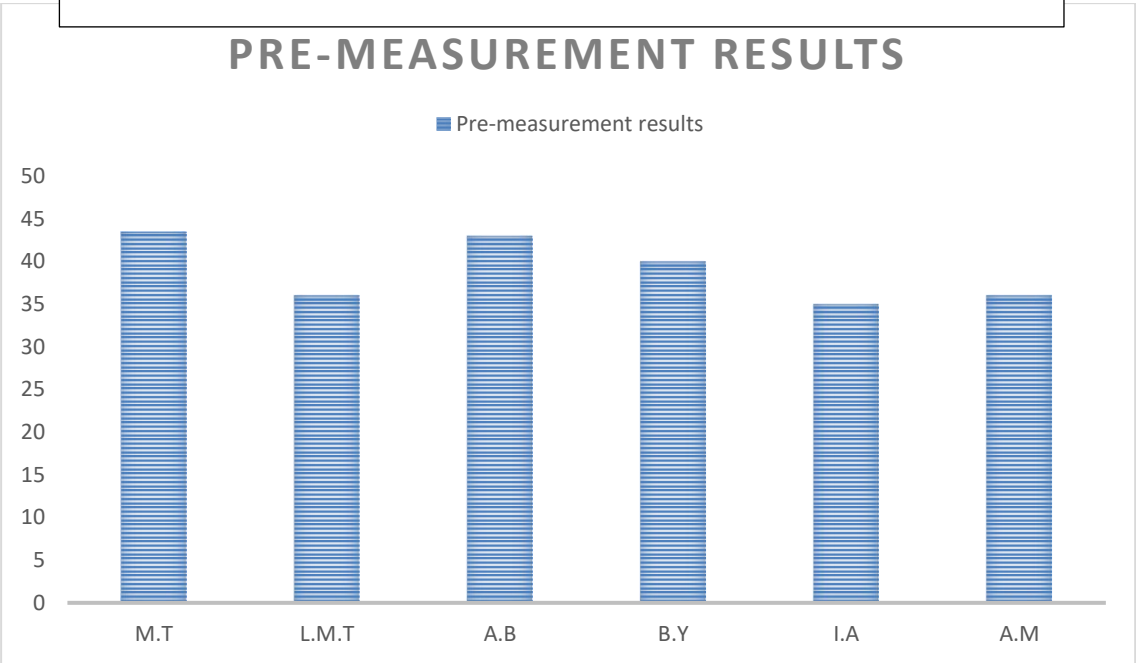
the responses of the sample members were diverse according to the results of the Childhood Autism Rating Scaletest, as they ranged from Between 2 to 4, which means the diversity of intellectual levels among the children in the sample, and this was observed, as the sample had diversity in responses, but it was mostly convergence in the most important basic axes such as social interaction and communication, and the lack of stereotypical movements, and with regard to the last item, which allows for the evaluation My estimate of the degree of autism for each individual in the sample. Five children from the sample were at a rate of 3, meaning autism of moderate severity, according to what appeared to the researcher and specialists at the center, except for one sample, which was at a rate of 2, given that this child possesses social and communication skills superior to his peers in the same group and within a the sample of the study as a whole, and as a general comment on the results obtained, it becomes clear that most of the sample members, and after calculating the total results for each item, it turns out that they are on the mild autism spectrum. It may be noted that an individual from the sample does not possess linguistic expression, but he may excel in understanding speech and what the addressee wants from him, and he may not. He has typical movements, unlike the rest. Each sample has characteristics that make it different from the other, but the degree of autism spectrum disorder in it is common in degree, which is that it is a mild and moderate degree of autism spectrum disorder.

The following table shows the degree of autism spectrum for each individual in the sample subject to the study:

Table 5: shows the autism spectrum scores obtained after applying the pre-measurement to evaluate childhood autism for each sample member

The sample	**M.T**	**L.M.T**	**A.B**	**B. Y**	**I.A**	**A.M**
Pre-measurement results	**43.5**	**36**	**43**	**40**	**35**	**36**

Chart 1: Shows the pre-score of the Childhood Autism Rating Scale



It should be noted that these scores allow for determining the type of autism spectrum disorder in each child in the sample studied, the results of which are presented in the following table:

Table 6: Shows the degree of autism spectrum for each individual in the sample

T he sample	**M.T**	**L.M.T**	**A.B**	**B. Y**	**I.A**	**A.M**
CARS result	**Severe**	**Average**	**Severe**	**Severe**	**Average**	**Average**

- ## Sessions using virtual reality technique:

Virtual reality technology was used for a period of approximately three months, at a rate of 4 days each week, and the child was subjected to virtual reality for a period of 5 minutes and sometimes 6 minutes and 49 seconds, depending on the video. Two videos were made that contained several things with sound and image, and as explained in the video. The game chapter, where all the contents of the game video are explained, for the first sample, which is:

- M.T:

Number of sessions: 12 sessions

Duration of watching a virtual reality video: 5 minutes in each session. In the last session, some of the video content was changed and the duration became 6.49 minutes.

Behavioral and interactive manifestations: expressing joy while watching using glasses, clapping sometimes, moving hands quickly as an expression of joy and delight in the content of virtual reality technology, repeating incomprehensible words as a reaction to the names of things heard while watching, being completely calm and immobile, if done. Addressing him by repeating a specific word, he produces incomprehensible sounds as

an expression of an attempt to pronounce and speak, despite the absence of any attempts before using virtual reality technology. This is the most prominent thing that was observed in him, as he was repeating sounds a lot, especially if the researcher or educators asked him to repeat what he heard.

- L.M.T:

Number of sessions: 13 sessions

Duration of watching a virtual reality video: 5 minutes in each session. In the last session, some of the video content was changed and the duration became 6.49 minutes.

Behavioral and interactive manifestations: In the first session, L.M. expressed a kind of hesitation in putting on the virtual reality glasses due to them causing a feeling of absence from the real world, and every time he checked them with his hands, and with subsequent sessions he got used to them and began to interact easily with their content and used to repeat Names of all things with all skill, accompanied by expressing a feeling of joy and enjoyment.

- A.B.:

Number of sessions: 11 sessions

VR video viewing time: 5 minutes per session

Behavioral and interactive manifestations: In the first session, A.B. expressed his passion for the content and accepted the glasses from the first session. However, later on, he became very active and restless, and frequently touched the glasses, which sometimes constituted an obstacle in perfectly continuing some sessions, and he showed a lack of interest in the content of virtual reality. However, he expresses his desire to use glasses when he sees his colleagues using them.

