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Original Article

Development and Evaluation of a Mobile Application for Enhancing the Academic and Social Behavior of Children with Attention-Deficit/Hyperactivity Disorder (ADHD)

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Abstract - *This study evaluates the effectiveness of an Android application for children with Attention Deficit Hyperactivity Disorder (ADHD) in reducing ADHD symptoms and improving children's academic and social performance through the application of the Pomodoro technique. The study adopted a quantitative approach using a questionnaire. The research process included evaluation tests conducted by lecturers using a questionnaire that evaluates the content, design, multimedia used, and performance, in addition to parents' evaluation of the improvement in their children's performance after using the application due to the difficulty of direct measurement by children. The waterfall approach was used to implement the application's design during the Software Development Life Cycle. The study's findings demonstrate that the program is appropriate for children with ADHD and can help them minimize ADHD symptoms, improve academic and social performance, learn more efficiently, and increase interactive visualization. However, learning methods in mobile applications can be integrated with artificial intelligence to become more effective. Thus, the research opportunity in integrating it with the education sector increases.*

Keywords - *ADHD, Behavioral skills, Mobile Application, SVM, The Pomodoro Technique.*

1. Introduction

Technology is now permeating all aspects of life, and its widespread use has led to changes in various aspects, primarily in communication between individuals, access to information, and interaction between them [1]. This transformation is represented by a comprehensive impact on various sectors, especially education and health [2],[3]. Attention Deficit Hyperactivity Disorder (ADHD) is a prevalent neurodevelopmental disease that affects about 5% of children [4]. It is distinguished by inattention, hyperactivity, and impulsiveness. It significantly affects academic achievement and social interactions. ADHD is characterized by a persistent pattern of inattention and impulsivity, which leads to poor academic performance and normal development in children. The disorder is divided into three categories based on severity: the first category is limited to poor attention without symptoms of hyperactivity, the second category is limited to hyperactivity and impulsivity, and the third category is a combination of hyperactivity and poor attention and concentration. Children with ADHD also face social challenges, as children suffer from low self-esteem. Traditional approaches to ADHD include behavioral interventions and medications. The current potential for treating children with ADHD is mostly focused on pharmacological treatments. Pharmacological treatments reduce the challenges faced by people with ADHD, but they show limited effectiveness in meeting their needs [5]. There are some reviews of technologies related to ADHD. Virtual reality, for example, has the potential to support the assessment and rehabilitation of children with ADHD [6]. Alternatively, brain functions in ADHD can be regulated through Neurofeedback. However, there are no reviews of the range of technologies specifically designed to regulate behavior and emotions in children with ADHD [7]. Children with ADHD face significant challenges in school due to a lack of concentration, which can lead to frustration and low self-esteem. It also affects social relationships [8]. The study [9] showed that children were asked to read short passages describing children with ADHD. After that, a list of descriptors that best characterized the target child was developed. The most commonly selected adjectives were "lonely," "stupid," "crazy," and "careless." The child with ADHD's personality is greatly impacted by these unfavorable opinions, which can also cause self-shame. With the difficulties faced by children with ADHD and the widespread use of technology, many solutions have emerged to make it

easier for them to deal with this disorder practically and easily [10]. Francesco Cirillo created the Pomodoro Technique in the late 1980s, and it is one of the most widely utilized strategies for treating ADHD [11]. This strategy is based on a timer that divides work into periods of focused work and short breaks. This method is not only used to increase concentration but also to manage time and has a clear positive effect [12].The Pomodoro Technique encourages sustained focus for children with ADHD by breaking tasks into chunks. The structure of 25 minutes of focused work followed by 5 minutes of rest allows them to fully engage without feeling like long work sessions and fosters a sense of accomplishment after each chunk, thus increasing self-esteem [13].

Another advantage of using the Pomodoro Technique for children with ADHD is that they learn to manage and estimate time effectively, as children can develop a better understanding of how long tasks take, thus improving their ability to plan their work. With continued use of the Pomodoro Technique, they will feel more in control of their work time and academic responsibilities [14]. Breaks break the work routine, as children can take a break, lie down, or do physical activities, which increases their productivity and revitalizes their focus during the work period. Sound effects, visual aids, and colorful charts with timers help keep children engaged.

They can also increase their overall commitment to the task [15]. According to the positive results of the authors who used the Pomodoro technique mentioned above and its success in improving time management and developing the academic and social performance of children with ADHD, this research aims to combine the interactive elements that can effectively attract children's attention and apply the Pomodoro technique in an Android application to determine the effectiveness of this joint intervention to reduce these symptoms and improve the performance of children with ADHD. While there is an increasing application of technology to support children with ADHD, current mobile applications typically lack a fully integrated approach to behavioral techniques designed to address both academic and social behaviors. The majority of existing applications focus solely on cognitive training or time management, but not both, all contained within user-friendly, engaging environments for young children. The fact that available applications do not provide both behavioral and academic improvements through one integrated, engaging mobile application is the foundation of this study.

