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Teaching and Learning Research Exchange

Innovation in the Classroom: An Exploration of Interdisciplinary Virtual Reality in Classrooms

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Specifically, it will:

1) Contribute to knowledge about teaching and learning.
2) Encourage educational inquiry through a wide range of methodologies.
3) Support the involvement of practising teachers in active research projects.
4) Encourage organizations as well as individuals to determine and act in areas of research and inquiry.
5) Encourage experimentation with innovative ideas and methodologies related to teaching and learning.

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Overview

This study investigated how immersive virtual reality impacts student engagement and learning in middle years classrooms. Students explored existing VR environments and created VR artifacts, while teachers collaborated through professional learning sessions to integrate VR into interdisciplinary units.

Purpose, Scope, and Objectives

The purpose of the proposed research was to investigate the influence of utilizing novel technologies (immersive virtual reality) in a middle years classroom setting on student engagement. Di Natale et al. (2020) completed a decade-long empirical review of research in virtual reality in education and identified a positive correlation with the use of virtual reality in learning and student motivation and engagement, with most studies taking place in the higher education sector. This study utilized an interdisciplinary approach that included multiple school subjects over a duration of time and examined the engagement levels of students throughout the process.

The International Society for Technology in Education identified seven standards for students designed to empower student voice and ensure student-driven learning (ISTE, 2017). These standards were incorporated into the research process, providing a level of grounding for the project, and formed the basis for portions of surveys and conversations as data was collected.

Our objective was to provide an interdisciplinary, immersive virtual reality learning experience for middle-years students allowing them to develop skills to successfully engage in the modern world. A collaborative summative task, which allowed students to design a virtual-reality world to demonstrate their learning, provided an opportunity for students to be creative communicators, moving beyond beginning steps of digital citizenship.

Background / Relevance of Research

Virtual reality has developed since the 1960s. Developments in VR have led to the creation of training simulators used by NASA, and since 2010 virtual reality has become increasingly accessible and affordable, being used by video game companies like Nintendo, PlayStation, and Xbox (Barnard, 2019). Virtual reality can be defined as:

> "A computer application capable of generating a 3D environment in which the learner is an active participant, interacting with the virtual learning world through a range of multisensory interfaces. Virtual reality allows instructors to immerse learners within authentic contexts, thus providing a safe, convenient and low-cost environment in which to practice and develop new skills and knowledge (Lave & Wenger, 1991, as cited in Huang and Liaw, 2018, p. 92)."

The use of VR in schools has the potential to increase student engagement and improve student success. In Hattie (n.d.)'s four meta-analyses containing 114 studies, he found that the effect size of Interactive Video Methods is 0.54 (Hattie, n.d.-a), indicating that virtual reality may have the potential to accelerate student achievement (n.d., Hattie). Furthermore, incorporating a level of interdisciplinary studies within lessons (effect size 0.40) increases the potential for accelerated student achievement (Hattie, n.d.-b).

VR provides an option for learning opportunities that previously have not been accessible to many students. Previous research indicates that hands-on learning is ideal for students, and VR provides a safe hands-on option that is accessible for most students (Hite, 2022). Students can travel back in time to visit historical sites, witness key moments of history, or explore parts of the world that were previously inconceivable.

Teaching VR through a lens of constructionism, a learning theory that emphasizes the importance of making a personally meaningful activity as well as constructing knowledge through exploration and discovery, will allow for deeper engagement within the content of instruction (Martinez & Stager, 2019). Martinez and Stager (2019) state:

> Virtual Reality (VR) and Augmented Reality (AR) will be adopted in one of two very different ways. In some schools these innovations will be used to deliver old lessons with new bells and whistles. If new technologies possess educational nutritional

> value, it is incumbent upon makers to find ways to use new gizmos to expand what students can do. . . building your own AR or VR simulation is in the spirit of 'making'. Using AI or VR to deliver a lesson, grade a quiz, or make a virtual frog pop out of a textbook is not.

