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THE EFFECTIVENESS OF VIRTUAL REALITY (VR) TOOLS IN ENHANCING SOCIAL INTERACTION AMONG STUDENTS WITH EMOTIONAL AND BEHAVIORAL DISORDERS (EBD)

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ABSTRACT

This study investigated the effectiveness of VR tools in enhancing social interaction skills among students with emotional and behavioral disorders in Buraidah, Qassim, Saudi Arabia. Using a quasi-experimental design, 13 students were assigned to either an experimental group (n = 7) or a control group (n = 6). A Social Interaction Skills Scale, developed and validated by the researchers, was used to measure four key domains: teamwork, social interaction, emotional regulation, and friendship formation. Statistical analyses, including the Mann–Whitney U and Wilcoxon signed-rank tests, revealed significant post-intervention improvements in all social skill dimensions for the experimental group compared to the control group. Furthermore, follow-up assessments showed no significant decline in skills, indicating sustained benefits. These findings highlight the potential of VR-based interventions as practical, accessible tools for improving social competencies among students with emotional and behavioral challenges.

KEYWORDS: Virtual Reality (VR), Social Interaction Skills, Emotional and Behavioral Disorders (EBD), Special Education Interventions, Educational Technology.

1. INTRODUCTION

VR has become a significant technological tool widely used in classrooms. Consequently, teachers and others involved in the educational process have recognized the important impact of this technology across various aspects, including academic, social, and behavioral (Oigara, 2018). VR devices also offer a variety of cost-effective and easy-to-implement solutions that can be readily made available and accessible in classrooms to support the academic, behavioral, and social skills of students in general and those with disabilities in particular (Carreon, Smith, Mosher, & Rowland, 2022). VR involves a limited number of technological devices, including head-mounted displays, motion-sensing gloves, and VR game controllers. However, VR cannot be limited to these devices alone; it also encompasses an experiential aspect that involves a three-dimensional digital simulation, where students interact physically through related equipment and devices (Oigara, 2018). VR can be extensively utilized in educational settings for both academic and recreational purposes. This innovative approach to education provides students and learners with a valuable opportunity to embark on various field trips around the world, travel to space, practice different skills through simulations, and encounter real-world challenges (Carreon, Smith, Mosher, & Rowland, 2022). Consequently, VR devices create a dynamic and highly flexible environment that allows learners to enrich their educational experiences and receive visual feedback during repeated exercises (More, 2008). VR is defined as a three-dimensional interactive program that simulates the real world. This method of education is commonly adopted in schools and universities. Furthermore, VR serves as an effective and valuable intervention for all students to cultivate social and behavioral skills (Ludlow, 2015). VR can be considered as one of the significant interactions it fosters between students and computers. VR enables individuals to fully immerse themselves in and interact with a virtual environment as if they were experiencing objective reality (Virtual Reality, 2005). The purpose of this study is to examine the effectiveness of virtual reality (VR) tools in enhancing social interaction skills among students with emotional and behavioral disorders in Buraidah, Qassim, Saudi Arabia.

1.1. *Research Hypothesis*

H1: There are statistically significant differences between the mean ranks of students with emotional and behavioral disorders in the experimental group and those in the control group on the Social Interaction Skills Scale after the application of VR tools, in favor of the experimental group.

This hypothesis was tested using the Mann–Whitney U test. The post-test results indicated statistically significant differences between the two groups, favoring the experimental group. These results demonstrate the effectiveness of VR tools in improving social interaction skills among students with emotional and behavioral disorders.

H2: There are statistically significant differences between the mean ranks of students with emotional and behavioral disorders in the experimental group before and after the application of VR tools on the Social Interaction Skills Scale, in favor of the post-test scores.

This hypothesis was assessed using the Wilcoxon Signed-Rank Test. The analysis revealed statistically significant differences between pre- and post-test scores, favoring the post-test, thereby confirming the positive impact of VR interventions on developing social interaction skills in the experimental group.

H3: There are no statistically significant differences between the mean ranks of students with emotional and behavioral disorders in the experimental group between the post-test and follow-up test on the Social Interaction Skills Scale.