The novelty in this research regards combining the Pomodoro technique with educational games to improve academic performance as well as social skills for children with ADHD. There are existing applications that combine cognitive training or academic learning, respectively, but few applications that incorporate both behavioral and academic learning on an integrated platform. This application differs from previous studies that look at cognitive skills or time management separately, where this application brings the two together in a platform that has been designed to merge educational outcomes and social interactions in light of the conceptualization of ADHD for children. Although there are multi-method research efforts to help children with ADHD, there are not enough applications that provide educational tools to help parents deal with their children with ADHD. This research aims primarily to improve the academic and social performance of children with ADHD, in addition to providing educational and recreational activities at the same time for children with their parents, which further improves their academic and social performance.

2. Related Work

One of the most prevalent mental illnesses among children is ADHD, which is characterized by impulsivity, hyperactive activities, and difficulty focusing and paying attention. Recent research has highlighted behavioral interventions that may reduce the symptoms of ADHD, control inattention and impulsivity, and thus enhance the child's self-regulation. Self-regulation is important at all stages of development [16]. With the rapid development and spread of technology, many innovative strategies have emerged that take advantage of new and commercially available technologies to support self-regulation in children with ADHD. An evaluation of the data supporting technology-based therapies that can benefit children with ADHD by evaluating their emotional and behavioral self-regulation was carried out by [17].

The study examined 36 studies investigating various platforms that have been created especially to assist children with ADHD, including computers, smartphones, wearable technology, sensors, virtual reality, and robotics. Although most of these technologies are still in the design and prototyping stages, there are studies on well-developed technologies that have undergone publication studies and controlled trials. These studies indicate promising effects for enhancing self-regulation in children with ADHD, which indicates a greater need for further studies and continued improvement of these interventions. This is the overall objective of the research, which involves analyzing and measuring the effectiveness of an application to enhance academic and social performance in children with ADHD.

The case of a 10-year-old child with ADHD and video game addiction was studied by [18]. The child received 40 mg of methylphenidate per day as a pharmaceutical intervention. The child started going to a cognitive training program called Tajima Cognitive Therapy (TCT), a kind of psychotherapy that focuses on changing negative attitudes and actions. This kind considers that feelings and actions are directly influenced by thinking. This approach makes use of smartphone apps, particularly the "ADHD Trainer" app, which was created to improve cognitive abilities such as visual-motor coordination, logic, processing speed, attention, and math skills. The objective of this research was to demonstrate that children

with ADHD can benefit from regular cognitive training on smart devices, which can also help manage their addiction to video games. These technological developments require a re-evaluation of mobile device capabilities to meet the requirements of modern learning. Modern technologies provide transformative opportunities for individuals with disabilities, enhancing their learning capabilities and academic performance [19],[20]. Referring to [21], this study examines tools used to assess and diagnose children with ADHD. This study highlights the interaction between memory capacity and attention, with an emphasis on how technology can be used to assess and improve memory and positively impact attention. Also, [22] addresses executive function deficits associated with ADHD.

In [23], the authors emphasized the importance of addressing deficits in inhibition and self-regulation to understand ADHD. Fortunately, apps specifically designed for this disorder provide engaging auditory and visual stimuli that enhance daily functioning and provide feedback that helps children maintain focus on academic tasks. There is also a clear focus on working memory (WM) according to [24], a type of short-term memory used to process and retain information for short periods while performing tasks. Working memory is essential for many cognitive processes and is associated with behavior, especially in children with ADHD. Referring to the results of the related studies, the Pomodoro Technique was used to improve regular training in order to improve cognitive deficits and thus develop cognitive performance.

Most technological interventions addressing ADHD have included either cognitive function training, behavior modification, or educational intervention. Applications like ADHD Trainer and TCT Cognitive Therapy are focused on improving attention and cognitive processing through gamified tasks [25]. However, there is no emphasis on time management. Other studies identify improvements in focus and time management using the Pomodoro technique, but do not combine educational games aimed at building social skills. Educational applications have incorporated different types of interactive games and developed studies that demonstrate improvements in memory and cognitive processing [26], but the transfer of those social skills is still not clear. This study will contribute to previous studies that apply the Pomodoro technique, gamified education games, and parent-child time management activities to improve academic performance, social skills, and time management for children with ADHD.

In summary, the current studies highlight the transformative potential of technology to support children with ADHD, particularly through tools that improve working memory and academic activities. These studies have shown that these technologies not only achieve better educational outcomes but also improve overall performance in daily life. To assess these programs' long-term efficacy and investigate the population's fundamental requirements, more thorough experimental research is still required. The main objective of this study is to assess how well an Android application supports children with ADHD. This will contribute to the body of knowledge regarding the use of technology in special education for individuals with disabilities, and ADHD specifically.

