Teaching Conscientious Design

How Learning VR Development Can Lead to Greater Understanding of Sustainability

Brian Beams

<table>
<thead>
<tr>
<th>Institution</th>
<th>Santa Clara University</th>
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<tr>
<td>Course Title</td>
<td>ARTS 185: Interactive Immersive Art II</td>
</tr>
<tr>
<td>Course Description</td>
<td>Develop a concept and vision for a VR project using VR and game design concepts for sustainability. Work as a team to create a unique vision for projects using Oculus Rift hardware, creating a stimulating hook or concept to engage participants. Present a finished “vertical slice” of their project—a polished version of what can be expanded into a larger project—conduct user studies on the project’s effectiveness and develop a user research study that will manifest as papers and posters that can be submitted/presented in outside conferences and venues.</td>
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<tr>
<td>Format</td>
<td>Face-to-Face (Pre-pandemic) / Online (Post-pandemic), 4 hours of class time split between lectures and lab/studio time</td>
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<tr>
<td>Enrollment</td>
<td>Enrollment over 3 courses totaling 32 students (course cap was 20)</td>
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Introduction

When teaching a class about design, instructors have an opportunity to structure projects in a way that combines fundamental skills with topics that allow students to hone their skill while addressing real-world problems. The class I designed and taught, vaguely titled *Interactive Immersive Art II* due to its listing in the department of Art and Art History, is an upper-level practical course where students were asked to design a “vertical slice”—a cross-sectional slice that shows refined or completed layers of code, art, and user interface—for a virtual reality (VR) game based on a concept related to sustainability. In 2018 I joined Santa Clara University (SCU) to be the director of the recently formed “Imaginarium,” a VR lab where students could learn about VR design and use the VR hardware and computers to view content for non-design-related classes. I had the opportunity to create a two-course sequence, where the first class would introduce the basics of design, and the second, upper-level course would require students to work in teams to research, design, and build a complete VR experience from the ground up in ten weeks. Development of this class was partly sponsored by the SCU Office of Sustainability through a grant that was intended to fund courses that integrate sustainability into their class content. What resulted was a class with these learning outcomes:

- Students will …
  - … learn how to create VR projects based on complex topics.
  - … understand how design and aesthetics contribute to the user’s understanding of a project.
• … use VR game design to effectively convey a message or topic.
• … analyze the response users have to your developed project.
• … use digital production techniques to produce interactive VR applications that are aesthetically and functionally appealing.
• … interpret the relationship of anthropometrics and ergonomics to scale, human form and experience for virtual reality.
• … construct the visual properties of form, materials, structure, lighting and environment for 3D virtual environments.
• … identify sources of information outside the classroom that can be helpful for the aesthetic problems and technical problems presented in class.
• … analyze, critique, and present work in a productive and effective manner using appropriate terminology.
• … critique one’s own work and the work of others within the context of project and course expectations.

This chapter will showcase an overview of the content that was presented to students in the course (from topics such as serious games, sustainability, and game theory), three examples of student projects, and qualitative outcomes from the class. In the process, we will also investigate ethical questions that arise from the use of VR content and creation.

Serious Games

In the book *Reality is Broken, Why Games Make Us Better and How They Can Change the World*, Jane McGonigal states that “Game design isn’t just technological craft. It’s a twenty-first-century way of thinking and leading. And gameplay isn’t just a pastime. It’s a twenty-first-century way of working together to accomplish real change” (McGonigal, 2011). A class on VR design has much in common with a game design course; the same tools that are used to create modern computer and video games are used to develop VR applications, and the systems that are the main drivers of a video game, such as computer graphics, state machines, and core mechanics are present in nearly all VR applications which use immersive, interactive virtual environments. At their core, these applications are driven by complex, overlapping systems that respond to human input.

