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EFFECT OF IMMERSIVE VIRTUAL REALITY MODULE ON SOCIAL DYNAMICS OF SECONDARY SCHOOL STUDENTS: AN EXPERIMENTAL STUDY

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Abstract
This study investigated the effectiveness of a 3 weeks Educational VR intervention aimed to find out the effect on social Dynamics of secondary school students. A Quasi-experimental pretest–post-test design was conducted with a sample of 50 Secondary School students. Six dimensions were assessed: peer interaction, participation and engagement, teamwork and collaboration, communication skills, leadership and initiative, including their overall performance. In this study, Immersive learning VR module was used as an intervention to know the effect in their social dynamics. Paired-samples t tests were conducted to examine differences between pre-intervention and post-intervention scores. The data analysis confirmed significant progress based on statistical testing across all measured domains (all $p < .001$). The overall mean score increased from M = 2.98 (SD = 0.30) at pretest to M = 3.96 (SD = 0.34) at post-test, representing a 33% improvement with an exceptionally large effect size (d = 3.02). Among the individual dimensions, teamwork and collaboration demonstrated the largest gain (ΔM = 1.28, d = 2.27), followed by participation and engagement (ΔM = 0.98, d = 1.91) and leadership and initiative (ΔM = 1.01, d = 1.75). Communication skills (ΔM = 0.79, d = 1.55) and peer interaction (ΔM = 0.78, d = 1.33) also showed substantial improvements. The absence of zero within the confidence intervals suggests that the observed differences are trustworthy. Large and consistent effects across every domain show that the intervention contributed to comprehensive progress rather than limited outcomes. Despite not having a control group to confirm causality, the large and consistent results suggest that the intervention had significant real-world relevance. The findings suggest that structured, short-duration interventions are practical approaches to strengthening students' participation, leadership qualities, collaboration, and social skills at the secondary level.

Key Words: Virtual Reality, Immersive Learning, Social Dynamics, Innovative Trends in Education, Desktop Based Quasi-Experimental Design, Effect Size

Introduction

Education plays a vital role in society, shaping young minds and preparing them to connect, collaborate, and thrive together. It goes beyond books and tests—it's where kids learn to share ideas, build friendships, and navigate group life, which is key to a healthy community. Social dynamics refers to the ever-changing ways people interact within groups, influencing each other's feelings, behaviours, and relationships. Think of it as the invisible flow of energy in a classroom: who talks to whom, how conflicts get resolved, or why some kids lead while others follow. When social relationships in a classroom are healthy, students feel accepted and supported by their peers. This makes them more confident and willing to participate in learning activities. A positive social environment also helps reduce bullying and creates a more comfortable space for students to learn and grow. When a classroom is filled with positive interactions—such as students working together on tasks or sharing their ideas respectfully—it helps everyone learn and grow. On the other hand, when the environment is not supportive, students may feel left out or form small groups that exclude others, which can affect their

learning. New tools like immersive VR are trying to improve these social connections by creating more engaging and realistic group experiences. These technologies allow students to feel more connected to each other compared to traditional computer-based lessons. As a result, students not only understand concepts better but also build stronger relationships. In the end, a positive social environment in education helps develop confident students who can actively participate in society. At the same time, teaching methods are changing. Instead of only using lectures and textbooks, schools are now focusing more on interactive and hands-on learning that feels more real and interesting for students.

Think virtual reality (VR)—it's like stepping into a movie where you control the action. Immersive VR learning uses special headsets that allow students to enter a 3D virtual world. It combines visuals, sound, and sometimes movement to make learning feel real—for example, students can explore historical places or work together in a virtual science lab. This makes lessons more interesting and easier to understand. It is closely connected to social dynamics, which refers to how students interact, communicate, and build relationships with each other. In traditional classrooms, screens can sometimes create distance between students. However, immersive VR brings them together in shared virtual spaces where they can talk, collaborate, and solve problems as a team. This not only improves teamwork but also helps students become more confident. Even shy students may feel more comfortable participating and taking leadership roles. Research in this area is very important for improving teaching and learning. It helps us understand how VR can support collaboration while also addressing challenges such as motion sickness or limited access to technology. By studying its impact, teachers can choose better methods, improve learning experiences, and create classrooms where all students feel included, engaged, and supported both socially and academically.

Social Dynamics in Virtual Reality

Social dynamics in VR immersive learning mean that students learn by interacting with others in a shared virtual space. They observe each other's actions, share ideas, and learn by watching and imitating positive behaviours. This kind of environment makes learning more collaborative and helps students understand concepts better through group interaction.