3. Problem Statement

Children with ADHD have difficulty concentrating, organizing time, and engaging in the social environment normally, which leads to poor academic and social performance. Although behavioral solutions exist for this problem, it is crucial to provide certain elements that capture children's attention and interests, creating an educational environment that is suitable for their age and interests. With the spread of technology and its entry into all aspects of life, it has become a major part of daily life and has entered into all activities that an individual practices in daily life. Children also use technology daily, such as browsing the Internet and using entertainment tools, and it has also been linked to the field of education, where it essentially forms the interaction between children and learning [27]. Educational applications have become an essential element for developing skills for all. However, children with ADHD find it difficult during the learning process, as a lack of focus or attention characterizes this disorder. One of the most common scientific solutions used in learning processes in these cases is the Pomodoro technique [28], [29], which focuses on distributing time regularly in order to obtain effective learning. This technique revolves around giving the learner a period of learning (25 minutes), then a 5-minute break, then returning again for 25 minutes. The Android application developed in this study offers many features that may attract children, especially those with ADHD, as follows:

- Simple and attractive Interface: To attract and motivate children, the interface is designed to be user-friendly, visually appealing, and easy to use.
- Interaction and motivation: The Application's interface contains interactive elements to increase motivation and enhance focus.
- Flexible education: children can use the Android application anytime and everywhere.
- Educational games: children can play educational games like colorful rings during break time.
- Fully free: the application is available for any children without charge.

4. Objectives

The aims of this study are the following:

- Developing and designing an Android application to help children with ADHD learn, enhance their educational and social abilities, increase concentration, and reduce distraction.

- Using evaluations from professionals and feedback provided by participating children's parents, the effectiveness of an Android app created to support children with ADHD is evaluated.

5. Methodology

5.1. Behaviorism Learning Theory

Behaviorism emphasizes the role of external stimuli in shaping behavior [30]. In a study of [31], the recurrence of stimuli and reactions is the basis for learning. Behaviorism emphasizes the importance of environmental influences and individual responses, which all contribute to the learning process. Based on [32], an individual's personality and behavior develop in response to external stimuli. Computer-based teaching methods often incorporate behaviorism. An educational application, for example, might include a brain-testing activity that requires the learner to progress through each stage until the concept is fully understood [33]. This process is also evident when learners interact with educational applications on computers. It is worth noting here that learning is a behavior that can be predicted, controlled, and implemented. It is through establishing a consistent relationship between external stimuli and the individual's internal responses [34].

5.2. Research Methodology

The goal of this study is to design and develop an interactive Android app aimed at reducing ADHD symptoms like hyperactivity and inattention among children diagnosed with ADHD. And to improve academic, social, and home interactions for children with ADHD by increasing focus and reducing distraction. In this study, The Software Development Life Cycle (SDLC) is employed to implement the application design. This study employs the Waterfall model, which is divided into five stages: requirements, design, implementation, testing, and maintenance [35]. Figure 1 presents the SDLC stages.

5.3. Research Procedure

Requirements, at this stage, the problem and background of the study are identified. Because it allows researchers to recognize and comprehend the advantages and disadvantages of existing technological applications, the requirements stage is regarded as one of the most crucial phases. At this stage, researchers review previous similar studies, apply the strengths, and reduce the occurrence of existing weaknesses. Interviews are also conducted with specialists in this field to analyze the content provided in this application by conducting a comprehensive comparison of the application with similar applications, taking into account the features that require improving these points to suit the target group.

Fig. 1 SDLC cycle

Design, the design phase is particularly important and inspiring in this study, as the target audience is people with disabilities. Adobe Photoshop, Adobe Animation, and Android Studio were used to create this application. Flowcharts, graphical representations, storyboards, content layouts, and navigation patterns were all used in the application's design. The application was developed through text, graphics, and audio components in line with the interests of the target audience, which is children with ADHD.

Implementation, the application includes 3 main units: the welcome page, which includes an overview of ADHD, the timer, which includes managing and controlling periods using the Pomodoro technique, and the advice and games, which includes some advice for parents, with a section for games that can be shared between the child and parents.

Testing, the researchers conducted a preliminary test during the development process to ensure that the application objectives were met with the needs of the target group. Evaluation can be categorized into two types: formative evaluation and summative evaluation. In this study, the formative evaluation was applied, where the application was evaluated at each stage of development. The purpose of this evaluation was to ensure that the project requirements were consistent with the principles of the Android solution. A summative assessment based on feedback from users was conducted following the consumer's use of the application. A survey questionnaire and interviews with respondents were used to assess their responses. The evaluation's findings were then taken into consideration, and any issues that occurred at this point were fixed.