While video games were traditionally bound to a flat computer screen or television, immersive VR brings these complex simulations
into virtual environments that users may often find indistinguishable from reality. If the moral panic around violent video games from the late 20th and early 21st century (and the ongoing discussion that continues to this day) is any indication, VR researchers and developers should stay abreast of ethical concerns to insure against the same legal retaliation that has been attempted. Although there is little research that shows any causal link between violent video games and real-world violence, there are advocates against violent video games that may see the tremendous potential of immersive VR technology as a serious threat (Markey & Ferguson, 2017). Although the causal relationship to games and violence is inconclusive at best, there are some concerns when it comes to the application of games in VR. Some research has shown the effect is particularly potent in young children, as interacting with virtual agents in an immersive environment showed a significant effect on the inhibitory control and social compliance of participants (Bailey et al., 2019). People who are developing VR for education and training should be aware of the ethical concerns surrounding young children and should be sure to distinguish “serious” VR from mainstream VR gaming in a way similar to how “serious” video games distinguish themselves from the rest of the medium.

In the intervening years between the rise of video games in the late 1980s to today, “Serious Games” have been adopted as a more academic approach to game design to contrast the more controversial mainstream video game industry and to provide an avenue for video game researchers and developers who want to emphasize a more ethical approach to game design. Serious games utilize the same game development concepts in order to teach, train, or engage players in a wide variety of topics such as scientific literacy, language learning, and simulation. When people speak about serious games, Microsoft Flight Simulator, which has been used for years as a basic introduction to the concepts involved in flying commercial and private aircraft, frequently enters the conversation. When reviewing the first version of Microsoft Flight Simulator in March of 1984, a pilot wrote in a magazine that he found the simulated Cessna 182 to be “surprisingly realistic,” and he concluded that Microsoft Flight Simulator is a “tour de force of programmers’ art” (Miastkowski, 1984). From a more academic perspective, the Center for Game Science at the University of Washington focuses on solving difficult scientific problems using video games. In 2010 they created a game called Foldit, which was used to solve complex protein folds. The team was able to utilize the internet to help solve complex protein-folding challenges through crowdsourcing for “ongoing
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research in **protein design** to treat diseases like influenza and COVID-19, **small molecule design** to invent new drug compounds, and **protein structure solving** to map the molecules that drive biology” (Foldit, n.d.). These challenges are developed by scientists and implemented in a game that shows global leaderboards for gamer scores, thus creating a competitive environment for people to challenge each other to find the best solution.

Games don’t need to be serious simulations to teach people how to understand complex systems or concepts. “Indie Games” have been proving grounds for some of the more interesting ideas in the games industry. Because of the size of the development teams and the scope they hope to achieve, these titles often utilize flexible and repeatable systems that rely on “replayability” and emergent gameplay to keep players engaged. The game **Opus Magnum** by developer Zachtronics, for instance, teaches people how to optimize assembly lines through means of a fictional system of alchemy (Zachtronics | **Opus Magnum**, n.d.). **Opus Magnum** effectively gets people to think about optimization and complex systems, giving players a puzzle sandbox. By contrast, Lucas Pope’s **Papers, Please** is an introduction to the experience of living under totalitarian governments and teaches how systems can be designed to oppress and manipulate people (**Papers, Please**, n.d.). In this game the player acts as a border agent checking passports, enforcing a series of increasingly draconian rules for a fictional Soviet-inspired dictatorship, and forcing the player into making increasingly more ethically and strategically challenging choices. While the field of VR game design is nascent, its ability to present players with moral dilemmas could be extremely potent. The question that VR game designers and developers should ask themselves is this: do we have an ethical, moral imperative to utilize immersive VR for good? And if so, in what ways can we positively influence human behavior when it comes to pro-social causes?

**Sustainability**

One potential answer to the above question is to utilize VR to teach about sustainability. If traditional video games can be used to teach people about various topics, it makes sense that sustainability would be a prime candidate for gamification. The examples mentioned earlier teach players how to understand procedures, patterns, and complex systems. In a sense, sustainability is a concept related to complex,
interwoven systems which govern, and are governed by, human behavior. The United Nation’s 1987 Brundtland Commission Report entitled *Our Common Future* argues that there are three pillars needed to achieve a sustainable society (World Commission on Environment and Development, 1987). These three pillars are economic vibrancy, environmental health, and a social component—either social development or social justice, depending on the context.¹

