Transforming project management: the impact of Virtual Reality on team communication and collaboration

Transforming Project Management: The Impact of Virtual Reality on Team Communication and Collaboration

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Abstract. Virtual Reality (VR) technology transforms project management by enhancing team building, communication efficiency, and critical thinking. It offers immersive and interactive solutions that promote trust, coordination, and collaboration. Its ability to create realistic simulations addresses key challenges traditional team-building methods face, especially for remote and distributed teams. While VR's adoption is growing, limited research has explored its specific impact on team-building activities and project outcomes, particularly in educational and remote contexts. This gap underscores the need for studies examining how VR can effectively be utilised to improve team performance and overcome barriers to collaboration. This study investigates the role of VR in enhancing team communication, fostering trust, and improving project outcomes. A mixed-methods approach was employed, integrating qualitative and quantitative data from surveys, observational analyses, and literature reviews to assess VR's effectiveness in project management. The findings reveal that VR significantly enhances communication efficiency and critical thinking, leading to better project execution. Additionally, VR effectively bridges geographical barriers, enabling seamless collaboration for remote teams. However, challenges such as financial constraints, resistance to adopting new technologies, and cognitive overload indicate the need for strategic implementation. Practical recommendations for integrating VR into project management include comprehensive user training, optimised system design, and strategies to minimise cognitive load. These insights highlight VR's potential to transform team dynamics and productivity while addressing challenges that may hinder its adoption. The study also identifies areas for further research to refine VR integration strategies and maximise its benefits.

Keywords: Virtual Reality, Team Building, Project Management.

1 Introduction

Project managers have traditionally relied on motivation to enhance team performance and achieve project objectives, particularly within team building. According to Lee (2000), motivation is crucial in fostering team learning, collaboration, and performance, especially in technology-driven environments where teams must engage actively and adopt self-directed approaches. As technology becomes increasingly pervasive in the workplace, organisations strive to integrate innovative tools that enhance productivity, collaboration, and communication (Perumal & Bakar, 2011).

One such transformative technology is Virtual Reality (VR), which, despite its origins in the 1970s, has advanced significantly in sophistication, affordability, and

applicability across various sectors, including medicine, education, and business. VR's immersive and interactive capabilities have garnered attention as a powerful tool for learning, training, and collaboration (Parmaxi, 2023). Within project management, VR holds great potential to create virtual collaborative spaces where geographically dispersed team members can communicate seamlessly, share information, and work together on tasks (Dodevska & Mihić, 2018). By eliminating physical barriers, VR facilitates real-time interaction, fostering team building, collaboration, and enhanced performance.

Moreover, VR enables more effective training opportunities, allowing project managers to use simulations to develop team competencies, assess risks, and improve decision-making. These immersive experiences enhance team confidence and preparedness, improving project outcomes.

This research examines VR's benefits and applications in project management, focusing on its impact on team building and performance. Section II of the paper summarises existing literature on the applications of VR technology in project management. Section III represents the research methodology used to utilise the existing study. Section IV Analysing the rationale for integrating VR technologies and applications into the realm of project management team communication and team performance. Finally, Section V proposes potential research directions and outlines areas for future work.

2 Research Background

To better understand the state of the art of using VR in communication and teambuilding for project teams in project management, a literature review has been conducted to synthesise research on the application of VR to upskill communication and team skills in project management. The review will be critically analysed to understand how research is currently being conducted and highlight gaps in the literature.

2.1 Introduction to VR in Team Building and Communication

Virtual Reality (VR) technology has become a transformative tool in team building and communication, especially in project management contexts. Effective teamwork and communication are critical to project success, as highlighted by established theoretical frameworks. VR's immersive capabilities offer an innovative solution to traditional challenges, creating virtual environments that foster collaboration, trust, and effective communication among team members, even in geographically dispersed teams. This background explores the theoretical foundations, the integration of VR frameworks, and empirical evidence supporting the application of VR in enhancing project team dynamics.

2.2 Theoretical Foundations of Team Building and Communication

Theoretical frameworks such as Tuckman's stages of development provide insights into the evolution of team dynamics from initial formation to high performance. The "norming" stage, where trust and clear boundaries are essential for achieving project success (Tuckman, 1965). Lencioni's five dysfunctions of a team framework further emphasise trust, conflict resolution, accountability, commitment, and results-oriented collaboration as key components of effective teams (Lencioni, 2010).