Maintenance, following the survey, the application entered a maintenance phase where technical issues were resolved and defects addressed based on feedback from experts and users. Then this application was evaluated to measure its effectiveness for community use, especially for children with ADHD.

5.4. Research Sample

In this study, the non-probability sampling method was used. The participants were 17 male and female teachers from different faculties of Al-Zaytoonah University of Jordan, taking into account gender diversity, and their ages ranged between 35-50 years, specifically 5 male and female teachers from the Faculty of Arts, Department of Special Education, 4 male and female teachers from the Faculty of Information Technology, Department of Multimedia Technology, 4 male and female teachers from the Faculty of Architecture and Design, Department of Graphic Design, and 4 male and female teachers from the Faculty of Information Technology, Department of Software Engineering, in addition to 25 parents whose children suffer from ADHD in order to evaluate the application's performance on improving their children's behavioral and academic performance.

5.5. Research Instrument

In this study, the questionnaire was used as a tool to collect information and data and to measure the extent to which the application is compatible with the study objectives, which include the extent to which the application content is appropriate to the interests of children with ADHD and the possibility of improving their academic and behavioral performance with continued use of this application. The questionnaire is easy to use, saves a lot of time and effort, and is characterized by privacy to ensure clarity of answers. All survey respondents provided their informed consent after being informed of the research's objectives, methods, and the reality that participation was completely voluntary and that participants might withdraw at any time.

The experiment was divided into stages, where the initial stage of the experiment was represented by asking 4 teachers from different faculties at Al-Zaytoonah University of Jordan to evaluate the practical application of this questionnaire and ensure that it was free of errors and appropriate for the research content. The evaluation content also included two types of questionnaires, the first to evaluate the content of the application by specialized professors, and the second was an evaluation of the children's performance after using the application by their parents to facilitate the evaluation process.

The evaluation of the application content was divided into 4 sections: the first section of the questionnaire related to ADHD was distributed to teachers from the Faculty of Arts, Department of Special Education at Al-Zaytoonah University, the second section related to evaluating the visual experience and interactive elements used in the application by teachers in the Faculty of Information Technology, Department of Multimedia Technology, the third section related to graphic design related to fonts, coordination and colors by teachers from the Faculty of Architecture and Design, Department of Graphic Design, and the fourth section related to evaluating the user experience, software selection and evaluating the application performance by teachers in the Faculty of Information Technology, Department of Software Engineering. The questionnaire uses a Likert scale, which requires you to indicate your level of agreement or disagreement with the statements in the questionnaire. It includes five options: strongly agree, agree, neutral, disagree, and strongly disagree. This scale is easy to understand and is considered more specific than a yes/no scale in terms of the number of options. The items included in the questionnaire are drawn from a comprehensive review of the literature [36], [37], [38], and from relevant research studies to ensure the validity and effectiveness of the assessment.

The reliability and efficiency of the questionnaire were verified using Cronbach's alpha test, the result of which was 0.852, which means that the questionnaire is reliable and highly efficient in evaluating the application. The questionnaire included questions with 5 options as responses are rated based on the following criteria: Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, and Strongly Agree = 5. Table 1 explains the Likert scale process [39], [40].

Table 1. Likert scale

Response	Description	Value
Strongly Disagree	Indicates a strong opposition to the statement	1
Disagree	Reflects disagreement with the statement	2
Neutral	Neither agreement nor disagreement	3
Agree	Shows agreement with the statement	4
Strongly Agree	Demonstrates strong agreement with the statement	5

The average score for each participant can be collected by dividing the total score by the number of questions. Using the Equation 1[41]:

$$Average = \frac{\sum Values}{NumbersofValues} \quad (1)$$

An Android application was created to help children with ADHD learn appropriately and regularly, and manage their time. The evaluation process of this application is to enhance social awareness of the importance of education and time management for all segments of society, especially children with ADHD.

5.6. Data Analysis and Evaluation

Both qualitative and quantitative data are collected for this study to assess the mobile application's effectiveness. Organizing and analyzing the data from teachers, parents, and experts also used both descriptive and inferential statistics. The survey used to access the data also has a Cronbach's alpha of .852, which demonstrates reliability. Using pre- and post-intervention data will enable a comparison of shifts in attention, hyperactivity, and social behavior. To understand the extent to which the Pomodoro method and educational gaming affected the child, analysis will determine the impact of each component. Future researchers will include longitudinal data collection to evaluate changes in behavior and academic performance over time. This comprehensive analysis will show how the mobile application improves self-regulation, attention, concentration, and general performance in kids with ADHD.

6. Results

This section presents the findings of the study, highlighting the effectiveness and usability of the developed application. The evaluation was conducted through expert assessments and visual analysis of the application's interface and functionality.

