A Classroom Model for Virtual Reality Integration and Unlocking Student Creativity

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Abstract Recent studies have shown immersive technology has a positive impact on learning. However, implementation and oversight remain major obstacles for school districts. This chapter explores a practical model for implementing virtual reality technology in a high school setting and shows how student contribution promotes a positive learning environment.

Keywords Collaboration · Facilitator · Near-peer classroom · Peer assisted learning · Student-led · Student ownership · Virtual reality implementation

Introduction

Sticker shock, educational value, and equipment management. Those three issues cause K–12 school districts with limited resources to hesitate about purchasing virtual reality (VR) equipment, and understandably so. While the release of stand-alone headsets such as the Quest 2 have increased affordability, it is easy to understand why many tech departments would be quick to dismiss the idea. Their budgets are already limited with the rollout of one-to-one initiatives, ongoing replacement cycles, and rising content subscription costs. Besides, isn't VR just for games anyway? In the high-stakes testing world that defines education, administrators and technology coordinators are quick to question the classroom value of immersive technologies (Metcalf et al., 2013), particularly in the face of rising costs. However, an increasing amount of research suggests immersive technologies can be effective and affordable when compared to non-immersive approaches (Wu et al., 2020).

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In this chapter, I examine how a suburban Ohio high school designed a course to teach and train students as VR experts. The new course consisted of 15–20 students with academic abilities ranging from normal to gifted. The course addressed concerns of both administrators and technology coordinators regarding implementation and equipment oversight, while providing a valuable outlet for student creativity and leadership. First, I lay out how a near-peer classroom model can have a positive effect on both the VR expert and the learner. Second, I describe how the core student group is empowered through responsibility and oversight, fostering a sense of ownership that in turn leads to increased classroom engagement. Lastly, I look at how instructional methods are improved by tapping into immersive technology and student creativity. In doing so, students are involved in the design process from beginning to end, making the activities personal. The chapter challenges us to reconsider traditional classroom roles by making students partners in the educational process and turning teachers into facilitators. If done successfully, this process creates school-wide access to the world of VR by placing the responsibility of training on a group of students, rather than on staff.

Vignette

As class was winding down one early winter day, one of David's students approached him with a suggestion, "We should get VR equipment for the STEM room." It was an absurd request on the surface. Could an emerging technology, stereotyped as a gaming device, really be used as an educational tool? David's initial reaction softened as possibilities were explored. It sparked conversations over the next several months—conversations that were student led, prompting research and brainstorming sessions. They resulted in the design of a student-driven high school course where the students became the teachers, and in many instances, the teachers became the students. Student expertise became the creative driving force. David's students designed lessons for core classes and assisted peers, teaching them to use VR technology while experiencing content. All David had to do was relinquish classroom control and become the guide rather than the source of knowledge.

The Argument for Using a Near-Peer Model

An ancient Japanese proverb says, "To teach is to learn." Over time, *near-peer* has been known by several different names: peer-assisted learning (PAL), team-based learning, peer tutoring, education through student interaction (ETSI), and peer mentoring (Evans & Cuffe, 2009; Lockspeiser et al., 2006; Ten Cate & Durning, 2007a, b). Through all the re-labelling, there exists a common theme; a student with more knowledge is put in a position alongside another to teach, assist, and help them gain understanding. For the sake of clarity, for the remainder of this chap. I use the terms teacher, near-peer tutor (NPT), and near-peer learner (NPL) to refer to the participants.

On the surface, it seems this model benefits the near-peer learner, but research shows both parties benefit in a near-peer setting. NPLs find NPTs more approachable and relatable than older instructors (Velez et al., 2011; Williams & Fowler, 2014), creating a more relaxed atmosphere where an NPL is more apt to admit they need assistance in clearing up misconceptions (McLelland et al., 2013; Ten Cate & Durning, 2007a, b; Topping, 2005). This relaxed relationship and understanding of learning difficulties between the two appear to exist because of more recent experience with the subject matter (Brueckner & MacPherson, 2004; Lockspeiser et al., 2006). Learners cited this cognitive congruence as a factor allowing NPTs to relay information at an appropriate level (Lockspeiser et al., 2006; Rashid et al., 2011; Ten Cate et al., 2012).