Complementing these models, Social Identity Theory (SIT) highlights the importance of a shared sense of identity within teams. A strong identification with the team fosters commitment, motivation, and improved communication (Hogg & Terry, 2014). These frameworks underscore the importance of teamwork and communication in project management and provide a foundation for integrating VR technology.

2.3 VR Frameworks Supporting Team Dynamics

VR technologies align with these theoretical foundations by leveraging social presence theory, which posits that virtual environments can enhance interpersonal connections by creating a sense of proximity (Calefato & Lanubile, 2010; Bulu, 2012). Embodiment theory supports VR's potential by suggesting that users feel fully present in their virtual avatars, enabling authentic and meaningful interactions (Kilteni et al., 2012). This is complemented by immersion theory, which describes the ability of VR environments to engage users deeply, focusing their attention on dynamic tasks and objectives (Nilsson et al., 2016).

2.4 Empirical Evidence of VR in Project Management

Research studies prove VR's ability to enhance teamwork and communication. For example, Ellis et al. (2008) demonstrated that VR environments foster collaboration and engagement, even among distributed teams. Similarly, Du et al. (2017) showed that VR-supported team activities improved project outcomes, with participants performing 55% better than those working alone. These findings underscore the importance of VR in creating meaningful interpersonal connections and fostering teamwork. However, the success of VR applications is highly dependent on the quality of the content and activities. Chiang et al. (2021) found that while VR improved problem-solving, its impact on teamwork was limited due to passive and unengaging content. This highlights the importance of designing VR experiences that promote collaboration and communication.

2.5 Challenges and Attitudes Towards VR Integration

Despite its potential, VR faces challenges related to cost, usability, and cognitive overload (Zaker & Coloma, 2018). Studies also reveal mixed attitudes toward VR's feasibility in project management, with users expressing concerns about comfort and the practicality of implementation. Nonetheless, research by Abbas et al. (2019) and Real et al. (2020) shows that VR communication is comparable to face-to-face interactions, particularly in fostering engagement and collaboration.

In conclusion, the literature demonstrates VR's potential to revolutionise team building and communication in project management by aligning with established theoretical frameworks. However, its successful adoption requires thoughtful implementation, including high-quality content design and user training. Future research should address gaps such as long-term user attitudes and the scalability of VR applications to harness their transformative potential in project team dynamics fully.

3 Research Methodology

The research methodology will be introduced, stating the method used for data collection and analysis. These choices will then be justified to comprehensively evaluate VR's role in team building and project management.

3.1 Research Design

A mixed-methods approach has been adopted for this research to align with a pragmatic research philosophy. This approach ensures the collection of both quantitative and qualitative data, allowing for a more comprehensive understanding of the impact of Virtual Reality (VR) on project management teams. By integrating both data types, the study aims to derive logical and practical conclusions regarding the formulated hypotheses and their applicability to real-world teams.

Mixed-methods research is becoming increasingly popular in the academic community, as studies such as Chiang et al. (2021) demonstrate that combining qualitative and quantitative methodologies leads to more reliable and generalisable results.

A deductive approach has been employed, as the literature review has provided a foundational understanding of VR in team-building and project management. The data collected will be used to test pre-established hypotheses based on existing research findings.

3.2 Data Collection and Analysis Methods

The data collected in this research in three steps: Surveys, Observational analysis, and Questionnaires underwent a rigorous analytical process to extract meaningful insights regarding the role of VR in enhancing team performance in project management as presented in Table 1.

Table 1. Represents Data analysis methods used in this research.

Data Collection Type	Data Gathering Type	Sampling Type	Data Collection Method	Data Analysis Method
Survey	Qualitative	Non- probability: Convenient, Judgment and Snowball	Cross-Sectional	Frequency analysis, Thematic analysis and descriptive statistics
Research Study Observation	Qualitative and Quantitative	Non- probability: Convenience and Purpose	Cross-Sectional	Thematic Analysis
Post-Observation Questionnaire	Qualitative and Quantitative	Non- probability: Convenience and Purpose	Cross-Sectional	Thematic and Content Analysis

- **Primary Data**

Primary data was collected through three key methods:

Step 1 - Survey: The "Assessing the Impact of Metaverse Technologies on Project Management" survey contained closed and open-ended questions designed to evaluate

participants' perspectives on using VR within their current organisations and potential future applications. The survey was conducted with 44 participants from various roles and sectors, including university students in project teams and real-world project managers and their teams. The survey was collected virtually over 31 days. It included mostly closed-ended questions (multiple-choice and Likert scale) and one open-ended question. This approach provided quantitative insights on VR use in project teams, attitudes toward upskilling, implementation, and industry concerns. The open-ended question captured participants' perspectives on the future of VR in project management.
Step 2- Observation Study: A controlled research study was conducted where a team engaged with VR software to improve their team-building and communication skills. The session was systematically observed to assess participant interactions, engagement levels, and overall performance improvements.
Similar to Chiang et al. (2017), the observation in this research outlines the criteria to identify what was being looked for in the observation to answer the research aim and hypotheses. This will help to minimize researcher bias and align this research with secondary research. The themes have been created and identified from the literature to see if this research finds similar or conflicting results, as presented in Table 2.

Table 2. Represents Metrics for Observation

Themes	Observation (Example of what has to be observed)	Justification
Communication Upskilling	-Full sentences being used -Appropriate tone and volume -Appropriate responses -Any other mention of communication from the participants	As mentioned in the research, quality communication is key and much like Tidbury et al (2020) we created this criterion to make sure participants can adapt their communication to the VR questions and be appropriate to the workplace.
Engagement	-Focusing on the task (not talking to others or being distracted) -Using hand and head gestures using the headset and controllers -Any other mentions of engagement from the participants	It is important to observe engagement to highlight if communication upskilling is effective in this way. Engagement has also been identified in previous studies, such as Ellis et al. (2008), in alignment with embodiment and immersion theory, so it is an important element to observe to see if similar results occur.
Usability	Adjustment of VR headset -Mention of problems with VR -Struggling to use VR controllers -No mention of VR problems	Research is conflicting in this area as Zaker, R., and Co-loma, E., (2018) found issues with usability, whereas Meisman, A., and Rosen, B.L (2020), stated no issues with usability. This criterion will help add to these find-ings and determine whether using VR is feasible.
Enjoyment	- Smiling -Laughing -Any mentions of enjoyment	Kolamaznik et al. (2017) found that attitudes surrounding teamwork decreased after partaking, which conflicted with their observation. As Real et al. (2020) stated, the participants enjoyed the study, and this research will help ensure enjoy-ment is still a factor observed to show effectiveness, as we do not want any conflicting results in research.

Step 3 - Post-Observation Questionnaire: Following the VR session, participants completed a questionnaire to provide feedback on their experience. The questionnaire measured user satisfaction, perceived skill enhancement, and any challenges encountered during the VR exercise. The questionnaire consisted of 15 questions designed to provide concrete evidence supporting observations and assessing whether participants enjoyed or learned from their experience. It included demographic questions about their role and age range, followed by inquiries about their prior experience with VR and its purpose—some open-ended questions aimed to determine what participants had learned, if anything, during the activity. Participants were instructed not to respond to team-building-related questions, as the activity did not cover this aspect. Finally, they were asked about their willingness to use VR again for upskilling in this setting.
Triangulating these methods has developed a comprehensive understanding of VR's impact on team dynamics and project outcomes. The findings highlight the benefits of VR adoption and shed light on areas requiring further improvement for successful integration into project management practices.

- **Secondary Data**

Secondary data was incorporated to complement primary findings and support analysis. This data was obtained from existing literature, including peer-reviewed journal articles, industry reports, and case studies. By synthesising prior research, the study aimed to reinforce its primary data findings and ensure a robust discussion of VR's effectiveness in project management. A mixed-methods approach was used, integrating both survey-based research and observational analysis. This approach ensures a well-rounded investigation into the impact of VR on team performance by capturing both subjective experiences and measurable performance indicators.

Furthermore, for this study, it was important that the users could individually improve their communication skills using VR software that allowed them to learn and then use that information in an activity to help solidify knowledge. The software chosen was “Bodyswaps.” Bodyswaps is VR software designed to help users improve their soft skills using avatars (aligning with embodiment theory) and artificial intelligence (AI) to present information and tasks that will help teach and practice skills (Bodyswaps, 2024). The ‘Workplace Communication’ module was designed with college students in mind, so it lays the basic foundations for excellent communication in the workplace.