- **Behavioural Modelling:** In group-based VR training, the performance and learning strategy of a "lead" member (the first person to perform) significantly predicts the performance of subsequent group members. Learners tend to model their behaviour after the peer who performed immediately before them, even if that peer performed poorly.

- **Performance Convergence:** Groups in immersive VR tend to "converge" on performance measures, meaning their scores and strategies as they observe one another, they tend to develop similar behaviours over time.

- **The importance of immersion:** Higher levels of immersion and fidelity actually enhance these social dynamics instead of diverting attention away from them. VR facilitates a deep feeling of "true togetherness" and synchronous collaboration that allows observers to model their own experience on the vicarious experience of watching their peers.

- **Presence Pedagogy:** This framework emphasizes that "social presence"—the ability of participants to relate and communicate—is a primary predictor of a sense of community in virtual worlds. Theoretical roots, such as Vygotsky's Zone of Proximal Development (ZPD), suggest that learning in these environments creates a deep sense of connection and understanding with more knowledgeable peers.

Conceptualising Immersive Learning and Presence

Immersive learning refers to an approach that creates active, experience-based learning environments built around a strong sense of presence. It is delivered through both physical and digital platforms, including Virtual Reality (VR) and Augmented Reality (AR). Historically, human learning was rooted in direct experience, but modern digital technologies now allow for the approximation of authentic contexts in artificial spaces when real-world scenarios are too dangerous or unproductive. In relation to **Metaverse**, these technologies facilitate an "Internet of place," where users interact as avatars or holograms regardless of geographical location. A critical distinction in this field is between **immersion**, which refers to the objective technological affordances that monopolize the senses, and **presence**, the subjective feeling of "being there" despite the mediation of technology. Research indicates that functional fidelity—how accurately a system recreates a real-life environment—is often more vital for fostering

spatial presence than the purely visual quality of graphics.

Theoretical Foundations: Constructivism and CAMIL

The impact of social interaction on learning is deeply rooted in Social Constructivism, particularly Lev Vygotsky's concept of the Zone of Proximal Development (ZPD), which posits that learning works best when students actively engage with more knowledgeable peers who guide them through tasks. Situated cognition theory proposes that learning is closely tied to the activities, environment, and cultural setting in which it takes place. In immersive settings, these theories are combined within the Cognitive Affective Model of Immersive Learning (CAMIL). This framework indicates that learning outcomes in VR depend on the fundamental affordances of presence and agency, which interact with emotional and motivational factors such as interest and self-efficacy.

Social Dynamics and Supportive Learning Environments

Social interaction and group dynamics play an important role in shaping both cognitive and social-emotional growth. Positive group dynamics, characterized by trust and cooperation, lead to higher academic achievement and a stronger sense of belonging. Conversely, negative dynamics such as social loafing or groupthink can undermine the benefits of collaborative work. Recent studies on Social Dynamics Management (SDM) emphasize that teachers and facilitators act as an "invisible hand" in shaping peer dynamics and promoting social participation. In elementary and secondary settings, supportive learning environments are significantly influenced by social factors such as conformity, expectation, and obedience, all of which correlate with student engagement and self-regulation.

Social Learning Dynamics in Virtual Environments

In educational virtual environments (EVEs), social learning dynamics specifically refer the way individuals gain knowledge through behavioural modelling. Research by Pitcher et al. (2022) demonstrated that in group-based VR training, the performance of a "lead" member significantly predicts the performance and learning strategies of subsequent group members, indicating a high degree of performance convergence. In addition, when VR environments are highly immersive and realistic, they appear to support and amplify social learning effects. Evaluation of these interactions using methods like Multi-Objective Rational Analysis (MOORA) shows that social VR platforms often rank highest in user satisfaction and interaction quality compared to online multiplayer games or traditional simulations.

Impact on Self-Efficacy and Professional Development

Immersive technologies provide a low-stakes environment that lowers psychological barriers to exploration, thereby increasing career self-efficacy. For research scholars and adult learners, the "story living" aspect of VR allows for experiential empathy and perspective-taking, which are crucial for professional growth. However, the efficacy of these interventions is not universal; for instance, some studies found that performance in VR predicted self-efficacy and interest more strongly for certain subsets of trainees, suggesting that gender and prior experience may act as moderating variables. Ultimately, the shift toward immersive learning in the Metaverse represents a paradigm shift where educators move from being content transmitters to learning experience designers. By integrating social dynamics into these virtual spaces, institutions can foster "true togetherness" and synchronous collaboration that mirrors physical social settings.