Research demonstrates that the near-peer model benefits the NPT by enhancing understanding, cultivating communication skills, and helping future career development (Evans & Cuffe, 2009; Williams & Fowler, 2014). Additionally, it offers them the chance to "learn twice" as teaching requires deeper learning of subject matter (Annis, 1983). Teaching a topic requires better cognitive organization to improve retrieval during instruction. Karpicke's (2012) research suggested that a group who studied content with the purpose of teaching retained 45 to 60% more information after one week than a group who studied it for the same amount of time without the expectation of teaching. Gregory et al.'s (2011) results support this finding and went one step farther by examining the knowledge gains of a group of medical students in a peer-teaching environment. The students were assigned two topics to teach. Then on instruction day, they were asked to teach only one of the topics. Peer tutors showed increased learning for both topics prepared, but they demonstrated more significant gains in the content they taught. When re-tested 60 days later, the learning gains were still present (Gregory et al., 2011).

When focusing on classroom climate in a near-peer setting, observations and survey responses from both groups perceived positive social interaction and a change in classroom dynamics. Class discussion increased and became more interactive. There was more laughing, smiling, and exchanging of ideas throughout the lesson than in a traditional setting. The improved climate encouraged a freer exchange of ideas. Research also shows that participants on both the teaching and learning sides appreciated the opportunity to make the material more creative. Near-peer learners remarked on how doing more hands-on work and applying what they had been learning makes it more interesting and engaging (Velez et al., 2011; Williams & Fowler, 2014).

There may be lasting benefits for NPTs as well. They develop an awareness of their individual learning styles through the planning and teaching process (Velez et al., 2011). A near-peer model also yields a deeper processing of information, which improves conceptual understanding. These two advantages combine to improve self-monitoring and comprehension when faced with new material in other areas (Benè & Bergus, 2014).

The most difficult aspect of incorporating a near-peer model lies with instructors since it requires us to relinquish control and take on the role of facilitator (Velez et al., 2011; Williams & Fowler, 2014). Most have been trained and taught in an educational setting where the instructor is the disseminator of information. But when the research surrounding near-peer instruction demonstrates increased knowledge gains for both parties, we need to be willing to embrace a more student-centred approach to teaching. Incorporating this student-centred model to unlock the potential of immersive technology reduces the need for schoolwide professional development while tapping into a valuable resource we all have sitting at desk: students.

Spencer (2019) proposes a shift from simply engaging students to empowering them. To do this, we as educators must recognize our job has shifted from being a fountain of knowledge to teaching students to think critically. Teachers should become facilitators within the classroom; they may shape the direction by asking leading, open-ended questions meant to guide thinking, but ultimately, they let students dictate the overall direction. When students share ideas or present findings, educators can offer perspectives that the students had not considered and ideas that perhaps come only with life experience or professional training. Yet educators must be willing to acknowledge and honour what students bring to the table. The facilitator mindset fits nicely with the near-peer model. Students still share their proficiency in a given subject with the gentle guidance from the instructor working in the background. This dynamic promotes student ownership of their education while giving them the autonomy to explore new ideas without the dark cloud of failure lurking overhead.

Student Empowerment from Conceptualization to Realization

In spring 2019, 18 high school students filed off a yellow school bus, backpacks over one shoulder and a laptop under the other arm. All were dressed in jeans and a plain black T-shirt. Three other students unloaded a wooden box, three large buckets of sand, and a desktop computer from the back of a minivan and onto a cart. The group made its way past the LeBron James Family Foundation logo painted on the sidewalk, toward the entrance of the I Promise School in Akron, Ohio. Inside the entrance, their eyes fixed on the walls bordering the spiral staircases, showcasing game shoes worn by James himself. But the group had to move on. They weren't there for a tour of the school; they were there to work. They made their way down the steps, walking past murals on the wall depicting James and other influential figures from history, into the *Think Tank*. There was a sense of excitement mixed with confidence as they transformed the large room into 15 VR stations: 15 spaces where each high school student would be paired with one fourth grader. Over the next two days, 110 fourth graders would be exposed for the first time to immersive technology and the worlds it opens.

The high school students had been preparing for these two days since the fall semester, learning how to use the equipment and troubleshoot problems that inevitably pop up from time to time. They had become adept at walking new users through the basics using effective verbal communication. Up until now, their knowledge had been refined with peers, community members, and adults at educational conferences. But for the next two days, their communication skills would be put to the test on a group of inner-city fourth-grade students.