Many studies that have identified the use of virtual reality focused on the students being consumers of pre-produced VR experiences (Cheng & Tsai, 2019; Hite, 2022; Huang & Liaw, 2018; Wu et al., 2021). A limitation of VR is that educational experiences are vastly limited to the content that is available, making it difficult to meaningfully connect VR into the classroom. According to Wu et al. (2021) limited research has been conducted on students creating their own VR experiences.

Innovative Points

When bringing new learning tools into a classroom, especially a disruptive new technology like VR, new understandings about expectations and appropriate use of the learning tools need to be explored, developed, and implemented. Before implementation, we established the learning goals that we wanted students to consider and achieve while using the technology and developed a series of expectations for students using VR. The expectations were communicated to students through a structured process within a classroom setting using the Gradual Release Model (I do, we do, you do) as part of the introduction of the new learning tool.

During implementation and use of VR, students and teachers were given regular opportunities to bring up concerns they have with using VR for learning, and everyone was able to collaborate on solutions that were shared amongst the teacher participants.

After implementation and throughout use, it was required for everyone involved to reflect back on the experience, and consider this question: "How could we make this better next time we do it?"

Research Method

The participants for this study were made up of a small group of self-volunteering teachers from South East Cornerstone Public School Division, which consists of 36 schools and serves a predominantly rural population of approximately 8,000 students. Teachers were invited to participate in the study either through digital means or in person, ensuring that the study had representation from the various geographic regions within the division, focusing on classrooms with grades 7, 8, and 9 as a primary focus. Within each classroom, students and parents were notified of the research process, and parents and students were given the opportunity to withdraw any qualitative or quantitative student data from the research process. Students were able to participate in the learning experiences regardless of their status with respect to data collection and research.

Throughout the research process, teachers were given opportunities to collaborate with other teachers through shared collaborative learning sessions, focusing on integrating virtual reality experiences into interdisciplinary classroom study. The purpose of these teacher learning sessions was to demonstrate appropriate use of the technology, and to collaborate on the development and delivery of interdisciplinary learning activities within their own classrooms.

Provided with a framework developed by the research team, teachers explored the immersive virtual reality experiences available. In collaboration with the other teachers, each teacher had an opportunity to provide input into framework revisions to ensure that each participating classroom had similar (comparable) immersive learning experiences. Within the planning framework, teachers were able to determine appropriate assessment methods for their student learning; researchers used ongoing qualitative feedback through journaling and post-project feedback surveys and conversations as a means of assessment.

Teachers were then given the opportunity to deliver interdisciplinary activities with their classrooms, which researchers facilitated as needed. Students provided ongoing feedback on their experiences, as well as a summative overview of their learnings through an immersive virtual reality experience shared with their peers.

Participants

Students: 69 pre-surveys; 66 post-surveys.

Teachers: Seven pre-surveys; four post-surveys.

Data Collection/Results

We used qualitative research methods, including teacher assessments of students' skills and work habits pre- as well as post-research activity, focus group interviewing with teacher participants, field memos/notes during collaborative learning sessions, and perceptual surveys from participants. This documentation focused on perceptual feedback from students and teachers related to the educational experiences and engagement in immersive learning activities as well as perceived skill development from students (as well as observed skill development from teacher participants).

Key Findings

THEME	FINDING
Engagement	65% of students rated VR engagement 4–5/5; 80% would recommend VR learning to others
Student Perspective	Students loved immersion, exploration, building VR worlds
Teacher Perspective	All post-survey teachers used VR "sometimes" or "often"
Critical Awareness	Some students became more aware of tech limitations
Barriers	Limited devices, performance lag, coding difficulty, motion sickness

Implications & Recommendations

Expand access to VR devices and batteries.

Provide clearer tutorials for coding and navigation.

Develop rubrics to assess VR artifact complexity and curriculum learning.