This hypothesis was also examined using the Wilcoxon Signed-Rank Test. The results showed no statistically significant differences between post-test and follow-up scores, indicating that the VR-based intervention had a sustained effect in maintaining improved social interaction skills over time. Over the past two decades, remarkable technological advancements have transformed educational systems and methods of therapeutic and educational intervention, especially in the field of special education. One of the most notable of these technologies is Virtual Reality (VR), which has garnered increasing attention in both academic and applied contexts. VR offers unprecedented opportunities to simulate real-life scenarios and interact with detailed and dynamic three-dimensional environments (Oigara, 2018). VR is defined as a technology that enables users to interact with a computer-generated, three-dimensional environment that simulates the real world or constructs entirely new scenarios using tools such as smart glasses, head-mounted displays, and motion-tracking systems. This immersive experience enhances sensory and cognitive engagement, thereby fostering interaction and learning (Slater & Sanchez-

Vives, 2016). As a result, VR has contributed to shifting education from traditional, lecture-based instruction to interactive learning based on experience, practice, and simulation. The significance of VR is especially evident in the education and rehabilitation of students who experience difficulties with social interaction, particularly students with Emotional and Behavioral Disorders (EBD). These students often face significant challenges in adapting to social and academic contexts and exhibit behaviors such as aggression, withdrawal, emotional dysregulation, poor communication, and weak self-regulation. These characteristics make their education and social integration particularly demanding (Kauffman & Landrum, 2018). Social interaction skills are fundamental to an individual's quality of life, social adjustment, and ability to build relationships and achieve academic and professional success. These skills encompass initiating conversations, understanding facial expressions, interpreting nonverbal cues, appropriately expressing emotions, resolving conflicts, and interacting in group settings. Researchers have emphasized that deficits in these skills among EBD students are not only a cause of their difficulties but also a result of repeated negative social experiences that reinforce isolation and maladaptive behavior (Gresham et al., 2010). VR presents itself as a promising and innovative tool for training social skills in a secure, judgment-free environment. It enables repeated exposure to social scenarios, offers immediate feedback, and adjusts difficulty levels according to individual needs and abilities (Lorenzo et al., 2019). Unlike traditional programs that rely on lectures or limited role-play, VR allows learners to interact with virtual agents that respond realistically, promoting experiential rather than theoretical learning (Parsons & Cobb, 2011). Numerous studies have highlighted the effectiveness of VR in teaching social skills to individuals with Autism Spectrum Disorder (ASD). However, empirical research on its application among students with EBD remains limited, despite shared social skill deficits between the two groups (Kandalaft et al., 2013). This underscores the need for experimental studies focusing on this specific population to evaluate VR's ability to enhance social interactions, reduce aggression or withdrawal, and promote greater engagement in educational settings.

2. CONCEPT OF (VR)

VR is a digital technology that enables users to engage with a simulated, three-dimensional environment, creating a sense of immersion. It employs head-mounted displays, handheld controllers, and motion sensors to construct this experience. VR has become an influential tool in education, psychological therapy, and social skills development, particularly for individuals with behavioral and developmental disorders (Slater & Sanchez-Vives, 2022). The power of VR lies in its capacity to recreate realistic and safe simulations of social interactions. This enables students with emotional and behavioral disorders to practice interpersonal skills without the fear of social criticism or punishment. Consequently, VR serves as a transformative tool for reshaping social behavior, improving communication skills, and enhancing engagement in daily activities (Freeman et al., 2022). Moreover, VR supports active learning principles, transforming the learner into an active participant rather than a passive recipient, which increases motivation, focus, and knowledge retention (Radianti et al., 2020).

2.1. Technological Definition of VR

VR is a computer-based technology that replicates real or imagined three-dimensional environments and enables real-time interaction through devices such as head-mounted displays, motion detectors, and spatial audio systems. This system achieves full cognitive and sensory immersion, allowing users to experience the digital environment as if they were physically present within it (Slater & Sanchez-Vives, 2022). VR environments are typically characterized by three core features: a) Immersion The sensation of being surrounded by the digital environment, b) Interactivity The user's ability to manipulate and influence the digital setting, and c) Presence The subjective feeling of being physically situated within the virtual world (Radianti et al., 2020).