How did those two days come about in the first place? We need to rewind our story back two years, when the idea of using high school students as near-peer teachers with immersive technology was initiated. Our plunge into the VR world began when an intelligent, yet quirky student asked me if we could purchase some VR headsets for our STEM classroom. Like anyone who thinks they understand how education views video games in the classroom, I immediately dismissed the idea. I cited my lack of knowledge, funding issues, and supposedly nonexistent educational value as the top reasons as to why VR could never work. But that one interaction set into motion a series of brainstorming sessions. Out of it came a course designed to not only use VR technology, but one that fashioned a space where students would create lessons using VR and assist classroom teachers in implementing it.

Any time a district decides to make a significant technology purchase, there must be a plan in place for equipment oversight and teacher training. Spend a little time talking to technology coordinators and educators, and you will hear stories of their districts investing significant amounts of money on technology and/or software, only to see it collect dust or end up damaged. There are many reasons: a lack of professional development, a convincing salesperson followed by poor customer support, compatibility issues, poor quality, etc. We were determined to avoid the same pitfalls. Incorporating immersive VR equipment is an easy step for those who are proficient at using technology but challenging for people who are unsure. We needed to guard against the outcome of broken equipment destined to live in locked cabinets.

The first priority of the course was equipment management and oversight. The initial investment was steep and demonstrated an act of trust by the Alcoa Corporation, our grant funder. We purchased 15 Oculus Rift VR headsets, 15 gaming laptops, and all the peripherals that went with them. Oversight included creating 15 online accounts for Oculus and STEAM, software updates, firmware updates, dealing with account issues, sanitization, repairs, software installation, and organization. All are aspects that would overwhelm a single teacher and put a time strain on their schedule. But by instilling the idea of ownership with a group of students, training them in the technology, and giving them responsibility for a single VR station, the task becomes manageable.

I witnessed student leadership emerging from the outset. Students are intelligent, unique, and many times have skill sets that quietly reside beneath the surface. Given the opportunity, they jump at the chance to showcase what they can do. I stepped back and let them do their thing. Some oversaw operating system and graphics-card updates, others handled equipment repairs, a few solved sound issues, and others made sure everything was organized and properly sanitized after each class. They learned and taught each other, themselves becoming the source of knowledge and no longer relying on me. They took pride in properly handling the equipment, updating it, and keeping it in pristine operating condition. What was once a daunting task for a single educator, lining up 15 computers and running updates one at a time, was now entrusted to a group of increasingly motivated teenagers. The foundations for a near-peer environment were well established moving forward.

Instructional Creativity Driven by Students

Once technology oversight is established, phase two is designing meaningful educational lessons. Bloom's revised framework for educational goals lists evaluation and creation at the apex of cognitive skills to help students learn (Wilson, 2016). Unfortunately, many classes are designed to have students enter, sit in a seat, absorb information, but never engage in higher-order thinking skills such as analyzing, reasoning, and evaluation. Students routinely complain about how boring school is and how the assignments are time fillers. Our goal was to change this.

Our approach to VR implementation puts students in control. It challenges them to transform ordinary topics into dynamic lessons. Students, our NPTs, are tasked with the responsibility of evaluating existing VR experiences. The process goes as follows: first, they search out, test, and create reviews of educational apps. These already exist in an app store and are either free or paid for using classroom supply funds provided by our district. The tested VR apps can be associated with any concept taught in one of our high school courses. Second, groups present their findings and opinions on the learning value of their selected VR experience. After discussion and deliberation, the class selects one app on which to focus, based on the criteria established by the class. Third, once the VR experience is selected, groups meet and brainstorm ideas for the activity structure. Fourth, these activity ideas are presented to the class. The class explores the positives and negatives about each, during which time we discuss aspects of meaningful instruction. Fifth, the class decides on a single concept to develop. Finally, they shape the activity structure and delivery, determine how information within the VR app is collected and applied, and formulate a plan to keep their peers engaged in the learning process. Out of this process comes an activity to accompany the virtual experience that reinforces core class concepts and furthers discussion. This series of steps engages the NPTs with the upper two levels of Bloom's framework: evaluation and creation.