The module allows you to pick your avatar and participate in a gameshow competing against another team. The participants must engage in multiple challenges to win the show. The challenges include using clear communication to influence others, active listening challenges and non-verbal communication. This allows them to learn and use their new knowledge in an activity. To engage with the content, the users must use their voice, which is picked up by the headset microphone, and their arm movements with the controller. Throughout the challenges, BodySwaps uses AI to produce feedback about their communication and lets them watch their responses to help them improve.

4 Research Analysis and Finding

This section presents an analysis of the collected data, offering insights aligned with the investigated research. The findings provide a descriptive overview of the participants and explore correlations identified within the data.

4.1 Survey Results: Key Trends and Insights

4.1.1 Sample Respondents

Understanding the composition of the sample was essential for this study. Below is a descriptive analysis of the respondents conducted using IBM SPSS. The majority of participants (77.3%) were aged 18-34, and more than half had less than one year of experience in project management as presented in Table 3 and Table 4.

Table 3. Age Distribution of Respondents

Frequency			Per cent	Valid Percent	Cumulative Percent
Valid	18-24	16	36.4	36.4	36.4
	25-34	18	40.9	40.9	77.3
	35-44	5	11.4	11.4	88.6
	45-54	4	9.1	9.1	97.7
	55-64	1	2.3	2.3	100.0
	Total	44	100.0	100.0	

Table 4. Project Management Experience

	Frequency		Percent	Valid Percent	Cumulative Percent
Valid	1-3 years	8	18.2	18.2	18.2
	11-15 years	2	4.5	4.5	22.7
	16-20 years	1	2.3	2.3	25.0
	4-6 years	5	11.4	11.4	36.4
	7-10 years	3	6.8	6.8	43.2
	Less than 1 year	23	52.3	52.3	95.5
More than 20 years		2	4.5	4.5	100.0
Total		44	100.0	100.0	

VR Benefits: Survey participants identified team-building, training, and communication as the key areas where VR could benefit project teams significantly has been presented in Figure 1.

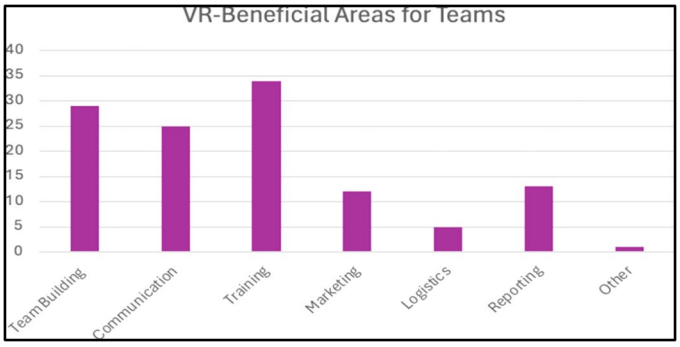

Fig. 1. VR Benefits

Communication Potential: The majority of respondents indicated that VR has a strong potential to enhance communication Figure 2, though a significant portion expressed scepticism about its effectiveness.

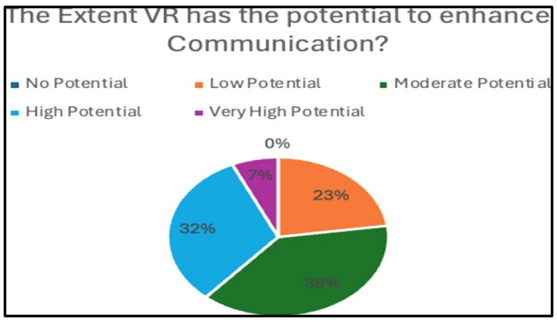

Fig. 2. Communication Potential

VR Risks: In Figure 3, several risks were reported, with eye strain and nausea being the most commonly cited concerns.