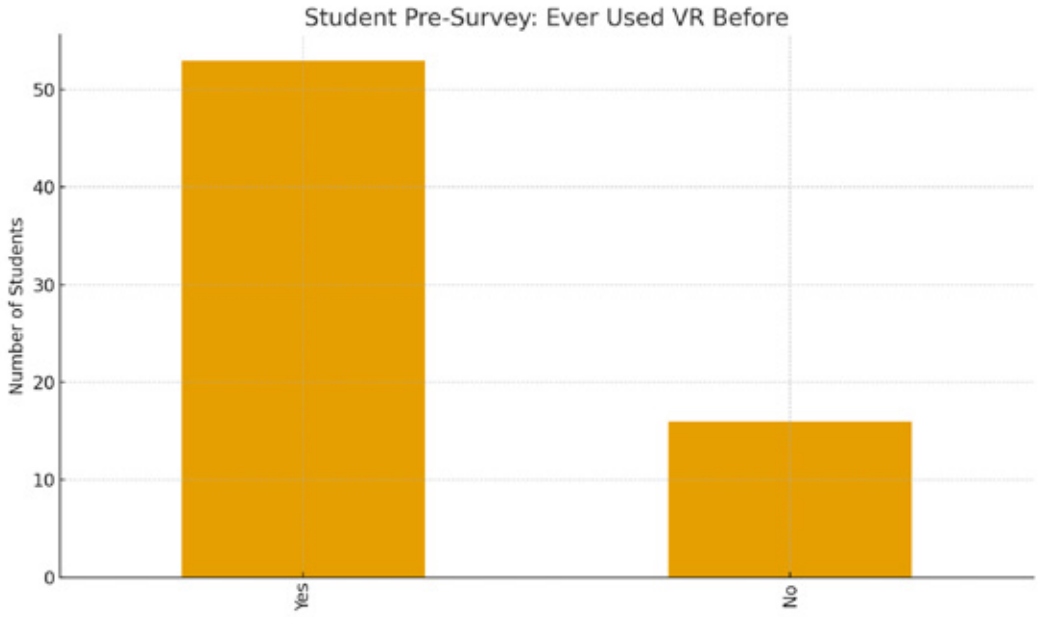
Maintain teacher collaboration for scalable implementation.

Results

Student Pre-Survey

Prior Experience with Virtual Reality

Before participating in the virtual reality project, students reported moderate familiarity with VR as a concept or recreational tool, but the majority rarely used it in daily life. Of the 69 respondents, 76.8 per cent had used VR at least once, with the remaining 23.2 per cent reporting no prior experience. However, the majority of students used VR "rarely" (46.4 per cent) or "never" (30.4 per cent), indicating infrequent exposure despite general awareness.