Here is an illustration using the application *eXPerience: Colorblindness*. This teaches users about types of colour-blindness and has them complete tasks through the eyes of people with varying types (Fig. 1). A simplistic approach for integrating this experience into the curriculum would involve parading biology students through the app. They would each spend 30 minutes in a VR headset, interact with their virtual environment, and then return to their respective biology classrooms where it seems the entire experience was a disconnected field trip. In essence, it would be akin to having the students watch a glorified video on the topic, never diving deeper into how it relates to the curriculum. This is a missed opportunity to tap into one of

Fig. 1 Activity screenshots from eXPerience: Colorblindness

the most powerful facets of VR—embodied learning, combining psychomotor learning with cognitive engagement. One empirical analysis of embodied learning studies showed significant gains in student learning when this method was used in comparison to a control group (Georgiou & Ioannou, 2019).

In an effort to maximize knowledge acquisition and retention, the NPTs created an accompanying student guide (Appendix), asking the NPLs to gather factual information, guiding them through color-blindness tasks, documenting results, and reflecting on the challenges each one posed. They also made a guide for the classroom teacher that explains the activity design, proposes a timeline, and provides teachers with answers to all the questions. This near-peer learning experience is designed to be done during a genetics unit within a biology class. Having the NPT on hand is a benefit because they are always in close proximity to the NPL, able to provide rapid content and technology support when needed. Overall, the experience enriches the learning by having the NPL undergo daily virtual tasks with different types of colour-blindness. The NPT will learn more from creating materials and teaching others, while the NPL will learn more from practicing and doing kinesthetic activities.

Other examples of student-created lessons in combination with VR experiences include the following: live tweeting during an immersive reading of the "The Raven" (Fig. 2), creating postcards from the past after getting a glimpse of the civil rights movement in "I AM A Man," interacting with detailed human anatomy in *Organon3D* (Fig. 3), and marketing molecules in social media posts after using *Nanome,* a VR application for molecular construction. Other VR experiences are excellent launching points for discussion about social issues and developing empathy. NPTs used Bloom's higher-order thinking skills to create activities. Within these activities, they used higher-order question-stems to construct discussion questions centred on topics such as race, homelessness, human impact on global warming, and disabilities. These question-stems urge students to analyze, evaluate, or create opinions.

Fig. 2 Screenshot from “The Raven” VR and a tweet template for students

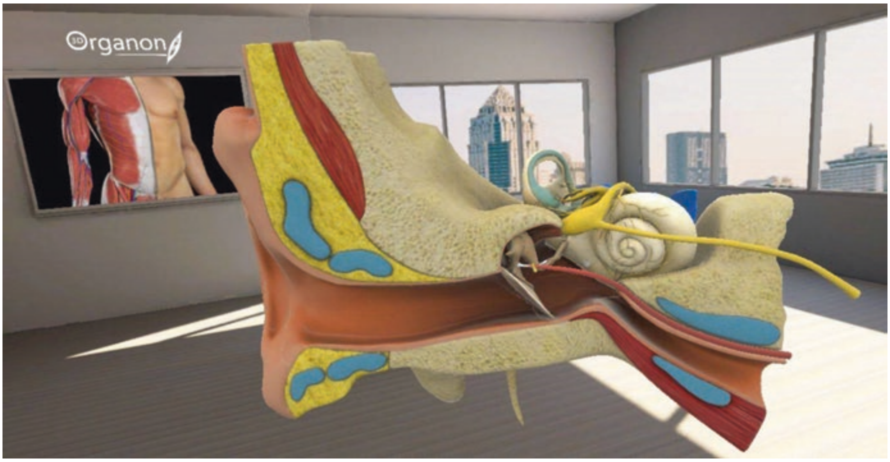

Fig. 3 Detailed human anatomy in Organon3D

Ultimately the design decisions are left to the students. They decide which immersive experiences they want to delve into, and the types of activities designed to complement them. It allows them to create meaningful lessons they would want to do in a classroom. A collection of student-created lessons can be found visiting envisionxr.net or scanning this QR code:

The Near-Peer Classroom in a Virtual World

The initial vision was to enhance the learning experience in classrooms by creating a model where students would assist with the technology, thus removing that hurdle from classroom teachers. There are some very practical advantages to using such a model for the integration of immersive technology. If we invested funds into VR equipment, designed accompanying lessons, but never let them leave our four walls, the technology and educational impact would be limited to a single class. But by incorporating a near-peer model, we are able to increase technology exposure.