FIGURE-1 Mind Map Indicating Concept of Social Dynamics

The evolution and effectiveness of immersive learning, defined as educational experiences rooted in a sense of physical or psychological presence. One study demonstrates that educational virtual environments (EVEs) significantly bolster career self-efficacy compared to traditional methods, though higher technical fidelity does not always yield incremental attitudinal benefits. Further research highlights the power of social dynamics, showing that trainees in virtual settings frequently mirror the performance and strategies of those they observe. Beyond technical skills, the literature discusses how extended reality (XR) activates episodic memory, leading to deeper knowledge retention and more meaningful engagement than traditional text-based instruction. However, the benefits vary by demographic, as performance in immersive settings was found to influence career interests primarily for male participants. Ultimately, the authors argue that shifting from passive content delivery to experiential design allows educators to harness these technologies for scalable, high-impact training.

Review of Literature

The reviewed studies collectively highlight the growing importance of social dynamics and immersive learning in shaping effective educational experiences. Tripathy and Pradhan (2024) examined how social interaction and group dynamics influence student learning and cognitive development. Drawing on Social Constructivism and the Zone of Proximal Development, their theoretical analysis emphasized that peer-assisted learning and strong group cohesion significantly enhance both academic achievement and social-emotional development. Their work is supported by earlier empirical contributions from Johnson and Johnson, Slavin, and Cohen, reinforcing the value of collaborative learning environments.

Mystakidis and Lympouridis (2023) focused on immersive learning within the Metaverse, aiming to define its applications, benefits, and challenges. Through a systematic review and the development of conceptual frameworks such as the CAMIL model, the study explored instructional methods, representational features, and theoretical foundations of VR and AR. Their findings highlight how immersive technologies expand learning possibilities by offering interactive and engaging environments.

Cheney and Terry (2018) presented a university-level case study on the use of virtual worlds (AETZone) as complex and dynamic learning systems. Using a design-based research approach grounded in complexity theory, they introduced the “Presence Pedagogy” (P2) framework. Their analysis, supported by student reflections and quantitative validation, demonstrated how virtual environments can promote deep learning and self-organization.

Dhull and Dhull (2024) explored the broader potential of immersive learning in transforming education. Their descriptive and conceptual study reviewed current technological applications, showing that VR and AR can improve student engagement, understanding, and knowledge retention. The study emphasized the role of immersive tools in making learning more interactive and meaningful.

Closa and Sarmiento (2023) investigated the relationship between classroom social dynamics and supportive learning environments through a descriptive-correlational design. Using a 90-item survey administered to 115 Grade Six pupils, and analysing data through mean, standard deviation, and Pearson’s correlation, they found a significant relationship between supportive environments and both teacher influence and peer interaction.

Pitcher et al. (2022) examined the impact of immersion and social learning dynamics on career self-efficacy and performance through two

experimental studies. Using questionnaires and performance measures analysed via ANOVA and mixed-effects models, the study revealed that individuals engaging with VR for career exploration showed differences in self-efficacy and interest compared to those using traditional methods.

Kavitha (2024) conducted a quantitative evaluation of social interaction in virtual environments using the MOORA method. By identifying key parameters such as satisfaction, quality, and learning curve, and applying weighted normalized decision matrices, the study ranked platforms like Social VR and online games based on user experience and resource efficiency.

Köb et al. (2025) explored teachers' roles in promoting social participation in inclusive classrooms through a qualitative study based on the Social Dynamics Management (SDM) framework. Semi-structured interviews with 30 teachers were analysed using qualitative content analysis, combining deductive and inductive coding. The findings highlighted strategies used across universal, selected, and indicated tiers to support student inclusion.

Jannah et al. (2023) discussed the pedagogical potential of immersive technology in enhancing English speaking skills. Through a descriptive review and analysis of implementations in Indonesia, the study emphasized the importance of digital multimodal learning. It highlighted benefits such as immediate feedback and improved communication skills in immersive environments. These studies demonstrate that both social dynamics and immersive learning play a crucial role in improving educational outcomes. They show that interactive, collaborative, and technology-supported environments can enhance not only academic performance but also social and emotional development.