-B. Y:

Number of sessions: 10 sessions

VR video viewing time: 5 minutes per session

Behavioral and interactive manifestations: B.Y. expressed joy and delight with the new device that was placed on his eyes. From time to time, he would look at the virtual content and then raise the glasses to see the real world. After several attempts by the researcher to obtain the names of objects and imitate them, the child began to Imitation in the third session, but he is not disciplined and very active, although he was hyperactive before using the technique. However, during it, his activity decreases and he is relatively calm. However, he expresses that he enjoys clapping more than repeating the names of things. This requires repeatedly asking him to name the thing he hears. Sometimes it repeats itself.

- I.A.:

Number of sessions: 10 sessions

VR video viewing time: 5 minutes per session

Behavioral and interactive manifestations: The first thing that was noticed about the child was that when he entered, he was quick to inspect the device and wanted to know more about it, then he asked to use it by pointing. When the glasses were placed on his eyes, he seemed as if he were in another world, and he became calmer, and it is enough to remind him once per session. To repeat the names of things or name them. He also expressed his joy while using the technique by clapping sometimes while receiving

encouragement or feedback from the researcher. For your information, after the session ended, the child insisted on using the glasses again.

-A.M:

Number of sessions: 9 sessions

VR video viewing time: 5 minutes per session

Behavioral and interactive manifestations: A.M. is characterized by a lack of stereotypical movements and behavioral discipline, which made him calmly wait for his turn while the rest of the sample members were using virtual reality glasses. During use, he was mostly focused on the content without checking the glasses and constantly touching them, as is the case with some of the previous sample members. He mentioned them. He was able to imitate all the names of the things he heard, and if he was asked about the name of the thing or animal, he answered with ease without repeating the question from the researcher. What is striking is that he has a strong memory, as at the beginning of using virtual reality technology, after one session, he could remember the names of several things in the virtual environment, and when he heard the word and named the thing, his imitation of it would match the weight of the word he heard in the virtual world. For example, if the word was in a strong tone, he would pronounce it in a strong tone, and vice versa.

B. Presentation of post-measurement data using the childhood autism Rating Scale:

After using virtual reality technology with all members of the sample, the Childhood Autism Rating Scale (CARS) was applied again to obtain an objective assessment of the effectiveness of virtual reality technology in inducing the development of certain skills, especially concerning the main axes of the autism spectrum, which are social interaction, social skills, and language. Communication, emotions, and stereotypical behaviors. The post-test results were as follows:

Table 7: Post-measurement results using the CARS

Childhood Autism Rating Scale (CARS)															
Sample	Contact with people	Simulation	Emotional response	Use of the body	Use of objects	Adaptation to change	Visual response	Auditory response	Taste, smell, touch and use response	Fear or nervousness	Verbal communication	Non-verbal communication	Activity level	Intellectual response	General impression
M.T	3	3	2.5	3	2	2	2	2	2	2	3	2	3	2	3
L.M. T	3	1	3	2	2	3	1	2	2	3	2	2	2	2	2
A. B	2	3	2	4	2	2	1.5	2	2	2	3	3	4	4	3
B. Y	2	2	3	2.5	3	2.5	2	2	2	2	2	2	3	2	3
I.A	2	2	2	3	2	2	2	3	2	1.5	2	2	2	3	2
A.M	2	2	2	2	2	2	2	2	2	2	2	3	2	3	3

- **Analyse and comment on the results:**

The results obtained were close to the results that preceded the experiment, but an improvement was observed in several aspects affecting social interaction, language, and behavior. Starting with the item of contact with people, an improvement appeared in the case of M.T., as the previous result was 4 after conducting the pre-measurement, while after conducting the measurement Afterward, an improvement of one degree was observed, and the result was 3. This is evident in the personality of the sample, as he often stays alone, does not engage in talking during classes, and does not initiate it. However, using virtual reality technology with him made him want to interact more and asked to watch the game video, which motivated him to Speech and pronunciation as well. As for the second sample, which is L.M.T., he had linguistic abilities, but they were limited, especially about pronouns. He did not show any improvement after the measurement and after being subjected to watching the game video. However, what is noticeable is his verbal interaction, which made him more conversational and conversational. During and after play, and according to what some of the nannies said, he was waiting for a long time for the student researcher to come to allow him to watch the virtual reality video and name the things he saw. His interaction was very fun and he appeared cheerful while watching, and he also showed more interaction and linguistic expressions after the interaction. With the game video, for case A.B., he showed an improvement of one degree, especially while using the technology with his colleagues, as he frequently asked for the device that allows him to watch virtual content, and he did not stop holding it and wanting to take it for himself, for sample B.Y. He does not show almost any meaningful words in his normal dialogue, but while watching the game video, he pronounces the words he hears clearly, and he has improved in the dimensional measurement by one degree as well, as before. It should be noted that B.Y is very mobile and has a special pattern in his hands, and yet during... His exposure to virtual reality technology calmed down almost completely, except for the movements of examining the virtual reality device. As for the sample E.A., he showed an improvement of one degree, with confirmation that he was also distinguished in naming things in the virtual world, as he was naming things before hearing their name or without having a name for them. Like mountains, for example, for the last sample, which was A.M., when he saw the student researcher repeating the names of things in virtual reality without being reminded of them, this drew attention to the excellence of his memory on the one hand, and to the improvement of his communication skills with people by one degree, and the improvement in skill was by half a degree.

As for the second item, which is related to simulation, an improvement in skill appeared for M.T., and L.M.T also showed an improvement of half a degree. As for the rest of the sample members, no improvement was noted after using virtual reality technology, as the scores were the same in the measurement. Pre-test. As for the third item, which is related to emotional response, an improvement appeared on one sample by one degree as well, which is M.I. As for the item using the body, an improvement appeared on sample B.E., especially while watching the game video in virtual reality. With regard to the item using objects, it showed There was an improvement in skills for both M.T. and L.M.T by half a point for each individual, whereas in pre-measurement 3 it became 2.5. With regard to

the item on adapting to change, an improvement in skills appeared for three individuals from the sample by half a point. And one degree for the last individual, with regard to the visual response item. There was no significant improvement except for two individuals from the sample, namely M.T. and L.M.T, and it was half a degree. It was observed that they stared a lot without paying much attention or responded better than before. Regarding the auditory response item, an improvement appeared in three cases: L.M.T., an improvement of one degree, and A.B.B.I., an improvement of half a degree. As for the responses to taste and smell, there is no improvement related to this skill. As for what is related to fear and nervousness, An improvement appeared in three individuals from the sample by a degree for each of them, and this was evident for them, especially in the change in some emotional aspects according to the educators and the researcher's observations. With regard to the verbal communication item, an improvement appeared in four individuals from the sample by a degree of three, and the fourth sample improved by a degree and a half. M. T. improved by one degree, and A. B. also improved by one degree. It was 4 and became 3. As for B. E., he showed an improvement of one and a half degrees. He obtained 3.5 in the pre-measurement and 2 in the post-measurement, as he began to pronounce words clearly between From time to time, especially the one he named or the one he was asked to repeat, and the remaining two samples, L.M.T and E.A., did not show any verbal improvement, and perhaps this is due to their mastery of speaking easily. However, an improvement in pronunciation was observed according to specialists and educators, especially in the case of L. M.T., with regard to the non-verbal communication item, there was an improvement in the case of M.T., especially since he lacks language. While using virtual reality technology, he showed many signs in order to obtain the game and the device, and even while his colleagues were play, he remained waiting while showing some signs. The same applies to the case of L.M.T., in whom the non-verbal signals improved, with regard to the activity level item. The results for all sample members ranged between 2 and 4 regarding the intellectual response item. The results ranged between 4 and 2 as well, and finally in the general impression item; The researcher's impression remained the same, as although the sample members showed improvement in several skills and this was observed, the student researcher did not see any significant differences between the pre-and post-measurements, and therefore the degree of autism was the same according to the researcher's impression.