In the weeks and days leading up to the actual VR experience, a typical engagement with the VR class involves NPT-led meetings between the near-peer tutors and the traditional classroom teacher. These meetings cover activity designs, modification suggestions, and a demo of the experience for the teacher. On the day(s) of the near-peer VR activity, a crew conducts an early morning setup of all the equipment. The NPTs assigned to each period know every aspect of the app to be used and can walk users through most issues with effective oral communication, something we practice and discuss. This enables keeping the user in the headset without the NPT needing to don the headset themselves. The role of the classroom teacher is simply to discuss content and ask probing questions; all the technology and VR-experience questions are answered by the near-peer tutor. At the end of the day, the setup crew comes back in to take down and pack up all the VR equipment, laptops, and electrical cords.

This model has proved highly effective and popular in our school. We have run demonstrations for community stakeholders, staff meetings, technology conventions, and other school districts. With each event or classroom collaboration, I see the confidence and communication skills grow among my students—but not without work. Much like Evans and Cuffe (2009), who concluded they should increase feedback opportunities in future trials, we recognize the need to do the same to improve the near-peer experience for the learners. These feedback opportunities prompt meaningful reflective discussions on initiating engagement, troubleshooting flowcharts, modifying activities, and increasing overall efficiency. We have had sessions where our delivery techniques were ineffective. NPLs shared that help was not always near, or NPTs struggled to effectively guide them through the application. This feedback told us where we needed to focus our efforts and make improvements.

My high school students were confident working with teenagers and adults, but what about impatient fourth graders who had never donned a headset? We had very detailed plans. Each student knew their role, from setup to tear down and everything in between. What happened those two days was amazing. I watched as my students executed the near-peer model. Each fourth grader spent 30 minutes in a one-on-one setting with one of my VR students (Fig. 4). They travelled the Earth, identifying and exploring landforms (Fig. 5), took a deep ocean dive with marine life, and played a basic game created by two of my computer programming students (Fig. 6).

Once the VR experience ended, small groups of students used an AR sandbox to create some of the same landforms they learned about in science class. They watched

Fig. 4 High school students working with fourth graders at the I Promise School

Fig. 5 Examples of different landforms explored in Google Earth

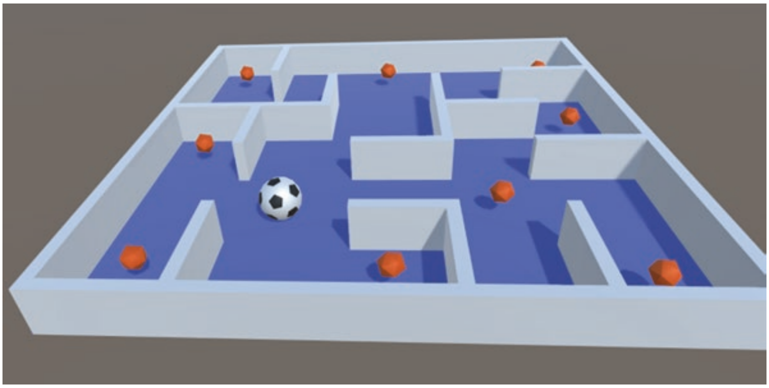

Fig. 6 Game created by high school students and played in VR

topographic lines change in real-time and virtual rainwater run down slopes and collect in low-lying areas. Those two days were remarkable to watch, from the awe and wonder in the expressions of 10 and 11-year-olds to the transformation I saw in my students as they worked with each one. Not only did these high school kids help bolster knowledge in the fourth graders, but by preparing to teach them, they also reinforced science topics that some had not covered in their own coursework in a few years.

Strategies for Implementation of Design

Educators may consider the following four pedagogical strategies when implementing virtual technologies in their classroom. It is important to know the audience and adapt as needed.