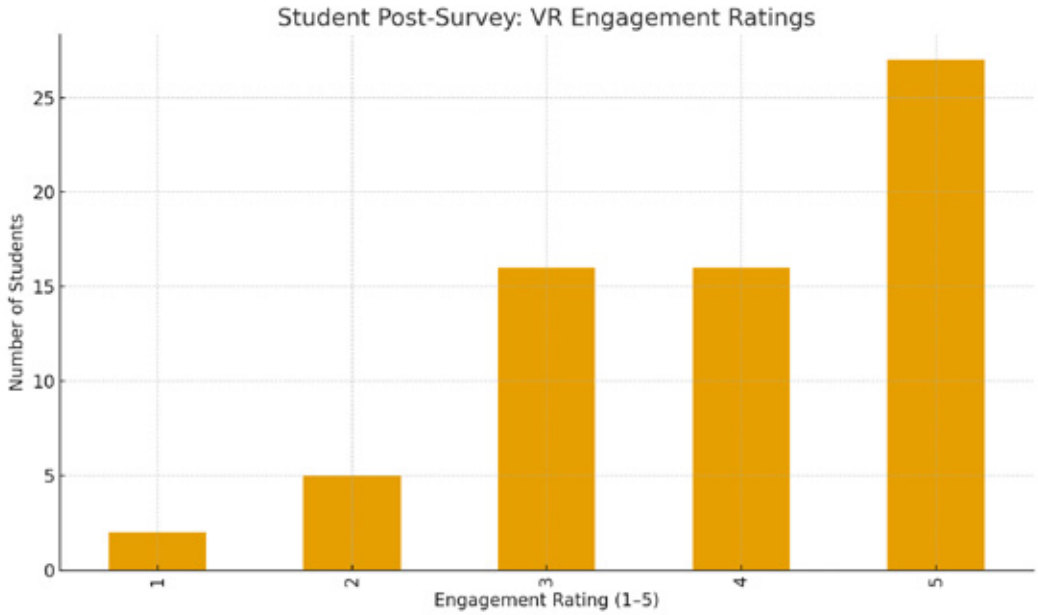
Technology Use for Learning

Students reported extensive use of technology in school contexts. Over half (53.6 per cent) indicated they used technology daily to support their learning, and almost one-third (31.9 per cent) reported weekly use. Only 4.3 per cent reported limited or no use (rarely/never). Perceptions of technology effectiveness were also strongly positive (M = 4.17, SD = 0.77, on a five-point scale), and no student rated technology below "3" in effectiveness at baseline.

Student Post-Survey

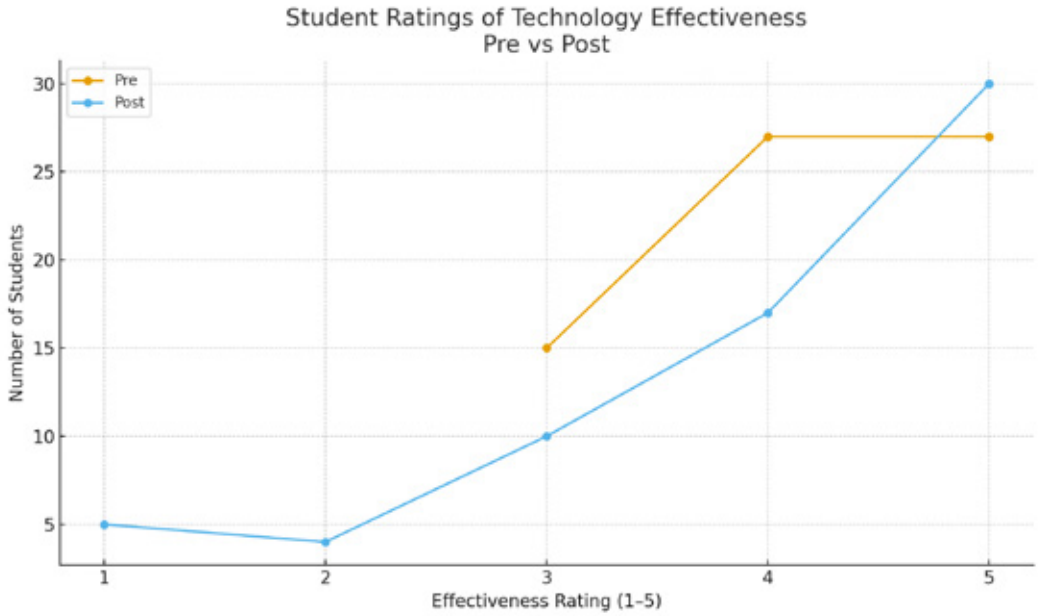
Engagement and Usability of VR for Learning

Following participation in classroom VR experiences, students reported generally high engagement levels on a five-point scale. Of 66 students, 65.1 per cent rated VR engagement four or five, with the average rating falling at M = 3.92 (SD = 1.11). Perceptions of interface intuitiveness were moderately positive (M = 3.53, SD = 1.13), with most students rating usability between three and four. In response to a 0 to 10 recommendation scale, students expressed a strong willingness to recommend VR to others (M = 7.38, SD = 2.65), with approximately 80 per cent rating six or higher.