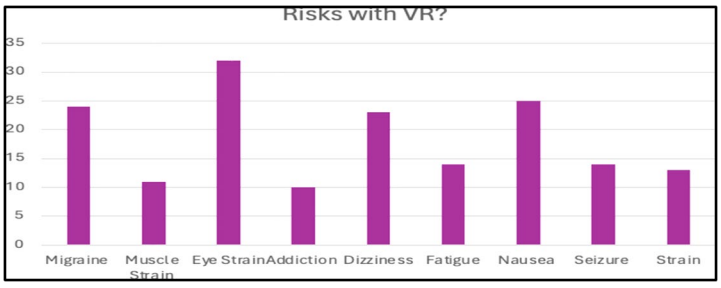

Fig. 3. Represent VR Risks

Improvement Impact Participants provided an average rating of 3.4 regarding VR's potential to improve skills in project management. However, 100% of respondents aged 45-54 rated the improvement potential as low, suggesting that older participants were less optimistic about the benefits of VR as presented in Figure 4.

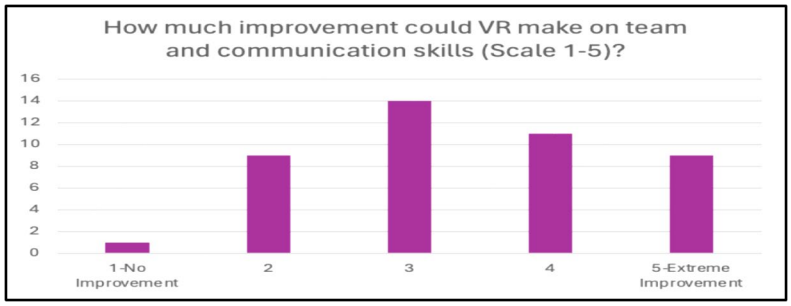

Fig. 4. Improvement Impact

The final question of the survey was open-ended, allowing respondents to share their perspectives on the future of VR in project management and its potential evolution. A qualitative thematic analysis was conducted to identify key themes. After cleaning the data in Excel to remove irrelevant responses, 38 responses have been analysed. Five major themes emerged, providing further insights into the research hypotheses regarding communication, teamwork, and training, as well as perceptions of usability and adoption as presented in Table 5.

Table 5. Key Themes Identified

Theme	Percentage of Respondents	Common Mentions
Communication	21%	VR for team meetings and improving communication
Teamwork	26%	VR for team collaboration, particularly in remote settings
Training	26%	VR as a tool to enhance general training
Usability Issues	8%	Concerns about ease of use
Adoption	79%	Affordability, limitations of current VR hardware, and openness to adoption (especially for virtual teams)

Given the **high response rate for the adoption theme**, a further breakdown was conducted:

- **50% of respondents** believed VR **will be adopted** in project management.
- **29% of respondents** did **not** believe VR adoption would occur.

Summary of Key Findings

- Demographics: Most respondents were young professionals (18-34 years old), with over half having less than one year of experience in project management.
- VR Benefits: Strong potential for team-building, communication, and training was highlighted.

- Communication & Adoption: While many saw communication potential, adoption concerns centered around cost and hardware limitations.
- Skepticism Among Older Participants: Respondents aged 45-54 were more doubtful about VR's impact on improving skills.
- Concerns & Risks: The most common risks mentioned were eye strain and nausea.

These insights help validate the research hypothesis, providing both quantitative and qualitative evidence on the potential and limitations of VR in project management.

4.2. Observation Results

4.2.1. Communication Upskilling

At the beginning of the observation, most participants were quiet and giggly when responding to questions. However, as they became more comfortable with the activity, their responses became louder and more articulate, particularly around the halfway mark when they had to engage more seriously to progress. During the task, participants had to interact with an avatar representing a colleague who felt unheard. They were required to respond in ways that demonstrated active listening, and the avatar would provide feedback based on whether they felt heard. This reinforced the importance of practical listening skills in team communication.

4.2.2. Engagement

Participants demonstrated different levels of immersion in the virtual environment. Participants were observed looking around the VR space, moving their heads to explore their surroundings. All participants successfully completed the non-verbal communication task, which required them to use physical gestures, such as dancing and moving their controllers. During this task, there was no verbal conversation, as all participants were fully focused on their activities.

Also, Participant stated that in traditional training, it is easy to "flick through" the material without truly absorbing it. However, with VR, they had to focus and engage with the content to progress. This suggests that VR training may enhance concentration and knowledge retention compared to traditional methods.