- **Expand your collaborative strategy repertoire**. Allowing peers, both NPT and NPL, to work together has several benefits. One aspect easily overlooked with respect to technology is varying comfort levels. Select small groups two to five students. The smaller groups reduce hiding spots for a student less willing to participate. Within the groups, designate roles such as a content evaluator, creative mastermind, and manager. With pairs or small groups, students with some anxiety toward technology are freer to learn at their own pace without feeling pressured. Groups often interact with more humour, placing everyone at ease.
- Tapping into this potential requires careful lesson design. Begin with a complex learning activity (Burns, 2016): a task that is too simple promotes independent work and allows some students in the group to contribute little to the cause, whereas a complex task promotes collaboration because it is too involved for one student to handle. One way to do this is by incorporating real-world problems for students to remedy. This problem may be solving a technical issue, designing engaging content to accompany VR experiences, or establishing a set of coherent procedures for a user to follow. It requires students to focus on a problem, conduct research, debate, and develop a working solution. During the collaborative process, build in opportunities to come back together as a collective group and share, using techniques such as round table, fishbowl debate, conver-stations, back-channel, or snowball (Gonzalez, 2015). Sharing and exchanging ideas intermittently can further spark creativity and progress as well as keep each group focused along the way. The instructor's role should include checking in on students, providing feedback, and asking probing questions.
- **Incorporate brainstorming sessions**. Immersive technology is more than a tool; its existence in the classroom should initiate critical thinking. Use the creative minds sitting at desks in your class to devise ways to transform the technology into a meaningful resource. Unlock the technology's potential through brainstorming, before the planned immersive session takes place. Provide the technology, the content standards, the freedom to ask "What if" questions, and the time to conceive and explore solutions. Begin by establishing a safe environment where students can share and discuss ideas without the fear of failure. Teach your students that with brainstorming, there are no right or wrong answers, just ideas. Be mindful that most class discussions are dominated by the loudest and most confident students, so one method of combating this tendency is brainwriting: introduce the topic ahead of time and allow individual students to con-

tribute anonymously. In-class brainstorming sessions should be structured. Set time limits. Divide students into small groups where they spend short amounts of time generating ideas, followed by time vetting those ideas, then repeat. Doing so keeps ideas flowing and forms connections. Another in-class option to ensure every voice is heard is the "card method." Each student lists their ideas on a card, then passes it to the person next to them. The student on the right adds to the idea or asks a clarifying question. Continue this process until each student has seen every card. Also, consider choosing a format that requires all students to contribute and then share. This discourages anchoring from taking place, where the first few suggestions sway the direction of all future discussions.

- **Empower students as designers**. A common complaint of students is a lack of connection between assigned tasks and the real world. The design process we implement in my VR course requires students to use metacognitive awareness as they think critically about a problem. At the top of Schlechty's Levels of Engagement (2011) is engagement, meaning that students have high attention and commitment because they associate the task with a result that has value, resulting in a willingness to persevere through challenges. To achieve this, instructors need to hand over control and encourage students' creativity to shine. First, challenge them to think and create content that is outside the box or beyond what is usually expected. Second, give students the latitude to make decisions about how immersive technology is implemented or assessed. Third, let them design the change they want to see. Fourth, let them create a product that has value and represents how they learn best. Finally, promote self-examination to determine how they learn best and apply that to lesson design (Schlechty, 2011).

The International Society for Technology in Education (ISTE) provides guidance for implementing technology in the classroom. Empowering students as designers fits in perfectly with ISTE standards 4A and 6D. These require students to know and use a design process for generating ideas and creating innovative artifacts, and then publishing or presenting content that customizes the message and medium for their intended audiences (ISTE, 2016). Since some students will struggle in the beginning, start by inviting them to collaborate with you. This allows them to have concepts reinforced while learning to work independently. Encourage creative risk-taking, where failures are welcomed as learning experiences. In the end, students will have a sense of ownership over their learning, a greater understanding of content, and a blueprint for transforming from consumers to creators (Spencer, 2019).

- **Look for incidental learning opportunities**. Constructivism is essential to education. The belief that new knowledge is constructed on the foundations of existing knowledge is important because our students come to us with different backgrounds and life experiences. The wider range of life experiences a student brings to class means potentially a larger foundation on which to build. Help students increase their base knowledge by giving them open-ended tasks that allow them to explore and investigate. Instead of giving them all the answers, push them to research information and solutions. The incidental learning through these assignments may not only help them relate to new topics in class but allow them to draw natural connections in other classes. In researching new VR applications, students in my class gained incidental knowledge in a wide range of areas, including types of colour-blindness, the Memphis sanitation strike, racial issues related to travel in the 1960s, geography, geology, medical terminology, medical conditions, empathy, and more. Their exposure to these topics can lead to class discussions and further investigation. These topics are not routinely covered, but they help students develop deeper empathy or increase their general knowledge of the world.