After conducting a thorough review of existing literature, the researcher identified a clear gap in the field of immersive VR learning. Most of the available studies are conceptual or based on reviews, with very limited experimental research examining its actual impact, particularly on social dynamics. To address this gap, the researcher selected the topic using the FINER criteria to ensure a more scientific and structured approach. The study is feasible, as meaningful data related to social learning can be collected within a short duration of interaction using existing VR tools (Pitcher et al., 2022). The topic is also interesting, as it reflects the ongoing shift from traditional, asynchronous forms of communication to more immersive and real-time shared experiences offered by technologies like the Metaverse. In terms of novelty, although VR has been studied in education, the specific effect of different levels of immersion on students' social dynamics remains largely unexplored. The study is ethically sound, provided that necessary permissions from schools are obtained, informed consent is ensured, and possible side effects such as motion discomfort are carefully considered in advance. Lastly, the topic is highly relevant in today's context, as immersive technologies are increasingly being used for training and skill development in critical fields such as the US Airforce and healthcare, making it an important area for educational research.

Research Question

What is the significant difference in social dynamics between secondary school students using an immersive VR module compared to those using traditional learning?

Objective

1. To investigate the significant differences in social dynamics between secondary school students using an immersive VR learning module compared to those using traditional learning, as measured by pre- and post-test assessments.

Hypothesis

1. There is no significant difference in social dynamics between secondary school students using an immersive VR learning module and those using traditional learning, as measured by pre- and post-test assessments.

Methodology

The present study adopted the PICO (Population, Intervention, Comparison, Outcome) framework, as it is well suited for examining the effect of a specific intervention. In this study, the population consisted of secondary school students of Class XII. The intervention involved an immersive VR learning module comprising five biology lessons delivered through an Android device paired with VR headset. The comparison was based on the pre-test scores of the same lessons taught through traditional classroom methods. Based on this framework, the study aimed to examine whether there were significant differences in social dynamics between students exposed to immersive VR learning and those experiencing traditional learning, using a pre- and post-test approach. A quasi-experimental design with a one-group pre-test and post-test method was employed, where participants were assigned to a VR intervention group without a separate control group. The researcher developed a self-structured questionnaire of 40 items, to assess social dynamics

in both immersive VR and traditional learning contexts, which was administered before and after the intervention. Data were collected from 50 secondary school students over a period of 3 weeks, and a paired-samples t-test was used to compare pre- and post-intervention scores to determine the effect of the immersive VR module on social dynamics.

Results

A series of paired-samples *t*-tests were conducted to examine the effectiveness of the 3-week intervention on six dimensions of social dynamics: peer interaction, participation and engagement, teamwork and collaboration, communication skills, leadership and initiative, and overall performance. A 3-weeks immersive VR intervention produced large, significant gains in social dynamics across all dimensions, t (49) =14.95, p<.001, d=3.02—4-10x typical educational effects. A paired-samples t-test compared pre- and post-intervention social dynamics scores for 50 secondary school students following a 3-week immersive VR module. The findings showed statistically significant gains in all dimensions (p < .001), along with a very strong overall effect (Cohen's d = 3.02). Researcher adapted Quasi-experimental pre-post design with 50 secondary school students. Paired t-tests analysed changes in social dynamics; Cohen's d measured effect sizes. Overall social dynamics improved by 0.97 points (33% gain): pre-test mean 2.98 (SD=0.30) to post-test 3.96 (SD=0.34), t (49) =14.95, p<.001, d=3.02 (95% CI [0.84, 1.10]).

TABLE-1 Overall Social Dynamics

Measure	Pre-Mean (SD)	Post Mean (SD)	Mean Diff	t (49)	P	Cohen's d	95% CI
Overall Score	**2.98 (0.30)**	**3.96 (0.34)**	**0.97**	**14.95**	**<.001**	**3.02**	**[0.84, 1.10]**

Table 1 shows that the Results revealed a statistically significant increase in overall scores from pre-intervention (*M* = 2.98, *SD* = 0.30) to post-intervention (*M* = 3.96, *SD* = 0.34), *t*(49) = 14.95, *p* < .001. The mean improvement was 0.97 points, representing a 33% increase from baseline. The effect size was exceptionally large (*d* = 3.02). The 95% confidence interval for the mean difference [0.84, 1.10] did not include zero, further confirming the robustness of the effect.