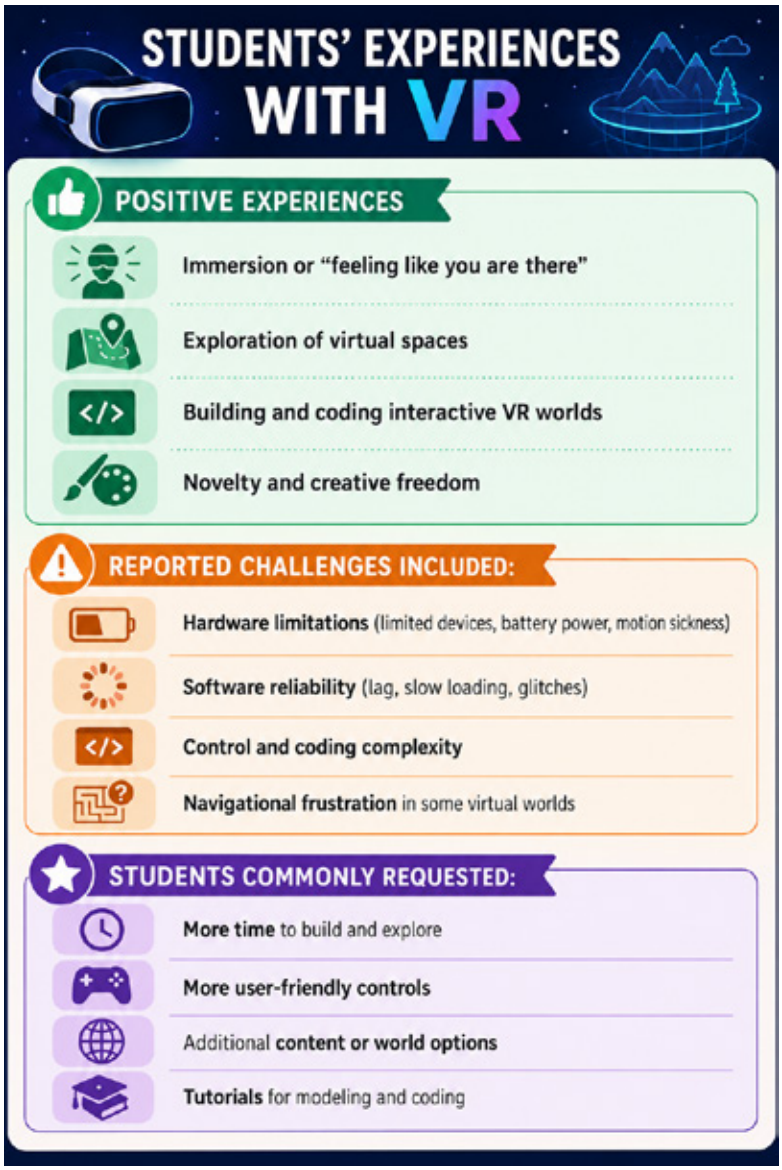
Post-Experience Perception of Technology

The same five-point measure of technology's effectiveness for learning was administered post-experience. Students remained generally positive (M = 3.95, SD = 1.25), although 13.6 per cent of post-survey ratings fell below a "3", contrasting with the pre-survey where no students selected one or two. This shift suggests that hands-on engagement with VR increased awareness of both the potential and limitations of digital tools in education.



Qualitative Student Responses

Open-ended responses revealed consistent themes.