Table 8: shows the results of the post-measurement of the CARS for each sample member

The sample	M.T	L.M.T	A.B	B. Y	I.A	A.M
Post-measurement results	**36.5**	**32**	**39.5**	**35**	**32.5**	**33**

Chart 2: Shows the post-score of the Childhood Autism Rating Scale

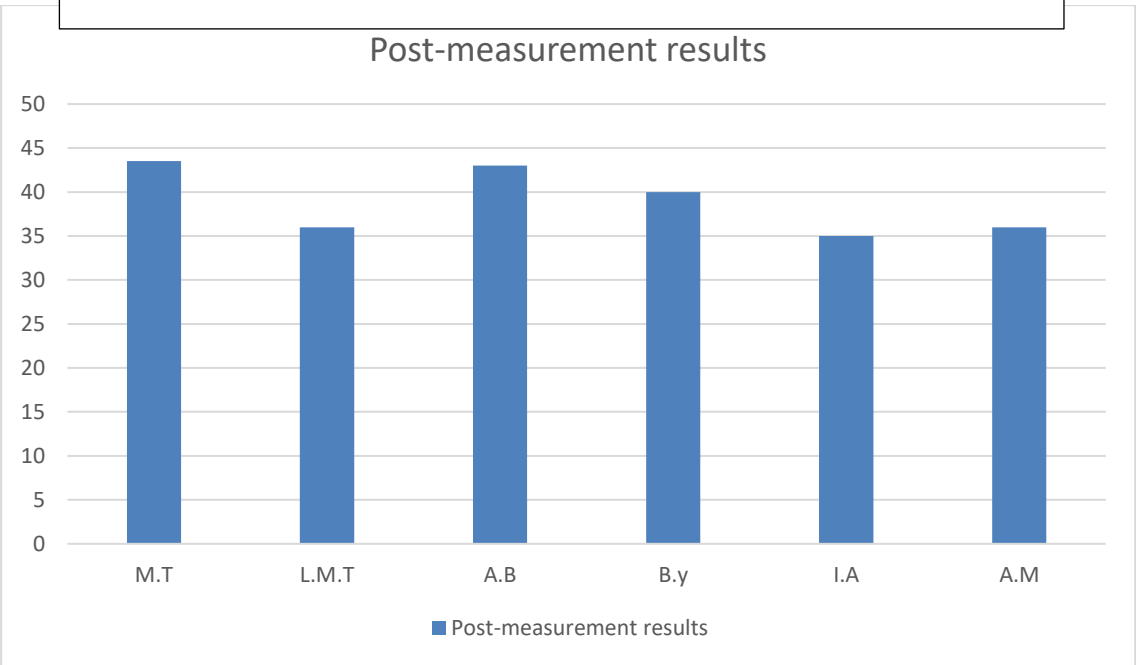


Table 9: Shows the degree of autism spectrum for each individual in the sample after undergoing to the experience of virtual reality technology

The sample	M.T	L.M.T	A.B	B. Y	I.A	A.M
CARS result	Severe	Average	Severe	Average	Average	Average

1. Comparison between pre- and post-measurement results using the Childhood Autism Rating Scale (CARS):

Table 10: Comparison of pre-and post-measurement results using the childhood autism

CARS Childhood Autism Rating Scale																														
Sample	**Contact with people**		**Simulation**		**Emotional response**		**Use of the body**		**Use of objects**		**Adaptation to change**		**Visual response**		**Auditory response**		**Taste, smell, touch and use**		**Fear or nervousness**		**Verbal communication**		**Non-verbal communication**		**Activity level**		**Intellectual response**		**General impression**	
M.T	4	**3**	4	**3**	3.5	**2.5**	3	**3**	2.5	**2**	2	**2**	2	**2**	2	**2**	2	**2**	2.5	**2**	4	**3**	3	**2**	3	**3**	3	**3**	3	**3**
L.M. T	3	**3**	1.5	**2**	3	**3**	2	**2**	2.5	**2**	3	**3**	1.5	**1**	3	**2**	2	**2**	3.5	**3**	2	**2**	3	**2**	2	**2**	2	**2**	2	**2**
A. B	3	**2**	3	**3**	2	**2**	4	**2.5**	2	**2**	2.5	**2**	2	**1.5**	2.5	**2**	2	**2**	2	**2**	4	**3**	3	**3**	4	**4**	4	**4**	3	**3**
B. Y	3	**2**	2	**3**	3	**3**	3	**2**	3	**3**	3	**2.5**	2	**2**	2.5	**2**	2	**2**	2	**2**	3.5	**2**	2	**2**	3	**3**	2	**2**	3	**3**
I.A	3	**2**	2.5	**3**	2	**2**	3	**3**	2	**2**	2.5	**2**	2	**2**	3	**2**	2	**2**	2.5	**1.5**	2	**2**	2	**2**	2	**2**	3	**3**	2	**2**
A.M	2.5	**2**	2	**2**	2	**2**	2.5	**2**	2.5	**2**	3	**2**	2	**2**	2	**2**	2	**2**	2	**2**	3	**2**	3	**3**	2	**2**	3	**3**	3	**3**