Conclusion

There is more to good teaching than technology. It does not take long to realize that investing in the latest software or gadget without investing in professional development means a closet full of unrealized potential. Immersive technology will not in itself revolutionize education, but creativity will. Successful implementation requires a plan that includes maintenance and professional development. In our district, this meant designing a course for students with leadership and creativity as key aspects. As a result, students became more fluent using technology and learning content through a variety of avenues, while applying the design process to improve technology integration.

For a program like this to be successful, educators must lead by example. In our case, we demonstrated being lifelong learners in a rapidly changing world. We took risks and pursued the unknown to move past the status quo. This provided an alternate educational experience and challenged traditional boundaries. Our students witnessed both our successes and failures during our plunge into VR integration. The technologies we were implementing did not exist when we entered the teaching profession; they were the fantasies and lore of science fiction. Without a roadmap, we were destined to have a few mishaps along the way, but those obstacles gave opportunities for group discussion and problem solving. The course involved students in real-world collaboration, showing them that not every endeavour produces success—just a learning opportunity. Moving forward, ideally our example will inspire educators and students to be relational, risk-takers, and lifelong learners in whatever field they choose.

Appendix: Instructional Guide Created by the Near-Peer Tutors

EXPERIENCE COLORBLINDNESS VR EXPERIENCE

OVERVIEW

Students will go through the "eXperience Colorblindness" VR app. They will work in pairs going through the app and collecting information in their student activity worksheets.

MATERIALS

- Oculus Rift or Rift S
- Oculus Touch controllers
- Student activity worksheet

SYNOPSIS

The eXperience: Colorblindness VR experience takes students on a deeper dive into the causes and types of colorblindness. It aims to educate and erase common misconceptions through interactive activities. These activities include daily tasks using filters to simulate what it is like to have the different types of colorblindness. These activities include sorting fruit and painting. The application finishes by giving them a colorblind test with results to see if they have any deficiencies.

TIMELINE

This activity is designed to take be completed in three-45 minute sessions.

✓ For added depth, use this activity in conjunction with the "eXperience Colorblindness VR and Discussion" activity to promote further discussion of what the students learned.

CREATED BY THE BARBERTON HIGH SCHOOL VR TEAM

TIMELINE

Day 1

- The teacher puts students into pairs and hands out the "eXperience Colorblindness" worksheets.
- Students take turns completing each segment of the VR application. The partner inside the headset should communicate information to be recorded by the partner outside of the headset.

Day 2

- Continuation of the previous day's activities.

Day 3

- Students will finish up the worksheet and should have time to answer the reflection questions at the end of the packet.

STANDARDS

Biology:

Heredity

- An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.
- Gene mutations can be passed on to offspring.
- Mendel's laws of inheritance.
- Employ the Punnett Square to determine results of monohybrid and dihybrid crosses to determine genotype and phenotype.

CREATED BY THE BARBERTON HIGH SCHOOL VR TEAM

EXPERIENCE: COLORBLINDNESS ACTIVITY

OPENING QUESTIONS

Fill in the blanks as Qbee describes how we see color. Restart if needed.

- The color we see is based off of incoming ____________________ of ____________________.
- Eyes use ____________ different types of ______________ to see color:
  - One for ___________________ wavelengths
  - One for ___________________ wavelengths
  - One for ___________________ wavelengths
- Color blindness occurs when one cone is either _______________________________ or

  ________________________________.

ONTO THE GARDEN

Write down a description of each type of colorblindness as Qbee explains them.

Deuteranomaly	
Protanomaly	
Tritanomaly	
Monochromacy (Chronomaly)	

FRUIT STORE

In the fruit store, sort the fruit and write down your results.

- **Partner 1:** How many did you get right? _______ How many did you get wrong? ______
  - **Bonus math question:** What is your percentage? ______
- **Partner 2:** How many did you get right? _______ How many did you get wrong? ______
  - **Bonus math question:** What is your percentage? ______

CREATED BY THE BARBERTON HIGH SCHOOL VR TEAM

THE MUSEUM

Once you've finished the colorblind experience and you're in the museum, take some time to look at the different paintings using different colorblindness filters.

- Which type of colorblindness do you find to be the **least** disruptive to sight?

- Which type of colorblindness do you find to be the **most** disruptive to sight?