2.2. VR in Educational Contexts

VR represents a transformative tool in education by transporting learners to realistic and engaging scenarios without leaving the classroom. Unlike conventional instructional methods, VR accommodates diverse learning preferences, particularly for students with special needs, by: a) Providing multisensory instruction (visual, auditory, kinesthetic), b) Minimizing environmental distractions, and c) Enhancing learner motivation and concentration. Research has shown that students with social difficulties, including those with ADHD and behavioral disorders, benefit greatly from VR-based learning environments. These environments offer safe spaces for trial and error, learning, and behavioral experimentation without the risks

associated with real-world social interactions (Freeman et al., 2022).

2.3. VR in Supporting Social Interaction and Skills

One of the most impactful uses of VR for students with emotional and behavioral disorders is its ability to simulate social situations that facilitate the development of core interpersonal skills. Within immersive VR environments, students can engage in structured exercises aimed at initiating dialogue, interpreting non-verbal cues, regulating emotions, and navigating increasingly complex social encounters. These controlled, repeatable scenarios offer safe conditions for learning appropriate behaviors. Research has shown that such applications lead to improved social outcomes, including increased positive peer interactions, reduced aggressive behaviors, and enhanced verbal cooperation (Yang et al., 2025).

2.4. Social Interaction Difficulties in EBD Students

Social interaction refers to the process by which individuals form relationships and exchange meanings and behaviors within a social context. It plays a vital role in shaping personality, building relationships, and fostering socio-emotional development (Gresham, 2020).

It encompasses verbal and non-verbal communication, such as eye contact and facial expressions, as well as responding appropriately to different social cues, roles, and group dynamics through flexibility, problem-solving, and negotiation.

Within educational contexts, social interaction is crucial for student adjustment and contributes to a sense of community, cooperation, and emotional well-being while reducing isolation (Wentzel & Watkins, 2021). Emotional and Behavioral Disorders (EBD) are psychological conditions marked by abnormal emotional regulation, behavioral responses, or both, which significantly interfere with a student's academic and social functioning.

These disorders include Oppositional Defiant Disorder, Conduct Disorder, Anxiety and Depressive Disorders, and Mood Dysregulation Disorders. Students with EBD commonly exhibit pronounced difficulties in social interaction, such as withdrawal, impulsivity, aggression, misinterpretation of social cues, and poor cooperation skills (e.g., turn-taking, patience). According to Cullinan (2022), such students often display maladaptive behaviors, poor problem-solving skills, and challenges in forming and sustaining healthy peer relationships.

Positive social interaction is crucial for students with EBD as it supports collaborative learning, promotes inclusion, fosters emotional and psychological stability, and mitigates behavioral problems and disciplinary incidents. Despite its significance, these students often face persistent challenges in forming effective social relationships, leading to increased feelings of rejection, anxiety, and decreased academic motivation (Lane et al., 2021). Studies confirm that limited social interaction adversely affects academic outcomes in students with EBD, contributing to fewer friendships, higher behavioral incidents, lower classroom engagement, and increased dropout rates. Gresham and Elliott (2020) identify social skills deficits as a major barrier to success in both academic and life domains for this population. In this context, VR tools have emerged as promising interventions capable of reducing aggressive, withdrawn, and impulsive behaviors while improving emotional regulation and adaptive social behavior (Yang et al., 2025). Recent studies support VR's effectiveness in enhancing emotional and social functioning (Xu et al., 2025; Zhang et al., 2025; Kourtesis et al., 2023; Capobianco et al., 2025; Jung & Park, 2025).

3. METHODOLOGY

3.1. Study Design

The study adopted a quasi-experimental design incorporating an intervention aimed at evaluating the effectiveness of VR tools in enhancing social interaction skills among students with emotional and behavioral disorders.