2. Comment on the results through the table and compare the pre-measurement with the post-measurement:

Most of the pre-and post-test results show an improvement at the level of some skills, especially about the skills of communicating with people and imitation, which affect the aspect of social interaction. It is noted that in the item "communicating with people" there is a growth of one degree or half a degree for almost all members of the sample. As for the item of imitation, most of the individuals in The sample did not achieve growth, except sample M.T., who improved in this aspect, and the same result was in the emotional response item, as for the use of the body item. Most of the sample members' results were the same in the pre-and post-measurements, except B.Y., who achieved growth by one degree, concerning the use of the body item. Things. Four individuals from the sample, their results remained the same and they did not achieve skill growth, except for M.T. and L.M.T. They fell one degree lower than they were in the pre-measurement, and perhaps this is due to their attachment to virtual reality, which made them not want to deal with other things. Despite their ability to do so, about the item on adapting to change, four of the sample members did not achieve growth in skill, while A.M. achieved growth by one degree, while E.A. declined by one degree. In the visual response item, all of the sample members did not achieve growth in skill. The skill and their pre- and post-test results are identical, while I.B. fell by one degree, with regard to the auditory response item. The sample members also remained the same and did not achieve growth in skill, with the exception of L.M.T, who achieved a growth of one degree, with regard to the taste and smell response item. And touch and use. Not all members of the sample achieved improvement and growth in skill, and their pre-results were identical to the post-results. The same was true for the fear and nervousness item. As for the verbal communication item, a clear improvement and growth appeared with four individuals from the sample, as they showed growth of one degree, and two remained at Their situation, and it can be said in this case that if verbal communication is not affected positively by virtual reality, then it is not affected negatively. As for the non-verbal communication item, two individuals from the sample achieved a growth in skill by one degree, namely M.T. and L.M.T., while Regarding activity level; The results remained the same and the pre- and post-measurement scores were identical for each sample member. With regard to the intellectual response item, there was growth in M.T. by one degree over what was in the pre-measurement, and in the last item related to the general impression, the scores are the same in the pre-and post-measurement because, From the researcher's point of view, the extent of the impact and effectiveness of virtual reality is limited and requires a longer period of practice and use with sample members. By commenting on the results distributed in the table, the general hypothesis
can be proven.

3. Presenting data related to the first hypothesis and testing it:

Remind the hypothesis:

The Play with virtual reality technologyhave effectiveness in developing the social interaction of children with autism spectrum disorder

Show data related to social interaction, which includes contact with people and imitation:

3.1. Contact with people:

Table 11: Determining the degree of effectiveness of the item Contact with People

Sample individuals	Degree of pre-measurement	Degree ofPost-measurement	Degree of growth In skill	Effectiveness
M.T	4	**3**	1	+
L.M. T	3	**3**	0	-
A. B	3	**2**	1	+
B. Y	3	**2**	1	+
I.A	3	**2**	1	+
A.M	2.5	**2**	1	+

3.2.Simulation:

Table 12: Determining the degree of effectiveness in the simulation item

Sample individuals	Degree of pre-measurement	Degree ofPost-measurement	Degree of growth In skill	Effectiveness
M.T	4	**3**	1	+
L.M. T	1.5	**2**	0.5-	-
A. B	3	**3**	0	-
B. Y	2	**2**	0	-
I.A	2.5	**2**	0.5	+
A.M	2	**2**	0	-

It is noted in Tables No. 11 and No. 12 that there is an effectiveness for virtual reality due to the emergence of a growth in skill of 1 degree for most of the sample members, especially with regard to communication with people, and the emergence of a growth of half a degree for one of the sample members, and communication with people is considered an important and major part of the process of social interaction, as Communication is considered a bond between the child and the rest of society, and from it the first hypothesis can be proven, which is that virtual reality technology have effectiveness in developing social interaction skills in a child with autism

spectrum disorder. The first results can also be strengthened with simulation results, despite the lack of growth in most of them. Sample members, but there was effectiveness in two individuals, one to one degree and the other to half a degree. Virtual reality technology can be considered helpful and effective in facilitating simulation for a child with autism spectrum disorder.

4. Presenting data related to the second hypothesis and testing it:

Play with virtual reality technologyhave effectiveness in developing communication skills in a child with autism spectrum disorder

presenting data related to communication skills, which include verbal and non-verbal communication:

4.1. Verbal communication:

Sample individuals	Degree of pre-measurement	Degree of Post-measurement	Degree of growth In skill	Effectiveness
M.T	4	**3**	1	+
L.M. T	2	**2**	0	-
A. B	4	**3**	1	+
B. Y	4	**2**	2	+
I.A	2	**2**	0	-
A.M	3	**2**	1	+

Table 13: Determining the degree of effectiveness in the verbal communication item

5.2. Non-verbal communication:

Table 14: Determining the degree of effectiveness in the non-verbal communication item

Sample individuals	Degree of pre-measurement	Degree ofPost-measurement	Degree of growth In skill	Effectiveness
M.T	3	**2**	1	+
L.M. T	3	**2**	1	+
A. B	3	**3**	0	-
B. Y	2	**2**	0	-
I.A	2	**2**	0	-
A.M	3	**3**	0	-

It is noted in Tables N13 and N14 that there is effectiveness for virtual reality due to the emergence of growth in the skill to a degree of 1 for three individuals from the sample and to a degree of 2 for one individual from the sample concerning verbal communication, which is the basis of the

communicative process in society, in addition to the presence of growth in the skill of Nonverbal communication among two individuals from the sample had a score of 1 for each, and from this the second hypothesis can be proven, which is that virtual reality technology have effectiveness in developing the communication skills of a child with an autism spectrum disorder.

6. Presenting data related to the third hypothesis and testing it:

Play with virtual reality technologyhave effectiveness in developing the emotional skills of a child with autism spectrum disorder

4.1. Emotional response:

Table 15: Determining the degree of effectiveness in the emotional response item

Sample individuals	Degree of pre-measurement	Degree ofPost-measurement	Degree of growth In skill	Effectiveness
M.T	3.5	**2.5**	1	+
L.M. T	3	**3**	0	-
A. B	2	**2**	0	-
B. Y	3	**3**	0	-
I.A	2	**2**	0	-
A.M	2	**2**	0	-

4.2. Fear and nervousness:

Table 16: Determining the degree of effectiveness in the fear and nervousness item

Sample individuals	Degree of pre-measurement	Degree ofPost-measurement	Degree of growth In skill	Effectiveness
M.T	2.5	**2**	0.5	+
L.M. T	3.5	**3**	0.5	+
A. B	2	**2**	0	-
B. Y	2	**2**	0	-
I.A	2.5	**1.5**	1	+
A.M	2	**2**	0	-

It is noted in Tables No. 15 and No. 16 that there is an effectiveness for virtual reality due to the appearance of a growth in skill of 1 degree in one individual from the sample with regard to the emotional response, but for the rest of the sample there is no effectiveness. As for fear and nervousness, a growth in emotional skills appeared with three individuals from the sample, and therefore the hypothesis of the effectiveness of virtual reality in developing emotional skills can be

proven. It should be noted that the specialists at the center where the study took place expressed their observations that indicated the calmness of the sample members in an unprecedented manner.