6.1. Evaluation of Application Content Performance

Experts from Al-Zaytoonah University of Jordan from more than one college participated in this study regarding the subject of the study to evaluate this application, 5 instructors from the Faculty of Arts, Department of Special Education, 4 instructors from the Faculty of Information Technology, Department of Multimedia Technology, 4 instructors from the Faculty of Architecture and Design, Department of Graphic Design, 4 instructors from the Faculty of Information Technology, Department of Software Engineering. However, Figures 2 and 3 show screenshots of the final application. Figure 2 illustrates the welcome page, which is the initial page that displays when starting the application, as well as the structure of the timer and a description of the learning process based on the application. Figure 3 depicts the timer and the process of learning strategy.

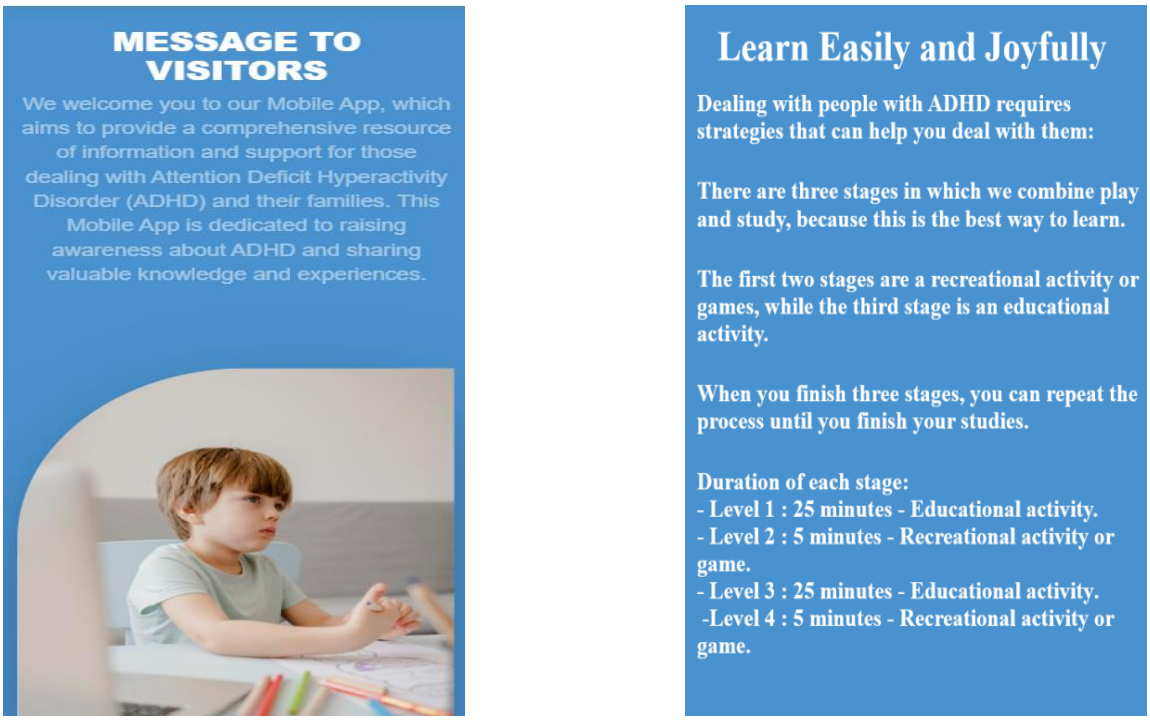