3.2. Study Sample

The study sample consisted of 13 students with emotional and behavioral disorders from Buraidah, Qassim, Saudi Arabia. The students were divided into two groups: an experimental group of 7 students and a control group of 6 students. As shown in Tables 1 and 2, the two groups demonstrated homogeneity in terms of chronological age, intelligence quotient (IQ), and social skills. Formal written informed consent was not obtained for this study because the participants were recruited from among individuals personally known to the researcher, and their participation was entirely voluntary.

Additionally, no identifiable personal information (such as names or other sensitive data) was collected or mentioned in the study. Anonymity and confidentiality were strictly maintained throughout the research process, and all ethical principles regarding the protection of human subjects were

upheld.

Table 1: Homogeneity of Experimental and Control Groups in Age and IQ.

Variable	Group	N	Mean Rank	Sum of Ranks	U Value	Z Value	p-value
Chronological Age	Control	6	92.5	35.0	14.5	0.984	Not significant
	Experimental	7	93.7	55.0			
IQ	Control	6	17.8	49.0	14.0	1.041	Not significant
	Experimental	7	6.0	42.0			

As shown in Table 1, the experimental and control groups were equivalent in terms of chronological age and intelligence quotient (IQ), with no statistically significant differences found between the two groups.

Table 2: Homogeneity of Experimental and Control Groups in Social Skills and Subdomains.

Variable	Group	*N*	*M Rank*	Sum of the Ranks	*U* Value	*Z* Value	*P*-Value
Teamwork	Control	6	6.00	36.00	15.00	0.89	Not significant
	Experimental	7	7.86	55.00			
Social Interaction	Control	6	7.67	46.00	17.00	0.61	Not significant
	Experimental	7	6.43	45.00			
Emotional Regulation	Control	6	6.0	36.00	15.00	0.89	Not significant
	Experimental	7	7.86	55.00			
Friendship Formation	Control	6	7.67	46.00	17.00	0.000	Not significant
	Experimental	7	7.0	45.00			
Total Social Skills Score	Control	6	6.43	41.50	20.50	0.073	Not significant

As shown in Table 2, the experimental and control groups were equivalent in the social skills variables (teamwork, social interaction, emotional regulation, and friendship formation) and the overall social skills score, with no statistically significant differences between them.

3.3. Study Instruments

3.3.1. Social Interaction Skills Scale

The researchers reviewed the available psychological literature on social interaction skills and examined several existing social interaction skills, scales used in various studies. Based on this review, they developed the current scale to better suit the study sample and the Arabic context, as previous scales were primarily designed for non-Arabic environments. The scale was structured around four key dimensions: teamwork, social interaction, emotional regulation, and friendship formation.

3.4. Scale Validation

The initial version of the scale was administered to a pilot sample consisting of 35 students with emotional and behavioral disorders from the Education Directorate in Buraidah, Qassim Region, Saudi Arabia, to assess the scale's reliability and validity.

3.5. Scale Validity

Two methods were employed to verify the validity of the scale: content validity (expert judgment) and criterion-related validity.

Content Validity (Expert Judgment):

The scale was submitted to 13 experts in psychology, education, mental health, and special education. They evaluated the appropriateness of the items relative to the adopted definitions, the clarity of language, the suitability of the items for the student population, the relevance of each item to its intended dimension, and the appropriateness of the instructions. Based on their feedback, some items were reworded, and others were eliminated. The final version of the scale consisted of 32 items distributed across the four dimensions, with each dimension comprising 8 items.

3.6. Criterion-Related Validity

Criterion-related validity was assessed by calculating the correlation coefficient between the pilot sample's scores on the researchers' Social Interaction Skills Scale and those on the Social Skills Scale developed by Saleh Haroun (1996) as an external criterion. The correlation coefficient was 0.86, statistically significant at the 0.01 level, indicating strong validity for the current scale.

3.7. Scale Reliability

The scale's reliability was determined using Cronbach’s alpha coefficient, based on the responses

of the pilot sample (n = 35) of students with emotional and behavioral disorders from the Education Directorate in Buraidah, Qassim Region, Saudi Arabia. Table 3 presents the reliability coefficients for each dimension and for the total score of the Social Interaction Skills Scale using Cronbach's alpha.