Chapter Eight: Discussion of the results

1.Discussing the general hypothesis
2.Discussing the first partial hypothesis
3.Discussing the second partial hypothesis
4.Discussing the third partial hypothesis
Conclusion

1. Discussing the general hypothesis:

The first hypothesis is that play with virtual reality technologyhave effectiveness in developing the skills of children with autism spectrum disorder

And through analyzing the results, we can conclude the following:

Virtual reality has effectiveness in developing various skills of children with autism spectrum disorder, especially social interaction and linguistic and expressive abilities. It was found after the field study and the use of educational videos using virtual reality technology that the children in the sample, all of whom were afflicted with autism spectrum disorder, regardless of its degree, showed positive results, especially in social interaction. And linguistic use and naming things. At the first time they used the glasses, they showed extreme joy and expressed their applause, trying to repeat words and names of things, and commenting on what they were seeing, even in cases that did not have language. One of the sample members was constantly repeating sounds, which indicates the stimulation that he was feeling. With it, the sample members appeared attached to the device, which is the virtual reality glasses that allowed them to see virtual content, and they appeared in a state of calm and concentration even in the most severe cases of stereotypical behavior. At first, they checked the glasses through touch, and they all behaved almost the same, even with Other children were not among the study sample, and due to their feeling of enjoyment, they were implementing what the educator or researcher asked of them without any objection and complying with the instructions. For example, if the game video was stopped and the student was asked to name the thing, he would answer directly and name what he saw in front of him, and with continuous field practice that exceeded for two months, the sample members had become accustomed to using the eyeglasses device, so it did not interest them as much as the virtual content itself did. They also expressed joy when seeing the researcher because it would provide them with what looked like cartoons in their view, so they were waiting for their turns with great patience, and what is worth noting in the end regarding the general hypothesis. It is the absence of stereotyping while watching virtual content and interacting with it, as the focus is often on the sample members instead of being preoccupied with secondary things, as they showed the ability to interact with the virtual content as well as the instructions of the researcher or educator without being affected by noise or any other stimuli, even if they were the voices of other people. In the hall, among the skills mentioned by the nannies and which they noticed appeared were fluency in speech, linguistic development, and vocabulary growth, along with calmness, concentration, and a reduction in excessive movement.

So, it can be said that this hypothesis has been verified

2. Discussion of the first partial hypothesis:

The first partial hypothesis is that play using virtual reality technology have effectiveness in developing social interaction in a child with autism spectrum disorder

And through analyzing the results, we can conclude the following:

Play and interacting with virtual content has shown growth in social interaction and relationships with the environment, especially with educators and specialists who the child on the autism spectrum believes can use technology with him.

The results showed that the skill of communicating with people improved, and virtual reality and educational video had a positive impact on developing skills related to social interaction

The effectiveness of virtual reality with regard to simulation at the linguistic level during play appeared in abundance. Most of the samples were repeating the names of things as an imitation of naming in the virtual game video, or imitating the voice of the researcher or the voice of the educator, and some of the samples imitated the sound of pronouncing the names of things, even with weights and voice pitches.

It can be said that virtual reality technology may be an effective educational starting point based on the results obtained related to the first partial hypothesis.

- The study proved that five individuals out of six, which is the total number of the sample, achieved growth in the skill related to communicating with people, which is a major part of social interaction, and therefore there is an effectiveness for virtual reality technology, and based on the results presented in Chapter Six, it can be said that this hypothesis has been verified

3. Discussion of the second partial hypothesis:

The second partial hypothesis is that play using virtual reality technology have effectiveness in developing communication skills in a child with autism spectrum disorder

And through analyzing the results, we can conclude the following:

The experiment demonstrated the effectiveness of virtual reality technology in bringing about significant communicative growth among all sample members with autism spectrum disorder, regardless of its severity.

The virtual content was motivating for the sample members, as they were naming things they saw even if their names were not mentioned phonetically in the video.

The sample members showed a greater level of concentration while using virtual reality glasses and watching the content, which allowed them to be given instructions without repetition, and their responses came in an immediate or very short time frame.

The sample members demonstrated the ability to understand instructions while watching virtual content, and they implemented what was asked of them without refusal. This is one of the communication skills that is considered a form of hearing the speaker.

- Through the results of the experiment published in Chapter Six, an improvement in the verbal communication skills of four of the sample members was demonstrated
- There was also an improvement in non-verbal communication skills among two individuals from the sample

Therefore, it can be said that this hypothesis has been verified

4. Discussion of the third partial hypothesis:

The third partial hypothesis is that play using virtual reality technology have effectiveness in developing the emotional skills of a child with autism spectrum disorder

And through analyzing the results, we can conclude the following:

- Although there was no improvement in most of the sample members, except for one sample, about emotions according to the results of the pre-and post-measurement, the educators confirmed the presence of changes in the psychological and emotional state of some individuals, especially the appearance of calm among them during and after the experience with virtual reality.

The results showed that most of the sample did not improve in terms of emotions, except one case, the results showed an improvement in three individuals from the sample by degrees of 0.5 to 1, which proves the third hypothesis

Therefore, it can be said that this hypothesis was achieved despite the need for more studies regarding emotions, as the average of one case improved out of a total of eight individuals, which is the total number of the sample. It is considered a very relative result, but it can be said that the third partial hypothesis related to the development of emotional skills was achieved.

Conclusion:

This thesis was an extensive research regarding the effectiveness of virtual reality technology in developing the skills of a child with autism spectrum disorder. It was based on the idea of whether it is possible to teach a child thing using virtual reality technology, and whether the latter have effectiveness in that. All hypotheses have been verified, and it has become clear. The effectiveness of this technology in providing care and support, and developing many skills in the child, and therefore this technology can be adopted initially to support the psychological care of children with autism spectrum disorder, especially as it provides them with interactive scenes and content that make them feel as if they are watching cartoons or existing in an unreal world that makes them forget themselves, which is what It's called immersion.

The use of virtual reality technology can also extend to developing behaviors even outside autism spectrum disorder, and content can be created to support care and treat fears, trauma, and several other disorders. The ease of this technology lies in the ability to control the content and design it according to the case or cases that are subject to care and treatment, and it can also be used to teach children who do not even suffer from mental disorders or mental retardation, as it is a tool for entertainment and education at the same time, and as was proven in this thesis, it has been shown that this technology is newly used and there is no previous research in Algeria that has paid attention to I studied it in the field of psychology in its various branches.

This thesis is an attempt by the student to achieve even a small amount of needs that were previously topics of interest to the Ministry of Higher Education and Scientific Research in previous years. It is an answer to the need to expand, improve and strengthen care for people with autism spectrum disorder through the development of therapeutic methods through scientific research, and due to the exacerbation of this disorder. As its causes continue to remain hypothetical rather than confirmations and certainties, it is imperative to improve care as much as possible by relying on previous studies on the one hand, and conducting experiments and developing effective therapeutic methods for care and treatment on the other hand.