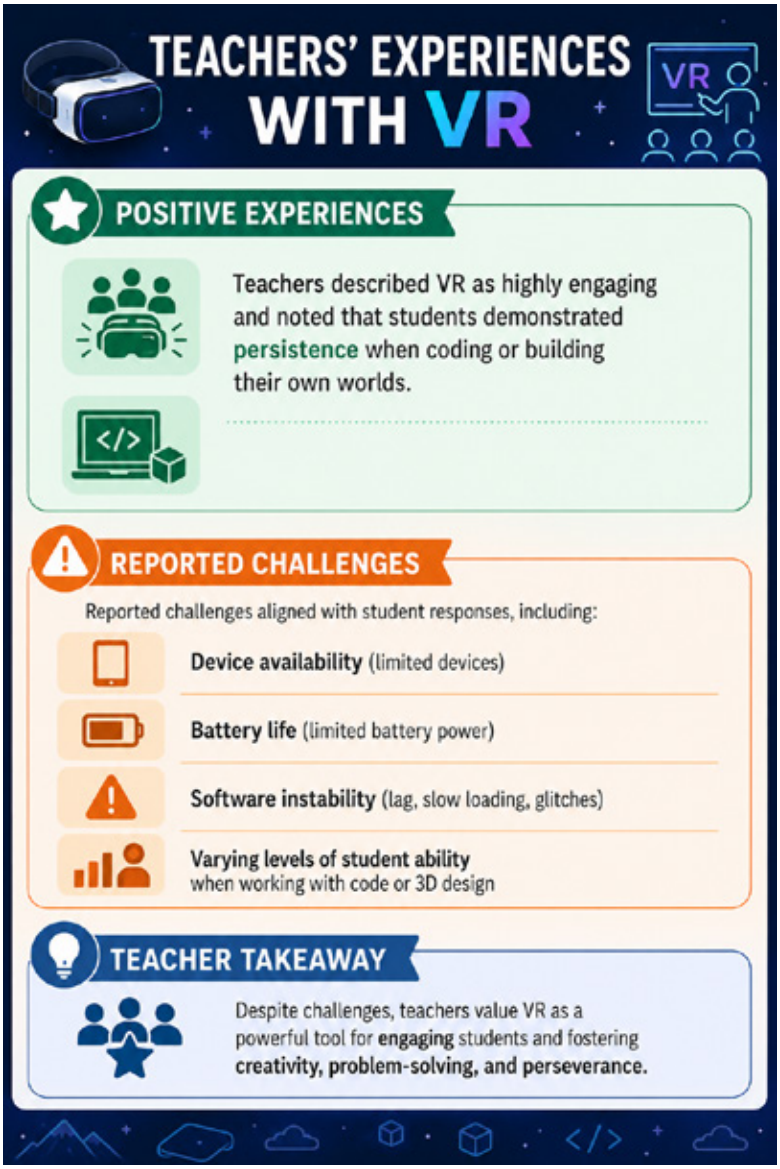


Teacher Findings

Teacher Experience and Adoption

Pre-survey data showed that 85.7 per cent of teachers had never used VR in teaching, although most identified as either "early adopters" or "early majority" users of educational technology. Teachers reported high comfort using technology in general, with 85.8 per cent identifying as "comfortable" or "very comfortable."

Despite minimal VR teaching experience at baseline, all post-survey teachers reported using VR at least "sometimes," and one reported using it "often." All post-survey teachers rated themselves comfortable or very comfortable using technology after the project.



Discussion

The results indicate that interdisciplinary VR experiences can significantly increase student engagement, particularly when students act as creators rather than passive consumers of digital content. The high engagement ratings and willingness to recommend VR suggest that immersive learning triggers emotional, cognitive, and motivational investment. These findings align with research suggesting that VR can enhance motivation and learning by situating learners inside meaningful, interactive contexts (Di Natale et al., 2020).

Students' enthusiasm for coding, artifact creation, and exploration reflects the potential of VR to support constructionist learning, in which knowledge develops through hands-on, iterative problem solving (Martinez & Stager, 2019). When students built virtual worlds, they engaged in narrative thinking, problem-solving, logic, and computational creativity, demonstrating how VR can extend beyond "entertainment technology" into curriculum-aligned skill development.

However, the emergence of critical ratings in post-survey technology effectiveness underscores a key point: deep engagement reveals limitations. Students not only enjoyed VR, but also experienced setbacks linked to performance, accessibility, and design complexity. Rather than interpreting this as a negative shift, the data suggests that students became more analytical users, capable of recognizing where learning tools succeed and where they require scaffolding, infrastructure, or redesign—a hallmark of digital literacy.