4.2.3. Usability

At the start of the session, participants quickly adapted to using the VR controllers and headsets, with minimal difficulty. However, some technical and usability challenges emerged during the study. Towards the end of the session, some participants attempted to adjust their headsets for a better fit. Despite these challenges, the other participants were able to complete the session successfully and progress to the gameshow finale. All participants noted that the VR headset felt heavy after extended use. Participants suggested that a 20-minute session would be the ideal duration for comfort and enjoyment.

4.2.4. Enjoyment and Content

Before starting the activity, participants expressed excitement, engaging in laughing and conversation about using VR for the first time. During the first 10 minutes of gameplay, they continued laughing, but they became more focused and engaged as the session progressed. Throughout the experience, all participants were observed smiling, indicating positive enjoyment.

After completing the session, participants naturally engaged in a conversation about their experiences. Some participants raised a key point about the relevance of the content of the VR training. Also, appreciated the artificial intelligence (AI) feature, which provided personalised feedback based on user responses. Other participants expressed a desire for a multiplayer experience, stating they wished they could interact in the virtual space rather than play individually. Some participants also felt that the dialogue within the game was too long and suggested adding a feature to speed up conversations.

4.3 Post-Observation Questionnaire Results

Based on the previously defined themes, the responses below outline the post-observation questions:

Enjoyment: From the post-observation questionnaire Figure 5, the authors can conclude that users find using VR an enjoyable experience. All participants in this study stated they enjoyed using this device, backing up the observation of this. Also, participants also mentioned they found this type of learning more interesting compared to traditional methods.

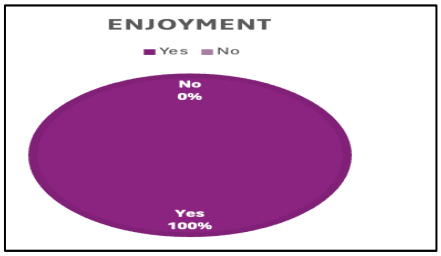

Fig. 5. Enjoyment from using VR

Learning Resources: 75% of participants stated they had learnt something about communication, and only one user did not. This was contradicted by the user in the post-observation conversation as they had stated they had learnt they were a bad listener. They did mention they felt they had not learnt as the content was being aimed at a different group. If more relevant or higher-level content were to be created, this could change the outcome of their perception of having learnt. The majority stated they did learn with examples of their learning, such as “active listening” presented in figure 6.

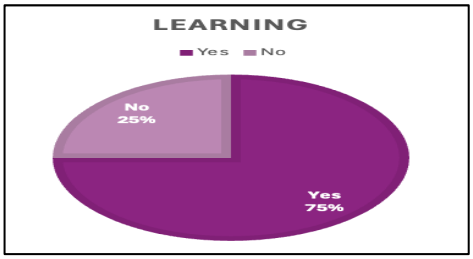

Fig. 6. Learning from using VR

Adaptability: Some participant's responses were inconclusive for this section, but the rest of the participants stated they were willing to adopt this into their team building and communication strategy (Figure 7).

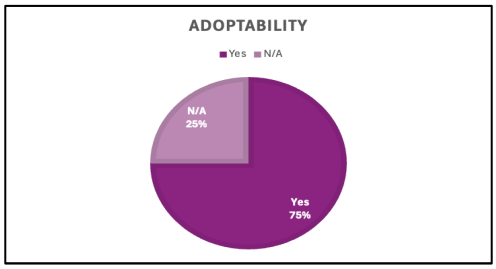

Fig. 7. Adaptability of VR

Usability: the theme of usability was reoccurring. One comment was made about the headset being uncomfortable and most participants had improvements that could be made about the content, presented in Figure 8.

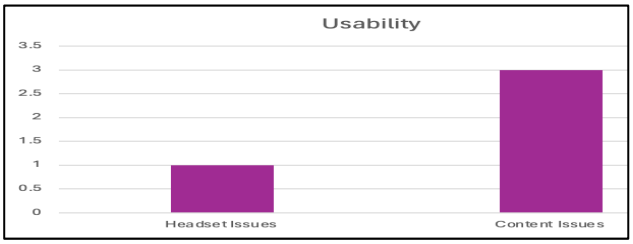

Fig. 8. Usability of VR

5 Discussion and Conclusion:

The findings from the observation, post-observation questionnaire, and survey support the hypothesis that VR can enhance communication skills in project teams. However, limitations were identified regarding usability, content relevance, and adoption challenges. While there was a positive attitude towards team-building applications of VR, participants believed the impact on teamwork would be moderate at best, with older age groups perceiving it as having little effect. The lack of primary evidence supporting this claim contrasts with secondary evidence from Ellis et al. (2008), Tidbury et al. (2020), and Kolamaznik et al. (2017), which suggests that VR has the potential for upskilling teamwork skills. This discrepancy indicates a need for further research into VR's effectiveness in team-building.