Finally, it can be said that this study contributed to spreading the idea of using digital software and videos that help activate the livelihood of a child with autism spectrum disorder and accelerate his transfer to communicate with real reality.

As recommendations that the student researcher deems necessary, the most important of which are:

- The research requires more studies and field research, especially the application of the experience in virtual reality with a larger sample than what was discussed in this thesis
- Using other measures instead of using only one measure, which is the Childhood Autism Rating Scale (CARS), to enhance the results of the study
- Interest in artificial intelligence, which has today become the subject of interest to senior researchers in several fields. This field will certainly occupy a place in psychology in developed and even developing countries if attention is paid to it and integrated with the human sciences. It can also be a starting point for research that integrates modern technology with psychology.
- Providing a sufficient period of time to carry out the experiment
- Using the experience in several states and not being limited to just one state
- Concerning virtual reality technology, the content should be diversified and not limited to one content in research and future studies

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Appendices
CARS

CARS-T

ÉCHELLE D'ÉVALUATION DE L'AUTISME INFANTILE

Eric SCHOPLER et col.

Traduction et adaptation française : Bernadette ROGÉ

CAHIER DE NOTATION

Nom ……

Date de l'examen Année ……. Mois…..…….. Jour……

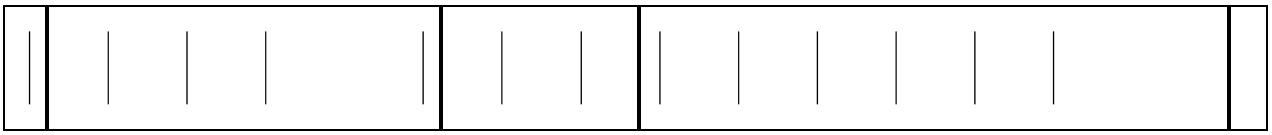
Date de naissance Année ……. Mois…..…….. Jour……

Âge chronologique Année ……. Mois…..……..

Examinateur ……

SCORES AUX DIFFÉRENTES CATÉGORIES

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	SCORE



CONSIGNES D'ADMINISTRATION

Pour chaque catégorie, utiliser l'espace prévu en dessous de chaque item pour prendre des notes sur les comportements à évaluer. Lorsque l'observation est terminée, coter les comportements correspondant à chaque item. Pour chaque item, entourer le nombre qui correspond le mieux à la description du comportement de l'enfant. Il est possible de nuancer la description en utilisant les notes intermédiaires 1,5 - 2,5 - 3,5. Pour chaque item, des critères de cotation abrégés sont fournis. Se reporter au chapitre 2 du Manuel pour prendre connaissance des critères de cotation détaillés.

I. RELATIONS

1. ***Pas de difficulté ou d'anomalie dans les relations avec les personnes***. Le comportement de l'enfant est approprié pour son âge. Un certain degré de timidité, de gène ou de contrariété lie au fait d'être guidé dans les activités peut être observé, mais pas davantage que chez les enfants normaux du même âge

1,5

2. ***Anomalies mineures dans les relations***. L'enfant peut éviter de regarder l'adulte dans les yeux, peut éviter l'adulte ou se montrer réticent si l'interaction est initiée de manière forcée, être excessivement timide, être moins sensible à la présence de l'adulte qu'il ne serait normal ou s'agripper aux parents légèrement plus souvent que la plupart des enfants du même âge.

2,5

3. ***Anomalies moyennes dans les relations***. L'enfant présente parfois des comportements de retrait, il paraîtinsensible à la présence de l'adulte. Une intervention importante et durable peut parfois être nécessaire pour attirer l'attention de l'enfant. L'enfant initie un minimum de contact

3,5

4. ***Anomalies sévères dans les relations***. L'enfant est constamment en retrait et insensible à ce que fait l'adulte. Il ne répond pratiquement jamais à l'adulte et ne cherche presque jamais le contact avec lui. Seulsles efforts les plus prolongés pour attirer l'attention de l'enfant peuvent avoir un effet.

OBSERVATIONS :

II. IMITATION

1. ***Imitation appropriée***. L'enfant peut imiter des sons, des mots et des mouvements qui correspondent à son niveau.

1,5

2. ***Imitation légèrement anormale***. La plupart du temps, l'enfant imite des comportements simples tels que taper des mains ou reproduire des sons. Occasionnellement, il n'imite que s'il y est poussé ou après un délai.

2,5

3. ***Imitation moyennement anormale***. L'enfant n'imite que de temps à autre et l'adulte doit insister et l'aider pour qu'il le fasse. Fréquemment, il n'imite qu'après un délai.

3,5

4. ***Imitation sévèrement anormale***. L'enfant n'imite que rarement ou jamais des sons, des mots ou des mouvements, même quand il y est poussé ou aidé par l'adulte.

OBSERVATIONS :

III. RÉPONSES

1. ***Réponses émotionnelles appropriées à l'âge et à la situation***. L'enfant présente un type et une intensité deréponse normaux. Cela se manifeste par un changement au niveau de son expression faciale, de sa posture et de sa façon de se comporter.

1,5

2. ***Réponse émotionnelles légèrement anormales***. L'enfant présente parfois un type et un degré de réactions émotionnelles inappropriés. Les réponses ont parfois peu de liens avec les objets ou les événements présents.

2,5

3. ***Réponses émotionnelles moyennement anormales***. L'enfant présente des signes d'inadéquation dans le type et l'intensité de ses réponses émotionnelle. Les réactions peuvent âtre relativement inhibées ouexcessives et peuvent être sans rapport avec la situation. L'enfant peut grimacer, rire, ou se raidir même si rien dans l'environnement ne semble devoir provoquer une émotion.

3,5

4. ***Réponse émotionnelles sévèrement anormales***. Les réponses sont rarement appropriées à la situation. Lorsque l'enfant est dans un état émotionnel déterminé, il est difficile de le faire changer d'humeur. Inversement, il peut présenter des émotions très différentes sans que rien n'a changé dans la situation.

OBSERVATIONS :

IV. UTILISATION DU CORPS

1. ***Utilisation du corps normale pour l'âge***. L'enfant bouge avec la même aisance, la même habileté et le même niveau de coordination qu'un enfant du même âge.

1,5

2. ***Utilisation du corps légèrement anormale***. De légères particularités telles que maladresse, mouvements répétitifs, pauvreté des coordinations sont observées. Des mouvements plus inhabituels apparaissent parfois.

2,5

3. ***Utilisation moyennement anormale du corps***. Des comportements qui sont nettement étranges ou inhabituels pour un enfant de cet âge sont relevés: mouvements bizarres des doigts, postures particulières des doigts ou du corps, fixation du regard sur une partie du corps ou manipulation du corps, auto-agression, balancement, tournoiement, agitation des doigts ou marche sur la pointe des pieds.