Teachers' transformation from non-VR users to regular users reinforces the value of collaborative professional learning. Supportive planning, shared troubleshooting sessions, and co-designing units contributed to teachers' willingness to implement emerging technology—consistent with adoption literature emphasizing community, coaching, and structured experimentation.

Future Considerations

To build on these results, future implementations should:

- Include structured tutorials for coding, navigation, and 3D modelling.
- Provide rubrics, enabling assessment of digital artifacts based on creativity, curricular alignment, logic, design coherence, and user experience.
- Invest in hardware reliability, including additional headsets and portable battery support.
- Document classroom interactions, such as collaboration, persistence, and iteration, to evaluate VR's impact beyond perception surveys alone.

Limitations

Limitations include unequal pre/post sample sizes, small teacher response counts, and reliance on perceptual measures rather than performance-based assessments. Future studies should examine artifact quality, coding complexity, and curriculum learning outcomes alongside perceptual data.

Summary Tables – VR Classroom Study

Table 1. Student Prior VR Use (Pre-Survey)

RESPONSE	COUNT	PER CENT
Yes, have used VR before.	53	76.8
No, have never used VR.	16	23.2

Table 2. Student Frequency of VR Use (Pre-Survey)

FREQUENCY	COUNT	PER CENT
Rarely	32	46.4
Never	21	30.4
Weekly	7	10.1
Monthly	6	8.7
Daily	3	4.3

Table 3. Student Frequency of Technology Use for Learning (Pre-Survey)

FREQUENCY	COUNT	PER CENT
Daily	37	53.6
Weekly	22	31.9
Monthly	7	10.1
Never	2	2.9
Rarely	1	1.4

Table 4. Student Perceived Effectiveness of Technology (Pre-Survey)

RATING (1–5)	COUNT	PER CENT
3	15	21.7
4	27	39.1
5	27	39.1

Table 5. Student Engagement in VR Experience (Post-Survey)

RATING (1–5)	COUNT	PER CENT
5	27	40.9
4	16	24.2
3	16	24.2
2	5	7.6
1	2	3.0

Table 6. Student Perceived Intuitiveness of VR Interface (Post-Survey)

RATING (1–5)	COUNT	PER CENT
5	15	22.7
4	19	28.8
3	22	33.3
2	6	9.1
1	4	6.1

Table 7. Student Recommendation Score for VR Experience (Post-Survey)

STATISTIC	VALUE
Mean	7.38
Standard Deviation	2.65
Median	8
Minimum	0
Maximum	10
N	66

Table 8. Student Perceived Effectiveness of Technology (Post-Survey)

RATING (1–5)	COUNT	PER CENT
5	30	45.5
4	17	25.8
3	10	15.2
2	4	6.1
1	5	7.6

Table 9. Teacher Years of Teaching Experience (Pre-Survey)

RESPONSE	COUNT	PER CENT
More than 10 years	4	57.1
8–10 years	2	28.6
1–3 years	1	14.3

Table 10. Teacher Prior VR Use in Teaching (Pre-Survey)

RESPONSE	COUNT	PER CENT
Never	6	85.7
Rarely	1	14.3

Table 11. Teacher Comfort Using Educational Technology (Pre-Survey)

COMFORT LEVEL	COUNT	PER CENT
Very Comfortable	3	42.9
Comfortable	3	42.9
Neutral	1	14.3

Table 12. Teacher Frequency of VR Use During Activity Period (Post-Survey)

FREQUENCY	COUNT	PER CENT
Sometimes	3	75.0
Often	1	25.0

Table 13. Teacher Comfort with Educational Technology (Post-Survey)

COMFORT LEVEL	COUNT	PER CENT
Very Comfortable	2	50.0
Comfortable	2	50.0

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