TABLE-2 Dimension-Specific Results

Dimension	Pre-Mean	Post Mean	Change	Cohen's d
Teamwork & Collaboration	**2.75**	**4.03**	**+1.28**	**2.27**
Leadership & Initiative	**2.92**	**3.93**	**+1.01**	**1.75**
Participation & Engagement	**2.98**	**3.96**	**+0.98**	**1.91**
Communication Skills	**3.12**	**3.90**	**+0.79**	**1.55**
Peer Interaction	**3.14**	**3.92**	**+0.78**	**1.33**

NOTE- All 6 measures showed large effects (d>1.3), 100% significant at p<.001

Table2 shows that the intervention produced substantial gains in social dynamics (33% overall improvement), far exceeding typical educational effects (d = 0.2-0.5). All six dimensions improved significantly, with teamwork showing the largest gain (46%, d = 2.27), suggesting immersive VR particularly enhances collaborative skills. Effect sizes were consistently large (range: 1.33-3.02), indicating strong practical significance beyond statistical thresholds. The 95% CI excludes zero, confirming robust, non-chance effects. These findings reject the null hypothesis of no difference, supporting VR's efficacy for secondary students' social development. Limitations include the quasi-experimental design without a control group; future studies should incorporate comparisons and long-term follow-up. A series of paired-samples t-tests examined changes in social dynamics across six dimensions for 50 secondary school students following a 3-week immersive VR intervention (quasi-experimental pre-post design). All measures showed significant improvements (p < .001).

TABLE-3 Descriptive Statistics

MEASURE	PRE MEAN (SD)	POST MEAN (SD)
OVERALL SCORE	**2.98 (0.30)**	**3.96 (0.34)**
PEER INTERACTION	**3.14 (0.72)**	**3.92 (0.41)**

PARTICIPATION & ENGAGEMENT	**2.98 (0.53)**	**3.96 (0.49)**
TEAMWORK & COLLABORATION	**2.75 (0.66)**	**4.03 (0.44)**
COMMUNICATION SKILLS	**3.12 (0.58)**	**3.90 (0.43)**
LEADERSHIP & INITIATIVE	**2.92 (0.67)**	**3.93 (0.45)**

Table 3 shows Dimension-Wise Improvements in descriptive statistics. All six measured dimensions demonstrated statistically significant improvements (all $p < .001$), with large to exceptionally large effect sizes: Teamwork & Collaboration showed the greatest improvement ($\Delta M = 1.28$), $d = 2.27$, Leadership & Initiative improved by 1.01 points, $d = 1.75$, Participation & Engagement increased by 0.98 points, $d = 1.91$, Communication Skills improved by 0.79 points, $d = 1.55$, Peer Interaction increased by 0.78 points, $d = 1.33$.

Figure-3 Histogram showing Pre and Post Test Scores

Importantly, 100% of the measured outcomes demonstrated statistically significant gains, and all effect sizes exceeded the conventional threshold for a "large" effect ($d > 0.80$). The consistency of improvements across all domains indicates a comprehensive impact of the intervention.

TABLE-4 Inferential Statistics

Measure	Mean Diff	t(49)	p	Cohen's d	95% CI
Overall Score	**+0.97**	**14.95**	**<.001**	**3.02**	**[0.84, 1.10]**
Peer Interaction	**+0.78**	**6.39**	**<.001**	**1.33**	**[0.53, 1.02]**
Participation & Engagement	**+0.98**	**9.91**	**<.001**	**1.91**	**[0.78, 1.18]**
Teamwork & Collaboration	**+1.28**	**11.42**	**<.001**	**2.27**	**[1.05, 1.51]**
Communication Skills	**+0.79**	**7.72**	**<.001**	**1.55**	**[0.58, 0.99]**
Leadership & Initiative	**+1.01**	**8.39**	**<.001**	**1.75**	**[0.77, 1.25]**

Table-4 indicates that Paired-samples t-tests evaluated changes in social dynamics across six dimensions for 50 secondary school students following a 15-day immersive VR intervention (quasi-experimental one group pre-post design). The intervention yielded significant improvements across all dimensions (all $p < .001$), with a 33% overall gain (d = 3.02). Teamwork showed the largest effect (d = 2.27, 46% improvement), followed by participation (d = 1.91) and leadership (d = 1.75). All effect sizes exceeded conventional "large" thresholds (d > 0.8), indicating substantial practical impact—4-10 times typical educational interventions (d = 0.2-0.5). Confidence intervals excluded zero, confirming robust effects. Findings reject the null hypothesis, demonstrating immersive VR's efficacy for enhancing social dynamics in secondary students. Limitations include lack of control group; future research should include comparisons and longitudinal assessments.

