THE USE OF TECHNOLOGY TO FACILITATE HOME-BASED LEARNING FOR CHILDREN WITH AUTISM: SYSTEMATIC LITERATURE REVIEW

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1. INTRODUCTION

Autism Spectrum Condition (ASD) is a developmental disorder that affects people of all ages and causes various degrees of impairment (Belanich, 2004), even though there are numerous consistent factors present in all or most autistic people. Among other things, it is typical for these persons to have poor fine or gross motor coordination, to love engaging with technology and video games, and to get obsessed with a certain topic area referred to as a special interest. Despite significant advances in early diagnosis, the results for most children with autism are still dismal, with only a minority of those who reach adulthood being able to live independently (Eaves, 2008). Many studies in the technology application-related involved in research into technology-based learning for parents and home learning settings for children with autism spectrum disorders.

2. THEORETICAL BACKGROUND
2.1 Autism Spectrum Disorders

There are two basic areas of functioning that are impaired in people with autism spectrum disorder (ASD), according to Keen (2010). These are: (1) social interaction with others; and (2) limited repetitive behaviours, interests, and hobbies (all of which are restricted in nature). Autism spectrum disorder, as described by the American Academy of Pediatrics, is a condition characterised by deficits in two key areas of functioning: (1) social communication and connection with others; and (2) restricted repetition of behaviour, interests, and activities. Even though autistic persons share a lot of characteristics with most other people, Autism Spectrum Condition (ASD) is a wide developmental disorder that affects people differently. Having poor fine or gross motor coordination, enjoying technology and video games, and being obsessive about a particular topic are all traits of people with developmental impairments that are referred to as special interests.

2.2 Aims of the Study

The purpose of this study is to give an overview of technological applications that can be used to assist home-based learning for children with autism. The following are the three precise goals:

i. To conduct a review of the technology classifications that are most prevalent suited for autism learners' development
ii. To conduct a reassessment of the categorization technology application.
iii. To analyse the impact of technology on education attempts for autistic children.

3. METHODOLOGY

This systematic literature review was carried out following the process proposed by Kitchenham (2007). Kitchenham outlined three fundamental phases for conducting a review of the literature: (1) planning the review, which includes creating the research questions and reviewing the protocol; (2) conducting the review, which includes the review, the selection and quality of studies, data extraction and data synthesis; and (3) publicizing the results after the review. Next, we detail the process followed for this document. Three research questions were developed to ensure that every area of interest was covered in this systematic literature evaluation. These questions consider significant and broad features that are critical for grasping the ideas that we believe are vital for this research.

3.1 Sources of Information and Search Strategies

To conduct this systematic literature review, we searched for scientific papers on five databases such as IEEE Xplore Digital Library, Science Direct, and Web of Science. For these sources, we considered only documents that were relevant in computer-related categories, such as technology, engineering, and computer science, excluding categories related to medicine.

3.2 Selection of Articles

The databases to users to search and determined the specific search strings to find the article to answer the research questions. Defined the exclusion and inclusion criteria to refine and filter the articles found.

3.3 Search Strings

We formulated the search strings based on the relevant topics to our systematic literature review. We determined a set of specific keywords to use in our queries, i.e., "autism spectrum disorder", "Gamification", "Serious Games", and "Game Elements" that would be useful to answer our research questions. These strings were focused on finding studies that analyzed or experimented with the use of games with people with ASD, considering aspects such as the user experience, accessibility, and game.

3.4 Document Selection

A total of 54 articles after applying the selection criteria. the overall process flow of the search for and selection of studies for this review, as well as the inclusion and exclusion criteria that were employed at each stage of the procedure.

3.5 Selection Criteria

To answer the research questions based on the selected articles and develop a general knowledge of the concepts that we were working with, we included the conditions listed in Table 1.

Table 1: Inclusion Criteria

ID	Inclusion Criteria
INS1	Journals articles and conference
INS2	Focused on Autism Spectrum Disorder
INS3	Study-related to the use of technology and educational context

Table 2: Exclusion's Criteria

ID	Exclusion Criteria
EX1	Study-related to medical treatment and medical diagnosis
EX2	Study-related to technology application for another context of autism learners
EX3	The study that does not involve any technology application

4. RESULTS AND DISCUSSION

The results and discussion will include an examination of the criteria that writers use to choose appropriate serious games, the primary technologies that are used in their creation, as well the potential for interactive and multiplatform development. Numerous previously published papers that detailed typical advances in the research area's chosen technical application domains were found after a thorough search was conducted. Because there are so many technology-based learning applications now available for individuals with autism spectrum disorders to utilise at home, the search has shifted to serious gaming for those who have autism spectrum disorders. To conduct a review of the most prevalent technology classifications. suited for further development. The research found that the technologies used in serious games development for autism includes 2D and 3D stand-alone and online computer game, mobile virtual reality, mobile devices, touch screen computer, and tabletop. Games that use technology are widely used to teach people conceptual knowledge and skills. There are different implementations of such games, such as serious games, gamification, and e-learning.

a. Desktop Game

A computer game, also known as a PC Game (personal computer game), is a video game played on a personal computer or notebook/laptop, rather than on a video game console or arcade machine. Earlier personal computer games often needed a keyboard for gameplay, or more commonly, required the user to buy a separate joystick with at least one button (Caria et. al, 2018). Players are required to control a keyboard and a mouse simultaneously in most modern computer games. Sometimes, these players can use gamepads and joysticks as well. Normally, computer games employ additional measures to offer interactivity and information

to the player. Speakers and headphones are utilized as sound reproduction devices since audio is virtually universal. Haptic peripherals, such as vibration or force feedback, are used as another type of feedback.