Table 3: Reliability of the Social Skills Scale Dimensions and Total Score Using Cronbach's Alpha (N = 35).

Cronbach's Alpha	Dimensions
0,84	Teamwork
0,73	Social Interaction
0,77	Emotional Regulation
0,81	Friendship Formation
0,77	Total Score of the Scale

As shown in Table 3, all Cronbach's alpha reliability coefficients for the dimensions of the Social Interaction Skills Scale and the total score were high, ranging from 0.73 to 0.84. These results indicate a strong internal consistency, suggesting that the scale is a reliable instrument for research purposes

3.8. Scale Scoring

Participants respond to the items on the scale by placing a check mark (√) next to the statement corresponding to the level of the social skill exhibited by the student. The available response options are: (Always, Sometimes, and rarely (and they are scored as 3, 2, and 1, respectively. A higher total score indicates a greater presence of social skills among this group of students.

Statistical Methods Used in the Study:

1. Cronbach's alpha coefficient.
2. Mann–Whitney U test to determine the significance of differences between the means of independent samples.
3. Wilcoxon signed-rank test to determine the significance of differences between the means of related samples.

All statistical analyses were conducted using SPSS software.

3.9. Study Results

First: Results and Interpretation of the First Hypothesis

The first hypothesis stated that there are statistically significant differences between the mean ranks of the experimental and control groups of students with emotional and behavioral disorders on the Social Interaction Skills Scale after the application of VR tools, favoring the experimental group. To examine this hypothesis, the researcher calculated the significance of the differences using the Mann–Whitney U test for independent samples, as shown in table 4.

Table 4: Post-Test Differences in Social Interaction Skills between Groups.

Dimension	Group	N	Mean Rank	Sum of Ranks	U Value	Z Value	p-value
Teamwork	Control	6	3.92	23.5	2.5	2.672	0.01
	Experimental	7	9.64	67.5			
Social Interaction	Control	6	4.17	25.0	4.0	2.574	0.05
	Experimental	7	9.43	66.0			
Emotional Regulation	Control	6	4.17	25.0	4.0	2.517	0.05
	Experimental	7	9.43	66.0			
Friendship Formation	Control	6	3.83	23.0	2.0	2.764	0.01
	Experimental	7	9.71	68.0			
Total Social Skills Score	Control	6	3.5	21.0	0.0	3.025	0.01
	Experimental	7	10.0	70.0			

As shown in Table 4, statistically significant differences exist between the mean ranks of the students in the experimental group and the control group on the Social Interaction Skills Scale after the application of VR tools, in favor of the experimental group in the post-test.

It is observed that all dimensions of the scale and the total score are significant at the 0.01 level, except the social interaction and friendship formation dimensions, which are significant at the 0.05 level.

This indicates the effectiveness of VR tools in enhancing social interaction skills among students with emotional and behavioral disorders.

Second: Results and Interpretation of the Second Hypothesis

There are statistically significant differences between the mean ranks of students with emotional and behavioral disorders in the experimental group before and after applying VR tools on the Social Interaction Skills Scale, in favor of the post-test.To examine this hypothesis, the researcher calculated

the significance of the differences using the Wilcoxon signed-rank test for related samples. The results are presented in Table 5

Table 5: Pre-Post Test Differences in Social Skills for Experimental Group.