Fig. 2 Welcome page and description of learning stages page

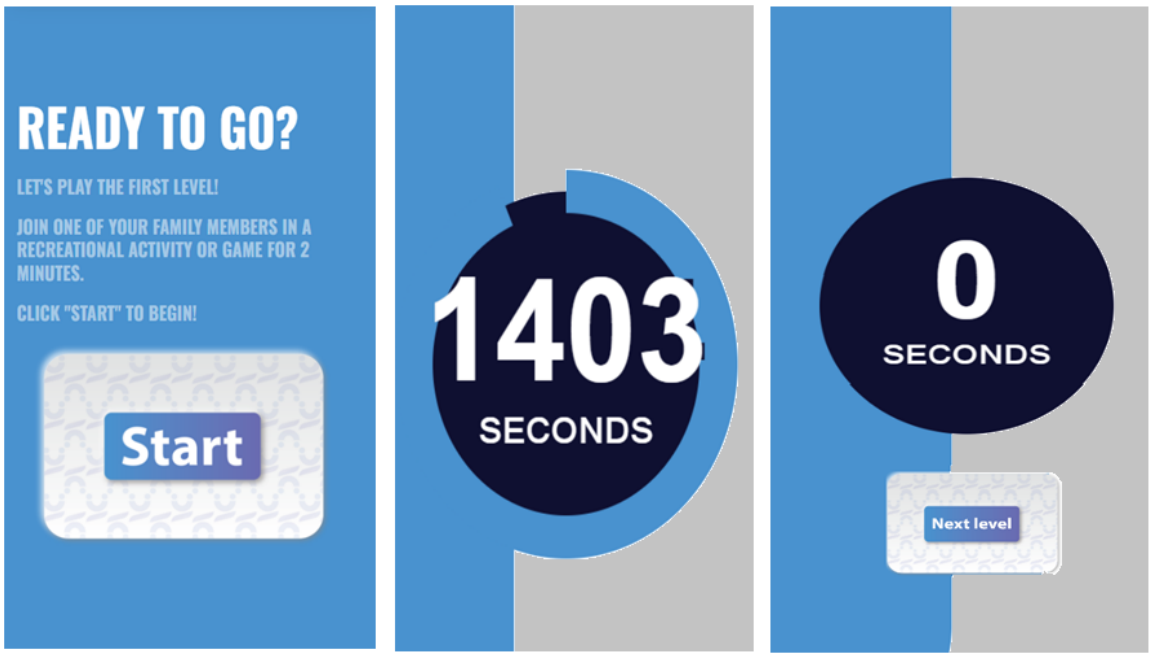

Fig. 3 Timer for the application

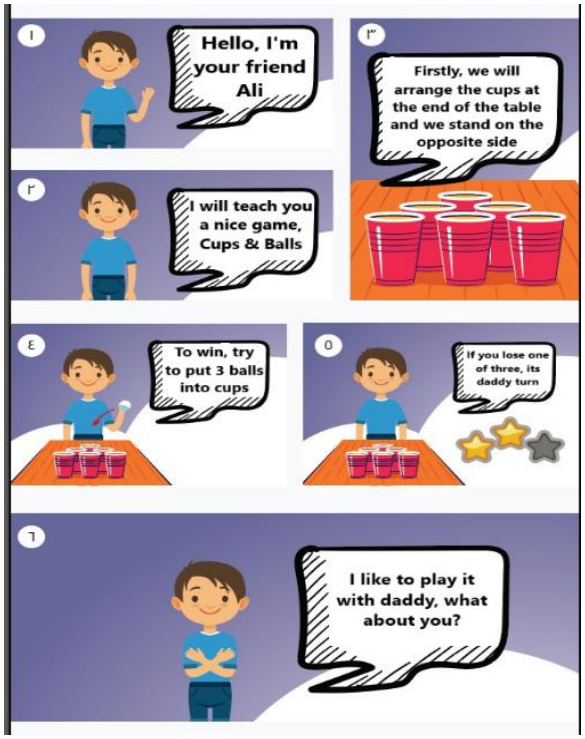

Fig. 4 Game 1 illustrated in the application

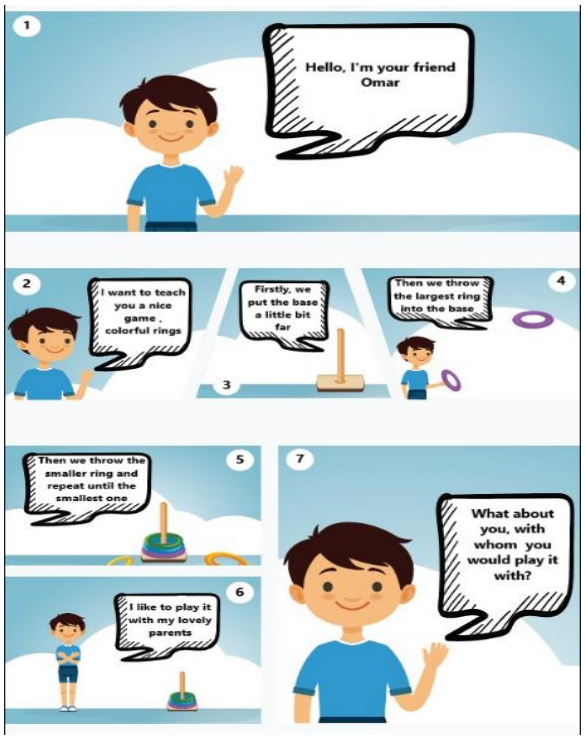

Fig. 5 Game 2 illustrated in the application

Figures 4 and 5 present the Games that are illustrated in the application. These games are considered to be the most effective games in helping to focus, as they depend on visual tracking, coordination of movements, and stimulating children's perception. These games provide immediate results, such as right or wrong, which contributes to maintaining focus, and the game can be completed in a short period of time, which also suits the attention span of children with ADHD. On the other hand, the main goal of sharing these games with parents is to enable parents to deal with their children with ADHD and share their interests effectively and entertainingly, which in turn increases children's self-esteem.