5.1. Key Findings

This section outlines the study's key findings, focusing on the hypotheses, usability, and feasibility of VR in project teams.

5.1.1. Hypotheses

Survey responses indicated that training was perceived as the primary benefit of VR in industry, followed by teamwork and communication skills. Since the hypothesis

focused on upskilling these areas, the results suggest that project team members conceptually support VR as an effective training tool.

In the observation, 75% of participants reported in the post-observation questionnaire that they had learned something related to communication, which they detailed in their responses. This supports the claim that VR can be an effective tool for communication upskilling, even in an individual learning environment. The observation further reinforced this, as participants became more confident, engaged, and articulate as the session progressed. Their adaptation to more serious and structured communication suggests VR can encourage professional communication development.

The findings align with previous research, such as Real et al. (2020), which found that VR improves communication through individual learning approaches. Similarly, Tidbury et al. (2020) highlighted that VR enhances communication adaptation skills, further supporting this study's results.

5.1.2. Enjoyment and Usability Issues

The research indicated that VR is perceived as an engaging and enjoyable training method, consistent with Real et al. (2020). Participants found the experience more engaging than traditional HR training, and there was excitement and laughter at the start of the session. However, it is possible that this reaction was partially driven by the novelty of VR, meaning repeated exposure might not elicit the same enthusiasm. Despite the positive engagement, usability challenges were noted. All participants experienced some level of discomfort with the VR headset, frequently adjusting it during the session. This finding contradicts Real et al. (2020) but aligns with Zaker and Coloma (2018), who identified usability issues as a barrier to VR adoption.

Several survey respondents expressed concerns about nausea, eye strain, migraines, and dizziness, which were further reflected in the observation, where technical issues, navigation confusion, and boundary adjustments consumed time. These factors suggest that VR usability concerns could deter adoption once the initial excitement wears off.

5.2.3. Feasibility and Adoption

The survey findings suggested that participants were generally open to adopting VR technology for training. However, similar to Kolamaznik et al. (2017), other data from this study contradicts this perception. One notable concern was the impact of VR on professional appearance. For example, one participant complained that the headset ruined her makeup, raising concerns for client-facing professionals who may hesitate to incorporate VR into their work routine. Additionally, some participants found the training module too long, suggesting that time constraints could hinder adoption among busy project managers.

The feedback also indicated that VR might be more effective for remote teams or for project management tools rather than communication training. This aligns with Abbas et al. (2019), who found that VR applications in project management are most effective when used in remote collaboration. These findings suggest that future research should explore alternative VR applications in project management beyond communication training.

5.2. Implications of this Research

This study contributes to **existing literature on VR-based communication training**, reinforcing the findings of Real et al. (2020) and Tidbury et al. (2020). While most

prior studies focus on team-based VR training, this research demonstrates that an individual learning approach can also be effective, provided the content is well-structured. This could be particularly beneficial for virtual teams, building upon earlier works such as Ellis et al. (2008).

In line with Real et al. (2020), this study also supports the idea that VR is an enjoyable upskilling method, with generally positive attitudes towards its impact and adoption. However, similar to Zaker and Coloma (2018), this research highlights significant usability and feasibility concerns. As VR technology is still in its early stages, further advancements may be required before it can be seamlessly integrated into project teams.

Additionally, several limitations impacted the study's findings:

1. Sample Size and Composition: Due to limited access to participants and VR headsets, the research was conducted on a small group that did not work directly in project management. This limits the generalizability of the results to real-world project teams.

2. Time Constraints: Only one communication module was completed, while the team-building module was not tested. As a result, the teamwork hypothesis lacks observational data, making its findings inconclusive.

3. Data Collection Gaps: The digital observation documents could not be edited electronically, leading to some participants leaving questions unanswered. These missing responses could have influenced the results.

4. Survey Sample Bias: The survey respondents were mostly younger professionals and newer to the industry, meaning the findings may not reflect the attitudes of older, more experienced project managers.