3,5

4. ***Utilisation sévèrement anormale du corps***. Des mouvements, tels que ceux décrits ci-dessus apparaissant avec une intensité et une fréquence importante, correspondent à une utilisation sévèrement anormale du corps. Ces comportements peuvent persister en dépit des tentatives pour les éliminer ou pour engager l'enfant dans d'autres activités.

OBSERVATION

V. UTILISATION DES

1,5 1. ***Intérêt normal pour les jouets et autres objets, utilisation appropriée***. L'enfant manifeste un intérêt normal pour les jouets et les autres objets adaptés à son niveau d'habileté, et les utilise d'une manière appropriée.

2,5 2. ***Intérêt légèrement anormal pour les jouets et les autres objets, utilisation légèrement inappropriée.*** L'enfant peut présenter peu d'intérêt pour les objets, ou jouer avec eux d'une manière immature (par exemple frappe avec le jouet ou le suce).

3,5 3. ***Intérêt moyennement anormal pour les objets, utilisation moyennement inappropriée***. L'enfant peut manifester très peu d'intérêt pour les jouets ou d'autres objets ou peut les utiliser d'une manière étrange. Il peut focaliser son attention sur une partie insignifiante du jouet, être fasciné par le reflet de lumière sur l'objet, mobiliser de manière répétitive une partie de l'objet ou jouer avec un seul objet à l'exclusion de tousles autres.

4. ***Intérêt sévèrement anormal pour les objets, utilisation sévèrement inappropriée***. L'enfant peut s'engager dans les comportements décrits ci-dessus, mais avec une fréquence et une intensité plus marquées. L'enfantest plus difficile à distraire de ses activités inappropriées.

OBSERVATIONS :

VI. ADAPTATION AU CHANGEMENT

1,5 1. ***Réaction au changement normale pour l'âge***. L'enfant peut remarquer les changements de routine et faire des commentaires, mais il accepte ces modifications sans signes de détresse.

2,5 2. ***Réactions légèrement anormales au changement***. Quand un adulte essaie de changer les tâches, l'enfant peut continuer la même activité ou utiliser le même matériel.

3,5 3. ***Réaction moyennement anormale au changement***. L'enfant résiste activement aux changements de routine, essaie de continuer l'ancienne activité et il est difficile de le distraire. Il peut se mettre en colère et se montrer perturbé quand une routine établie est modifiée.

4. ***Réaction sévèrement anormale au changement***. L'enfant présente des réactions sévères au changement.Si un changement est imposé, il peut se fâcher, refuser de coopérer et manifester de la

OBSERVATION

VII. RÉPONSES

1,5 1. ***Réponses visuelles appropriées pour l'âge***. Le comportement visuel de l'enfant est normal et approprié pour un enfant de cet âge. La vision est utilisée avec les autres sens pour explorer un nouvel objet.

2,5 2. ***Réponses visuelles légèrement anormales***. Il faut rappeler de temps en temps à l'enfant de regarder les objets. L'enfant peut être plus intéressé par les miroirs ou les lumières que par ses pairs, il peut parfois fixer dans le vide. Il peut aussi éviter de regarder les gens dans les yeux.

3,5 3. ***Réponses visuelles moyennement anormales***. Il faut fréquemment rappeler à l'enfant de regarder ce qu'il fait. Il peut fixer dans le vide, éviter de regarder les gens dans les yeux, regarder les objets sous un angle inhabituel, ou tenir les objets très près des yeux.

4. ***Réponses visuelles sévèrement anormales***. L'enfant évite constamment de regarder les gens ou les objets et peut présenter des formes extrêmes des particularités visuelles décrites ci-dessus..

OBSERVATIONS :

VIII. RÉPONSES

1,5 1. ***Réponses auditives normales pour l'âge***. La réponse auditive est normale et appropriée pour l'âge. L'audition est utilisée avec les autres sens tels que la vision et le toucher.

2,5 2. ***Réponses auditives 1égèrement anormales.*** Un certain manque de réponse ou une réaction légèrement excessive à certain bruits peuvent être relevés. Les réponses aux sons peuvent être différées, et il peut être nécessaire de reproduire un son pour attirer l'attention de l'enfant. Celui-ci peut être distrait par des bruits extérieurs.

3,5 3. ***Réponses auditives moyennement anormales.*** La réponse de l'enfant aux bruits peut varier. Il ignore souvent un son lors de sa première présentation. Il peut sursauter ou se couvrir les oreilles en entendant desbruits auxquels il est pourtant quotidiennement confronté.

4. ***Réponses auditives sévèrement anormales***. L'enfant répond trop ou trop peu aux bruits. Sa réponse est excessive quel que soit le type de stimulus sonore.

OBSERVATIONS :

IX. GOÛT - ODORAT - TOUCHER (RÉPONSES ET MODES

1,5 1. ***Réponse normale aux stimuli gustatifs, olfactifs et tactiles ; utilisation normale des 5 sens***. L'enfant explore les nouveaux objets d'une manière appropriée pour l'âge, généralement en les touchant et en les regardant. Le goût et l'odorat peuvent être utilisés quand cela est adapté. Lorsqu'il réagit à des douleurs minimes et courantes, l'enfant exprime de l'inconfort mais n'a pas de réaction excessive.

2,5 2. ***Réponses légèrement anormales aux stimuli gustatifs, olfactifs et tactiles; utilisation légèrement anormale des 5 sens.*** L'enfant peut continuer à porter les objets à la bouche, renifler ou goûter des objets non comestibles, ignorer une petite douleur ou présenter une réaction excessive par rapport à la simple réaction d'inconfort d'un enfant normal.

3,5 3. ***Réponse moyennement anormales aux stimuli gustatifs, olfactifs et tactiles; utilisation moyennement anormale des 5 sens.*** L'enfant peut être moyennement préoccupé par le fait de toucher, sentir ou goûter lesobjets ou les personnes. Il peut réagir trop fortement ou trop peu à la douleur.

4. ***Réponse sévèrement anormale aux stimuli gustatifs, olfactifs et tactiles; utilisation sévèrement anormale de ces sens.*** L'enfant est préoccupe par le fait de renifler, goûter ou toucher les objets, davantage pour la sensation que par souci d'explorer ou d'utiliser ces objets. L'enfant peut ignorer complètement la douleur ou réagir très fortement à un léger inconfort.

OBSERVATIONS :

X. PEURS, ANXIÉTÉ

1,5 1. ***Peur ou anxiété normale***. Le comportement de l'enfant est approprié à la situation compte tenu de son âge.

2,5 2. ***Peur ou anxiété légèrement anormale***. L'enfant présente de temps à autre une peur ou une angoisse trop forte ou trop faible comparée à la réaction d'un enfant normal du même âge dans la même situation.