The questions in Tables 2, 3, and 4 were developed by the authors with the help of a literature review and theoretical framework. Table 2 shows questions about the content of the application and its suitability for children with ADHD. Table 2 displays the findings of the examination of the application's content and suitability for the case of ADHD, which was undertaken by experts from the Faculty of Arts, Department of Special Education. Regarding the third and fourth questions in particular, there is consensus that the application can help alleviate the symptoms of ADHD. In general, the experts expressed a majority that the program is suitable for children with ADHD, and it can ease their symptoms and enhance users time management.

Table 2. Applications content results

#	Question	Average scale
1	How effective is the app in reducing ADHD symptoms?	4.2
2	Can the app reduce the symptoms of ADHD children?	4.6
3	Can the app improve the attention for ADHD children?	4.9
4	Can the app improve focus for ADHD children?	4.8
5	Can the app help with time management for ADHD children?	4.7
6	Is the content of the app age-appropriate for ADHD children?	4.5
7	Are the Games in the app relevant to the needs of ADHD children?	4.3
Total Average		**4.5**

Table 3. Application multimedia suitability results

#	Question	Average scale
1	How effective is the app's use of multimedia elements?	5.9
2	The multimedia engaging with the interests of ADHD children?	6
3	Does the app offer a diverse range of multimedia content that adapts for various learning styles?	5.8
4	Does the sounds used in the app appropriate with ADHD children?	6.1
5	Does the animation used in the app appropriate with ADHD children?	6.2
Total Average		**6**

Table 4. Application design results

#	Question	Average scale
1	Does the app visually engage children with ADHD?	6
2	Is the app design easy and clear for children with ADHD?	5.8
3	Are the colors used in the app suitable for children with ADHD?	5.7
4	Are the buttons and icons suitable for children with ADHD?	5.5
5	Can app design help increase attention and focus for children with ADHD?	5.9
Total Average		**5.78**

Table 5. Application's performance

#	Question	Average scale
1	Do the app's features fulfill the needs of children with ADHD?	5.5
2	Does the app display good speed and responsiveness?	5.9
3	Does the app control multitasking and interruptions?	6.1
4	Is the app's user interface easy for ADHD children?	5.7
5	Are the navigational components easy to use and understand?	5.6
Total Average		**5.76**

Table 3 displays the results of an evaluation of the application content and its suitability for children with ADHD conducted by experts from the Faculty of Information Technology, Department of Multimedia Technology. The results generally show agreement regarding the effectiveness of the multimedia used in the application, and in particular, the experts expressed strong agreement with the choice of sound and animation.

Table 4 shows the evaluation results of the application content in terms of design and the acceptability of the designs used in the application for children with ADHD by experts from the College of Architecture and Design, Department of Graphic Design. The experts generally gave strongly agreeing ratings for the colors, fonts, buttons, and icons as being suitable for children with ADHD.

Table 5 shows the evaluation of the application content in terms of performance, where experts from the College of Information Technology's Department of Software Engineering assessed the application's performance and suitability for youngsters with ADHD. The results showed that the application is appropriate, fast, and responsive. The experts also indicated that the application is easy to use, multi-tasking, and easy to understand. Figure 6 shows the total average of all the aspects. As shown in figure 6, the total average of all the aspects of the content evaluation of the application. Content evaluation got average of 4.5 score of likert scale, multimedia evaluation got 6, design evaluation got 5.78, and performance got 5.76. The results indicates that the application has high efficiency and good effectiveness.

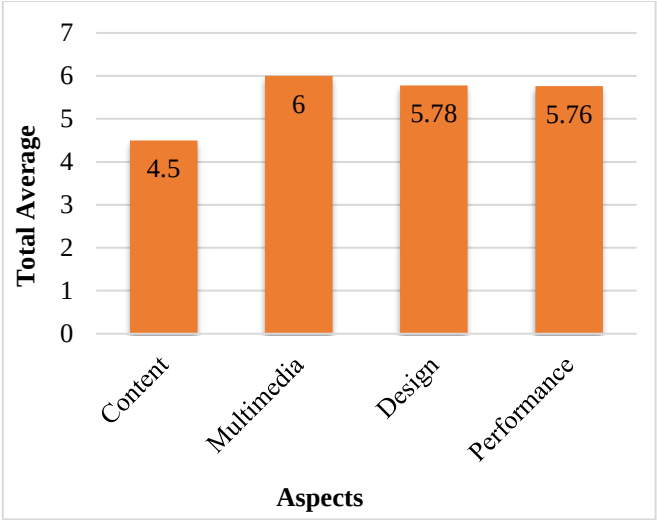

Fig. 6 Total average of all the aspects

6.2. Evaluating the Effectiveness of the Application on children's Performance

Twenty-five parents of children with ADHD evaluated their children's performance utilizing the program being studied. Given the children's young age, evaluating the application themselves was difficult. Figure 7 shows the results of the parents' evaluation of their children's performance while using the application.