COLORBLINDNESS TEST

Now take the color blindness test. (have your partner record your results)

- Partner 1: ________________________________
- Partner 2: ________________________________

How did your results compare with those of your partner's?

PAINT A PICTURE

Take a moment to try and paint a picture of a supreme pizza or a fruit stand or a rainbow or something that requires using many different colors. Try doing it with each type of color blindness.

- Which type was the hardest to paint with and why?

- Which was the easiest and why?

CREATED BY THE BARBERTON HIGH SCHOOL VR TEAM

HUE SORTING ACTIVITY

Let's try the hue sorting activity. Take a couple minutes and see if you can finish.

- Were either of you able to finish?
- What made this activity difficult?

REFLECTION

After you are finished with the activities above, discuss with your partner how each type would make everyday life difficult and what they could to make adjustments.

- What are some of the difficulties people with colorblindness encounter on a daily basis?
- What are some possible solutions to help combat these difficulties?

CREATED BY THE BARBERTON HIGH SCHOOL VR TEAM

EXPERIENCE COLORBLINDNESS VR & DISCUSSION ACTIVITY

OVERVIEW

Students will go through the "eXperience Colorblindness" VR app. Using the material covered by the experience and any other supplemental materials or information covered in the class, students will engage in discussions.

MATERIALS

- Oculus Rift or Rift S
- Oculus Touch controllers

CREDITS

www.cultofpedagogy.com/speaking-listening-techniques/

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SYNOPSIS

The eXperience: Colorblindness VR experience takes students on a deeper dive into the causes and types of colorblindness. It aims to educate and erase common misconceptions through interactive activities. These activities include daily tasks using filters to simulate what it is like to have the different types of colorblindness. These activities include sorting fruit and painting. The application finishes by giving them a colorblind test with results to see if they have any deficiencies.

Upon completion of the activities, use one of the two suggested discussion formats described on the next page. This is meant to engage students in thoughtful conversation about the VR experience and colorblindness. You will find sample questions on the third page to get the conversation started.

TIMELINE

This activity is designed to take be completed in three-45 minute sessions.

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DISCUSSION FORMAT SUGGESTIONS

Gallery Walk

a.k.a. Chat Stations

Basic Structure: Stations or posters are set up around the classroom, on the walls or on tables. Small groups of students travel from station to station together, performing some kind of task or responding to a prompt, either of which will result in a conversation.

Variations: Some Gallery Walks stay true to the term gallery, where groups of students create informative posters, then act as tour guides or docents, giving other students a short presentation about their poster and conducting a Q&A about it. In Starr Sackstein's high school classroom, her stations consisted of video tutorials created by the students themselves. Before I knew the term Gallery Walk, I shared a strategy similar to it called Chat Stations, where the teacher prepares discussion prompts or content-related tasks and sets them up around the room for students to visit in small groups.

Socratic Seminar

a.k.a. Socratic Circles

Basic Structure: Students prepare by reading a text or group of texts and writing some higher-order discussion questions about the text. On seminar day, students sit in a circle and an introductory, open-ended question is posed by the teacher or student discussion leader. From there, students continue the conversation, prompting one another to support their claims with textual evidence. There is no particular order to how students speak, but they are encouraged to respectfully share the floor with others. Discussion is meant to happen naturally and students do not need to raise their hands to speak. This overview of Socratic Seminar from the website *Facing History and Ourselves* provides a list of appropriate questions, plus more information about how to prepare for a seminar.

Variations: If students are beginners, the teacher may write the discussion questions, or the question creation can be a joint effort. For larger classes, teachers may need to set up seminars in more of a fishbowl-like arrangement, dividing students into one inner circle that will participate in the discussion, and one outer circle that silently observes, takes notes, and may eventually trade places with those in the inner circle, sometimes all at once, and sometimes by "tapping in" as the urge strikes them.

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DISCUSSION QUESTIONS

- What were the 3 main types of colorblindness? Which one do you think is the worst variation of colorblindness?
- What makes the ability to see the world in a new way important? (Empathy)
- What would one task be that would be harder for people that are colorblind than people that aren't?
- What would you try and come up with to help the colorblind people navigate daily tasks?

STANDARDS

Biology:

Heredity

- **An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.**
- **Gene mutations can be passed on to offspring.**
- **Mendel's laws of inheritance.**
- **Employ the Punnett Square to determine results of monohybrid and dihybrid crosses to determine genotype and phenotype.**

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