5. Changing Perceptions: The adoption attitudes captured in this study may reflect current opinions, which could evolve as project managers become more familiar with VR technology.

Despite these limitations, the research provides valuable insights into VR's potential for communication training in project teams.

5.3. Conclusion

This research set out to explore whether Virtual Reality (VR) can improve communication and teamwork skills in project teams and whether an individual learning approach would be beneficial for upskilling project members. The findings suggest that VR has the potential to enhance communication skills, as evidenced by the observation, post-observation questionnaire, and survey results. However, while participants acknowledged some benefits of teamwork, there was no primary evidence to confirm a significant impact on team-building. The study also identified several barriers to adoption, including usability issues, headset discomfort, concerns about eye strain and nausea, and content length. These findings suggest that while VR can be an effective and engaging learning tool, its long-term adoption in project teams may be hindered unless usability concerns are addressed.

While this study provides valuable insights, it is important to acknowledge its limitations, including small sample size, a lack of real-world project teams, and time constraints. Future research should expand on these findings by studying diverse teams across different industries and conducting longitudinal studies to assess the long-term impact of VR on project success.

Ultimately, while VR shows promise as a tool for upskilling communication skills in project teams, further research and technological improvements are needed before it can be widely adopted in professional project environments.

References

1. Abbas, A., et al. (2019). Effectiveness of Immersive Virtual-Reality based Communication for Construction Projects. *KSCE Journal of Civil Engineering, 23*(3), 1–12.
2. Calefato, F., & Lanubile, F. (2010). Communication Media Selection for Remote Interaction of Ad Hoc Groups. *Advances in Computers, 78*, 271–313.
3. Bulu, S.T. (2012). Place presence, social presence, co-presence and satisfaction in virtual worlds. *Computers & Education, 58*(1), 154–161.
4. Chiang, C., et al. (2021). Examining the Effectiveness of 3D Virtual Reality Training on Problem Solving, Self-efficacy, and Teamwork. *Journal of Medical Internet Research, 23*(11).
5. Dodevska, Z.A., & Mihic, M. (2018). Augmented Reality and Virtual Reality Technologies in Project Management: What Can We Expect? *European Project Management Journal, 8*(1), 17–24.
6. Du, J., et al. (2017). Cloud-Based Multiuser Virtual Reality Headset System for Project Communication of Remote Users. *Journal of Construction Engineering and Management, 144*(2).
7. Ellis, J.B., et al. (2008). Games for Virtual Team Building. *Proceedings of the Designing Interactive Systems Conference*, 295–304.
8. Hogg, M., & Terry, D.B. (2014). *Social Identity Processes in Organizational Contexts*. Psychology Press.
9. Kilteni, K., Slater, M., & Groten, R. (2012). The Sense of Embodiment in Virtual Reality. *Presence: Teleoperators & Virtual Environments, 21*(4), 373–387.
10. Kolamaznik, M., Sullivan, M., & Vyvyan, K. (2017). Can Virtual Reality Engage Students with Teamwork? *International Journal of Innovation in Science and Mathematics, 25*(4), 32–44.
11. Lencioni, P.M. (2010). *The Five Dysfunctions of a Team*. Jossey-Bass.
12. Nilsson, N.C., Serafin, S., & Nordahl, R. (2016). Immersion Revisited: A Review of Existing Definitions of Immersion. *Human Technology, 12*(2), 108–134.
13. Real, F.J., Meisman, A., & Rosen, B.L. (2020). Usability Matters for Virtual Reality Simulations Teaching Communication. *Medical Education, 54*(11), 1067–1068.
14. Tidbury, L., Jarvis, K., & Bridge, P. (2020). Initial Evaluation of a Virtual Reality Bomb-Defusing Simulator for Development of Undergraduate Healthcare Student Communication and Teamwork Skills. *BMJ Simulation & Technology Enhanced Learning, 6*(4), 229–231.
15. Tuckman, B.W. (1965). Developmental Sequence in Small Groups. *Psychological Bulletin, 63*(6), 384–399.
16. Zaker, R., & Coloma, E. (2018). Virtual Reality-Integrated Workflow in BIM-Enabled Projects Collaboration and Design Review: A Case Study. *Visualisation in Engineering, 6*(4).