As shown in Figure 7, the results of the application evaluation indicate that it had a significantly positive impact on the performance of children with ADHD. Most parents responded that the application showed a good ability to improve attention and concentration in children, with an evaluation rate of 4.2 on the Likert scale. It also showed a rate of 4.3 in improving control over hyperactivity, which is attributed to the well-known Pomodoro technique used in developing the application.

As for social behavior, the results showed a rate of 3.9, indicating that the children's social performance was good but may need more activities that may stimulate increased social interaction. The academic performance rate is 4.5, reflecting excellent academic behavior for children. Finally, the time management results showed 4.0, indicating the effectiveness of the application in helping children manage their time well, but there is always a need to improve this aspect. In summary, the evaluation results reflect the effective performance of the application in enhancing the academic and behavioral performance of children with ADHD.

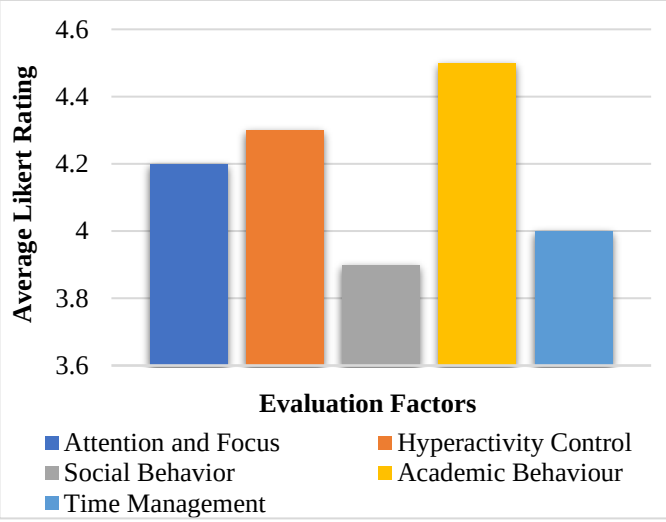

Fig. 7 The results of the parents' evaluation

7. Discussion

The results indicate that the Android application developed to help children with ADHD has been successful in enhancing children's time management skills and alleviating symptoms of the disorder, such as inattention and hyperactivity, as evidenced by the assessment tool used. The design and animation helped to attract the attention of children with ADHD, and the Pomodoro technique helped to improve attention and reduce hyperactivity using the timer in the application. The timer also helped to improve the children's educational time management, thus increasing their sense of accomplishment and increasing their social skills and self-confidence. The research results confirm the importance of using the application in order to reduce the symptoms of ADHD and improve the academic and psychological aspects of children. This study was conducted in accordance with the previous study [39], in which researchers designed an Android application to improve the reading ability of students with ADHD. The study confirmed that enhancing reading and learning abilities through Android applications is reliable, feasible, and effective. In a parallel study [42], on the evaluation of the mHealth application and its safety for children with ADHD, this study described the term mobile health, which is a term that refers to the intervention of mobile phones for medical and health purposes. The study describes that there is a new tool for mobile health to improve memory and cognitive abilities through serious games. The preceding studies [39], [42] focused on safety and learning to read. This study focuses on improving the academic and behavioral performance of children diagnosed with ADHD.

Based on this, the authors conclude that using Android applications to teach children with ADHD is effective. Various research studies have focused on improving reading and writing through similar techniques. For example, memory-enhancing applications have been developed using serious games, while this research focuses on improving academic and behavioral performance through integrated learning activities. These studies demonstrate the effectiveness of these applications in enhancing the skills of children with ADHD.

In conclusion, this research provides valuable insight into the importance of employing technology and benefiting from it in all aspects of daily life, especially Android applications that help in education. The results presented in this research confirm the importance of Android applications in helping with self-development and improving the quality of life by investing in developing this type of application. However, there are challenges that must be faced, such as the possibility of accessing devices and providing serious content.

8. Conclusion

This study developed an Android application to help children with ADHD. By developing the application and evaluating its effectiveness using a questionnaire, this study succeeded in developing an application that allows children with ADHD to organize their study time entertainingly, reduce their inattention and hyperactivity, and improve their academic and social behavior. By analyzing the content of the application by experts from Al-Zaytoonah University of Jordan from various faculties associated with the study aims and distributing a questionnaire to these trainers, the validity of the research results was validated. The data analysis showed that the application is appropriate for children with ADHD and can help them improve their academic, behavioral, and social skills by managing time and decreasing symptoms associated with ADHD, such as lack of focus and hyperactivity. These results demonstrate the importance of the tools used in this study (the questionnaire) and their effectiveness in showing valid results that can be relied upon to evaluate the application.

It is useful for future studies to compare the application developed in this study with other similar applications designed for children with ADHD by examining how different applications affect the same results. Despite the study's hopeful findings, one of the challenges that may be encountered is some communities' limited access to smartphones or tablets, which impedes widespread adoption and the positive impact of the application.

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