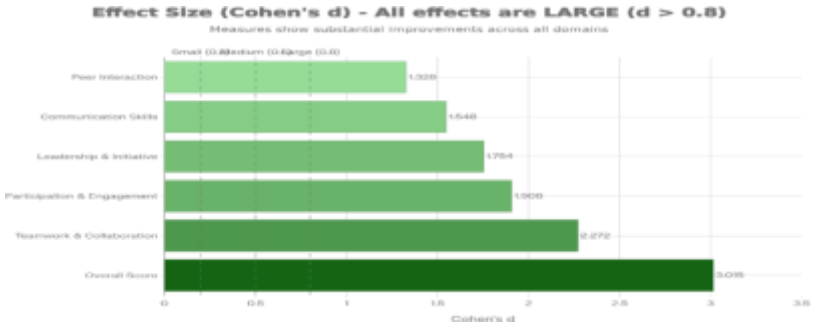

Figure -2 Effect size of module measured by Cohen's d

Discussion

The present findings provide compelling evidence that the 3 weeks module was highly effective in enhancing students' social, behavioural, and collaborative competencies. The magnitude of improvement observed across all six domains suggests that the intervention addressed fundamental developmental processes rather than isolated skills. The overall effect size (d = 3.02) is exceptionally large by educational research standards. In most educational interventions, effect sizes typically range between 0.20 and 0.50. Therefore, the observed effects in this study indicate substantial practical significance in addition to statistical significance. The intervention did not merely produce detectable change—it generated transformative improvements in student functioning. Teamwork and collaboration exhibited the largest mean gain (46% increase). This suggests that the intervention may have been particularly effective in fostering cooperative learning behaviours, shared responsibility, and collective problem-solving. The substantial improvement in this domain may reflect structured peer interaction, collaborative task design, or immersive engagement strategies embedded within the intervention.

Leadership and initiative showed notable improvement, indicating that students became more proactive and confident in taking responsibility. Similarly, participation and engagement improved significantly, suggesting increased intrinsic motivation and active involvement in learning processes. These outcomes align with the theoretical expectation that immersive and student-centred interventions promote autonomy and agency. A key strength of the findings lies in their consistency. Every dimension improved, and no area showed stagnation or decline. The narrow range of mean improvements (0.78 to 1.28) indicates stable and uniform benefits across competencies. This pattern suggests that the intervention fostered holistic development rather than selectively targeting specific behavioural outcomes. Beyond statistical metrics, the results indicate meaningful real-world change. Students moved from below-average or moderate baseline levels to clearly above-average post-intervention performance across domains. Improvements in teamwork, leadership, and communication have implications for classroom climate, peer relationships, and long-term academic engagement. While the findings are robust, it is important to interpret them within the study's quasi-experimental framework. The absence of a control group limits causal certainty. Although the within-subjects design strengthens internal validity by comparing each student to themselves, future studies should incorporate randomized control groups to further validate the findings. Hence, the study measured short-term outcomes immediately following the 3-weeks intervention. Longitudinal follow-up is necessary to determine whether these gains are sustained over time.

CONCLUSION

The 3-weeks immersive VR module produced substantial enhancements in social dynamics among secondary school students, with a 33% overall score increase (d = 3.02) and significant gains across all dimensions (all $p < .001$). Teamwork and collaboration exhibited the strongest effect (d = 2.27, 46% improvement), followed by participation (d = 1.91) and leadership (d = 1.75). These large effect sizes—far exceeding typical educational benchmarks (d = 0.2-0.5)—demonstrate VR's practical potency in fostering interpersonal skills, rejecting the null hypotheses of no differences. These large effect sizes—far exceeding typical educational benchmarks (d = 0.2-0.5)—demonstrate VR's practical potency in fostering interpersonal skills, rejecting the null hypotheses of no differences.

These findings align with prior research indicating immersive VR enhances social presence and collaboration through embodied, shared virtual environments. The pronounced teamwork gains likely stem from VR's ability to simulate realistic group interactions, reducing spatial barriers and promoting nonverbal cues absent in desktop learning. Leadership improvements suggest VR

empowers initiative via agency in virtual scenarios, while consistent effects across dimensions underscore broad applicability for adolescent social development. Practically, results support VR integration in secondary curricula to bolster classroom dynamics, particularly collaboration essential for 21st-century skills. However, the quasi-experimental design lacks a control group, limiting causal attribution amid potential maturation effects. Short-term assessment necessitates longitudinal follow-up, and self-report measures may inflate effects versus behavioural observations. Future studies should incorporate randomized controls, gender/board moderators per objectives, and diverse samples for generalizability. Overall, this intervention ranks among top-tier educational outcomes, warranting scaled implementation with refined protocols.

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