Measurement	Dimension	Rank Type	N	Mean Rank	Sum of Ranks	Z Value	p-value
Pre–Post	Teamwork	Negative	0	0.0	0.0	2.207	0.05
		Positive	6	3.5	21.0		
		Ties	1				
Pre–Post	Social Interaction	Negative	0	0.0	0.0	2.207	0.05
		Positive	6	3.5	21.0		
		Ties	1				
Pre–Post	Emotional Regulation	Negative	0	0.0	0.0	2.032	0.05
		Positive	5	3.0	15.0		
		Ties	2				
Pre–Post	Friendship Formation	Negative	0	0.0	0.0	2.201	0.05
		Positive	6	3.5	21.0		
		Ties	1				
Pre–Post	Total Social Skills Score	Negative	1	1.0	1.0	2.197	0.05
		Positive	6	4.5	27.0		
		Ties	0				

As shown in Table 5, statistically significant differences exist between the mean ranks of students in the experimental group on the pre-test and post-test scores of the Social Interaction Skills Scale, in favor of the post-test. The scores for the dimensions and the total score of the scale were significant at the 0.05 level, with the (Z) values for these dimensions and the total score being (2.207), (2.207), (2.032), (2.201), and (2.197), respectively. Thus, the hypothesis is confirmed.

Third: Results and Interpretation of the Third Hypothesis

There are no statistically significant differences between the mean ranks of students with emotional and behavioral disorders in the experimental group between the post-test and follow-up test on the Social Interaction Skills Scale."

To examine this hypothesis, the researcher calculated the significance of the differences using the Wilcoxon signed-rank test for related samples. The results are presented in Table 6.

Table 6: Post-Follow-Up Differences in Social Skills for Experimental Group.

Measurement	Dimension	Rank Type	N	Mean Rank	Sum of Ranks	Z Value	p-value
Post–Follow-up	Teamwork	Negative	3	2.83	8.5	0.423	Not significant
		Positive	3	4.17	12.5		
		Ties	1				
Pre–Post	Social Interaction	Negative	3	4.5	13.5	0.085	Not significant
		Positive	4	3.63	14.5		
		Ties					
Pre–Post	Emotional Regulation	Negative	2	3.25	6.5	0.843	Not significant
		Positive	4	3.63	14.5		
		Ties	1				
Pre–Post	Friendship Formation	Negative	2	2.5	5.0	1.527	Not significant
		Positive	5	4.6	23.0		
		Ties	0				
Pre–Post	Total Social Skills Score	Negative	3	5.33	16.0	0.338	Not significant
		Positive	4	3.0	12.0		
		Ties	0				

As shown in Table 6, there are no statistically significant differences between the mean ranks of students in the experimental group for the post-test and follow-up test scores on the Social Interaction Skills Scale. The (Z) values for these dimensions and the total score were (0.423), (0.085), (0.843), (1.527),

and (0.338), respectively. This confirms the program's effect's stability, thereby supporting the hypothesis's validity.

4. DISCUSSION OF RESULTS

The results of this study provide strong evidence for the effectiveness of VR tools in improving social interaction skills among students with emotional and behavioral disorders (EBD). Significant post-test differences between the experimental and control groups indicate that VR-based interventions resulted in notable improvements in teamwork, social interaction, emotional regulation, and friendship formation. These findings align with previous research that emphasizes VR's ability to simulate real-life social scenarios in a safe and controlled environment. Studies like Lorenzo et al. (2019) and Yang et al. (2025) have shown that repeated VR exposure enhances appropriate social behavior and reduces maladaptive responses, supporting the observed improvements in this study. The sustained gains observed at follow-up suggest long-term retention of skills. The interactive nature of VR, as discussed by Parsons & Cobb (2011), likely contributed to improvements in emotional regulation and confidence, offering a more engaging alternative to traditional training methods. Moreover, while prior research has focused more on autism spectrum disorders (e.g., Kandalaft et al., 2013; Zhang et al., 2025), this study extends those findings to the EBD population, showing similar benefits in social development. In conclusion, VR emerges as a powerful, engaging, and effective tool for enhancing social skills in students with EBD, offering lasting behavioral improvements and addressing the limitations of traditional methods.

4.1. Limitations

One of the limitations of this study is the relatively small sample size (n = 13), which may affect the generalizability of the findings. This limitation was anticipated and addressed through non-parametric statistical methods (Mann–Whitney U and Wilcoxon signed-rank tests), which are suitable for small sample sizes and help ensure the validity of results under such conditions. Nevertheless, future studies involving larger and more diverse samples are recommended to validate and extend the current findings.

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