b.   E-Learning

e-Learning is an acronym for "electronic learning," which is what the word refers to. In his definition of e-Learning, Khan (2018) stated that it is "a hypermedia educational program that takes advantage of the features and resources of the Internet to build relevant learning environments." To put it another way, e-Learning refers to online teaching and learning that takes place via the use of the Internet and technology.

c.   Virtual Reality

Virtual reality is a computer-generated, three-dimensional environment that may be experienced from a variety of perspectives, including first-person, third-person, and fourth-person. As a result, the person is pulled into the virtual world and given the ability to control objects and engage in a variety of activities there, as previously stated. Serious games are being developed using virtual reality technology. As a result of technological advances, a diverse set of serious gaming disciplines has developed. One significant benefit of virtual reality is the ability to reproduce events and situations that would be difficult to duplicate in the actual world. Investigate the potential of replicating traumatic events in virtual reality to help people who have been traumatised (Altan 2017). Virtual reality, on the other hand, enables the user to completely immerse oneself in the experience via the use of a range of equipment that allows for reciprocal engagement with serious games. In the framework of "virtual reality," which may relate to a variety of technologies, many applications are linked to immersive 3D worlds. Some of the current projects include CAD software, graphics hardware acceleration, head-mounted displays (HMD), Data Acquisition Glove, 3D vision goggles, the mouse or keyboard, 3D LCD panels, and the sensor body. Tashnim (2017) provides a formal description in his article, where he writes: (Tashnim, 2017).

d.   Mobile Devices

We will all have a growing number of mobile devices at our disposal as time passes. They are beneficial in the classroom due to their diverse talents. A mobile game is played on a mobile phone, smartphone, personal digital assistant (PDA), tablet, or another similar portable device. The PlayStation 2 and Nintendo DS are not included in the list of portable video game systems. These mobile games are often built on Microsoft's Windows Mobile, Google's Android, Apple's iOS, and Microsoft's Windows platforms and technologies. other points of interest on a touch screen, a user's finger may be recognised as being present inside the display area, as well as its location. In general, it refers to the act of putting a finger or a hand on the display of a device. A touch screen can detect objects that are not moving. Touch screen technology is integrated into a broad range of products, including game consoles, all-in-one personal computers, tablets, and smartphones. A touch screen has two distinguishing features. To begin, it eliminates the need for additional devices such as a mouse or a touchscreen to interact with the displayed content. Second, there is no need for the user to utilise any additional portable devices as an intermediate. In practise, these displays may be connected to other equipment, such as computers and networks. Digital devices such as cell phones and video games, for example, rely heavily on these screens.

i.   To conduct application types of technology learning-based used for autism children home/non home?

Serious games are designed with the primary goal of assisting players in problem-solving. Although serious games can be enjoyable and amusing, their primary function is to train, study, or market their sponsors. Now and again, a game will intentionally sacrifice enjoyment and pleasure to help the player get the progress they seek. Serious games may be divided into several different categories. The classification has not been validated, however, because several words are often used.

ii.   To identify types of knowledge or skills acquisition from the application of technology for autistic children

As previously stated, autism spectrum disorder (ASD) is a disease that is classified as a handicap because of the cognitive difficulties that persons with ASD experience. (Arciuli, 2019). A wide number of research papers discovered that the vast majority of individuals demonstrate a natural affinity for technology and excellent manners while utilising it using computers to learn (Lin et al, 2014). As a result, the stable, regular nature of these encounters doesn't interrupt patterns and repeated behaviours, helping ASD individuals keep their comfort levels while keeping up with progress. (Wojciechowski, 2017).

Several researchers recommend using current methods to assist ASD patients to master necessary abilities. The following papers discuss virtual reality, virtual agents, augmented reality, geolocation, and Kinect technologies and offer a few intriguing uses of them. Education for individuals with Autism Spectrum Disorder (ASD) is being impacted by technology in terms of the skills that they focus on teaching ASD for a range of life skills such as Imaginative abilities, Psychomotor Capabilities, Social Aptitudes, and General Capabilities.

Table 3: Summarization on Skill Acquisition from Technology Application in ASD Education

Topic	Percentage of Study
Cognitive	39
Psychomotor	23
Social	27
General Skills	11

Cognitive skills

The primary goal of language studies was to promote the acquisition of words, concepts, and feelings via the use of written language. Testing has demonstrated that this software aids in the development of mathematical abilities. However, it was recommended that before publication, the program be evaluated by a larger group of people and in a variety of institutions. There was a substantial rise in motivation among the participants as a result of the intervention, which proved to be very beneficial for teaching.

Social Skills

The Social Skills category, which accounted for 27 percent of the total number of studies conducted. Communications is the first of the three subcategories investigated in this study,

and it focuses on the development of skills such as the exchange of information between two or more individuals.

General Skills

Finally, 11% of the courses fell under the umbrella of General Skills. We only created one subsection for this category, the General subcategory since it included so many different subjects. Using computer games to assess autistic children, Backman et al. discovered a technique of assessing autistic children that is objective, engaging, and risk-free. Computer games offer tremendous promise in special education as an assessment tool to explain the difficulties connected with learning disabilities, even though additional study is needed.

5.   CONCLUSION

This article, which includes a systematic review, addresses the creation of serious games in conjunction with autism research. According to published studies, games have been proven to be extremely helpful in the treatment and education of children with autism. Researchers performed a thorough literature review to determine if technology has any effect on individuals with an autism spectrum disorder. The majority of this material is derived from current research, which may be accessed in relevant scientific sources. People seem to be getting more interested in this subject since more articles about it have been published throughout time. Surprisingly, case studies comprised the bulk of the papers given at the conference (74 percent). There were four kinds of talents studied: intellectual, practical, social, and all-around capabilities. The conceptual abilities category got the most study interest. The bulk of the study has focused on social skills.

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