3,5 3. ***Peur ou anxiété moyennement anormale***. L'enfant présente une peur trop intense ou trop faible par rapport à la réaction d'un enfant même plus jeune dans une situation identique.

4. ***Peur ou anxiété sévèrement anormale***. Les peurs persistent même après l'expérience répétée de situations ou d'objets sans danger. Il est extrêmement difficile de calmer et de réconforter l'enfant. A l'inverse,l'enfant peut ne pas réagir de manière appropriée à des dangers qu'évitent les enfants du même âge.

OBSERVATIONS :

XI. COMMUNICATION

1,5 1. ***Communication verbale normale pour l'âge et la situation***

2. ***Communication verbale légèrement anormale***. Le langage présente un retard global. L'essentiel du
2,5 discours a une signification: cependant, l'écholalie ou l'inversion pronominale peuvent. Des mots particuliers ou un jargon peuvent être utilisés occasionnellement.

3. ***Communication verbale moyennement anormale***. Le langage peut être absent. Lorsqu'elle est présente, lacommunication verbale peut être un mélange de langage doté de sens et de particularités telles que
3,5 jargon, écholalie ou inversion pronominale. Le langage peut comporter aussi des particularités comme les questions répétées ou une préoccupation excessive pour des sujets spécifiques.

4. ***Communication verbale sévèrement anormale***. L'enfant n'utilise pas un langage fonctionnel. Il peut émettre des cris infantiles, des sons étranges ou ressemblant à des cris d'animaux, des bruits complexes se rapprochant du langage, ou peut faire un usage bizarre et persistant de certains mots ou phrases.

OBSERVATIONS :

XII. COMMUNICATION NON-

1,5 1. ***Communication non-verbale normale pour l'âge et la situation***.

2. ***Communication non verbale légèrement anormale***. La communication non verbale est immature.
2,5 L'entant peut pointer vaguement du doigt, ou toucher ce qu'il veut dans les situations où un enfant normal du même âge montre du doigt ou présente des gestes spécifiques pour indiquer ce qu'il veut.

3. ***Communication non verbale moyennement anormale***. L'entant est généralement incapable d'exprimer sesbesoins ou désirs par gestes. Il est également incapable de montrer ce qu'il veut par des gestes.
3,5

4. ***Communication non verbale sévèrement anormale***. L'enfant n'utilise que des gestes bizarres ou particuliers qui n'ont pas de signification apparente. Il n'intègre pas la signification des gestes et des expressions faciales des autres

OBSERVATIONS :

XIII. NIVEAU

1. ***Niveau d'activité normal à l'âge et la situation.*** L'enfant n'est ni plus actif, ni moins actif qu'un enfant
1,5 normal du même âge dans une situation semblable.

2. ***Niveau d'activité légèrement anormal***. L'enfant est parfois légèrement agité ou plutôt ralenti. Son niveau
2,5 d'activité n'interfère que très légèrement avec sa performance.

3. ***Niveau d'activité moyennement anormal***. L'enfant peut être très actif et difficile à contrôler. Il peut dépenser de l'énergie sans limite et ne va pas volontiers au lit le soir. A l'inverse, il peut être apathique et
3,5 une stimulation importante est alors nécessaire pour le faire bouger.

4. ***Niveau d'activité sévèrement anormal***. L'enfant présente des niveaux d'activité extrêmes allant de l'hyperactivité à l'apathie. Il peut même passer d'un extrême à l'autre.

OBSERVATIONS :

XIV. NIVEAU ET HOMOGÉNEITÉ DU FONCTIONNEMENT

1. ***Intelligence normale : fonctionnement intellectuel homogène.*** L'enfant est aussi intelligent qu'un enfant
1,5 du même âge et ne présente ni habileté exceptionnelle, ni problème.

2. ***Fonctionnement intellectuel légèrement anormal***. L'enfant n'a pas une intelligence aussi développée que
2,5 celle d'un enfant du même âge et ses capacités sont également retardées dans tous les domaines.

3. ***Fonctionnement intellectuel moyennement anormal***. En général, l'enfant n'a pas une intelligence aussi développée que celle d'un enfant normal du même âge. Cependant, il peut présenter une performance
3,5 proche de la normale dans un ou plusieurs domaines du fonctionnement intellectuel.

4. ***Fonctionnement intellectuel sévèrement anormal***. Alors que l'enfant n'a généralement pas une intelligence aussi développée que celle d'un enfant normal du même âge, il se montre capable de fonctio**n**ner à un niveau supérieur par rapport aux enfants de son âge dans un ou plusieurs domaines

OBSERVATIONS :

XV. IMPRESSION

1,5 1. ***Pas d'autisme***. L'entant ne présente aucun des symptômes caractéristiques de l'autisme.

2,5 2. ***Autisme léger***. L'enfant présente seulement quelques symptômes ou un léger degré d'autisme.

3,5 3. ***Autisme moyen***. L'entant présente un certain nombre de symptômes ou un degré moyen d'autisme.

4. ***Autisme sévère***. L'entant présente beaucoup de symptômes ou un degré extrême d'autisme.

OBSERVATIONS :

Pictures from the application using the virtual screen in the pedagogical center of Amara Laroubi Constantine - 2 –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فعالية اللّعب باستخدام تقنية الو اقع الافتراضي في تنمية مهارات الأطفال المصابين باضطراب طيف التوحد

أطروحة مقدمة لنيل شهادة الدكتوراه في الطور الثالث

إعداد: طالب الدكتوراه بوهيدل شعيب *تأطير: البروفيسور بَهتان عبد القادر*

ملخص:

لقد انتشرت الوسائط التكنولوجية أكثر من أي وقت مضى. في هذا السياق، وفي إطار المنهج التجريبي، تهدف الدّراسة إلى تطبيق تقنية الواقع الافتراضي سيما "الشاشة الافتراضية" على عيّنة (ذ: 6؛ السن: [7 - 12]) أطفال مصابين باضطراب طيف التوحد من أجل تحفيز وتنمية المهارات التعلّمية الاجتماعية والتواصلية والانفعالية.

امتدت مدة التجريب إلى حوالي ثلاثة أشهر. و وزّعت خلالها جلسات اللّعب التعليمي.بحيث تم تطبيق قياسين: قبلي وبعدي باستعمال سلم تقييم التوحد الطفولي (CARS) لإثبات مدى فعالية تقنية الواقع الافتراضي بالنسبة للعينة قيد الدّراسة.

أفرزت النتائج دلالة فعالية تقنية الواقع الافتراضي في تنمية مهارات تعلّمية، وتواصلية، وانفعالية، واجتماعية لدى العيّنة قيد الدّراسة.

كلمات مفتاحية: لعب، واقع افتراضي، تنمية، مهارة، اضطراب طيف التوحد، تفاعل اجتماعي، تواصل، انفعال.