As described by the Brundtland Report, these three components must align to make society sustainable. For example, if a society observes the environmental and economic pillars and ignores the social aspects, society can be viable, but inequity will have to be resolved to avoid social strife that ends up harming its economy and environment. Some examples of how that would manifest include terrorism, civil war, and social unrest. A society that doesn’t address all these elements equally will inevitably collapse. While there is a certain degree of debate on the impact and effectiveness of *Our Common Future*, especially considering the deep challenges that have emerged in the nearly four decades since its original writing, the concepts presented are still a helpful set of tools and definitions when it comes to our understanding of sustainability (Kashani & Hajian, 2021). The role of society is to keep all these elements in balance through a series of complex, interwoven systems. It is hard for individuals to visualize the impacts of decisions and policies in the abstract, but by using games and role-playing we can compress the timeline to simulate the effects in controlled environments.

One such example of games and role-playing that is called *The Big Catch: A Practical Guide to Development* by A.F. Robertson, which is an interactive case study that is designed as a sort of guide for role playing in class (Robertson, 2018). In this book students are told to roleplay different scenarios, where one side is “Fishing Village A” and the other is “Fishing Village B,” and both have to work towards finding sustainable development of both communities through non-cooperative gameplay, a concept described below. The goal is to increase the economic vitality and social vibrancy of their communities while having the least environmental impact of their fishing operations. Instructors use this book to get future environmental scientists, city and urban planners, and government officials to think more critically about the challenges behind sustainable development.

To understand the science of population growth and management, researchers have created mathematical models to simulate the use and growth of fisheries, which in turn inform real-world development strategies. One of these models, known as Maximum Sustainable Yield,
operates under the assumption that populations will grow when their population density decreases. This is a matter of a population needing resources to grow, and once they reach a certain point, resources become strained, and their population plateaus. Scientists developed a model of this exponential growth equation and determine how much one is able to take from a certain fishery based on its available resources. Because these growth models are determined by numbers, it can be reasonably simulated with a computer, which can in turn be simulated in a virtual environment. However, these models only make sense if we have case studies that show that this is effective. Unfortunately, real-world examples are hard to come by due to one major, unpredictable variable: human behavior.

Ryan Anderson, an Associate Professor of Anthropology at SCU who studied sustainability in Cabo Pulmo for 9+ years, says that sustainability is “an idea laden with contradictions that leaves it wide open for political and social manipulation.” The idea of doing something sustainably would potentially conjure optimistic images of better ways of doing development. But, on the other hand, sustainability can be easily co-opted by a broad field of powerbrokers (Anderson, 2015). The human behavior side of sustainable development is hard to simulate and can complicate what should be straightforward scientific models.

The Fisherman’s Dilemma

Let’s consider the prisoner’s dilemma, which is arguably the most familiar non-cooperative model in the field of game theory. In this scenario, we have Prisoner A and Prisoner B. Both are held in a holding cell separate from each other and are presented with two choices: to either stay silent (cooperate) or implicate their partner (betray). In one scenario Prisoner A pleads not guilty and prisoner B also pleads not guilty (cooperate) and they both go free. However, if one betrays the other while the other stays silent, the one who is betrayed will get 10 years and the other will go free. If Prisoner A and Prisoner B knew to cooperate, they could end up with the optimal scenario, but without the assumption of goodwill from both parties the dominant strategy is betrayal.

The same scenario can be applied to fisheries. Let’s say we have Fisherman A and Fisherman B. And they have the option to conserve or deplete a fishery. In a non-cooperative game, the scenario is the same as the prisoner’s dilemma, where both would choose to deplete due to
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this being the dominant strategy (Munro, 2003). Human behavior is an important concept to understand for VR game designers, regardless of what they are attempting to represent. The player will always choose the dominant strategy, unless given the proper incentive to choose otherwise (Figure 3.1).

Game Mechanics

In class I use this context of sustainable fisheries to give students a starting point for how sustainability can be implemented in a game engine. It is possible to take the formula for maximum sustainable yield and, with some slight tweaks, plug it into a game engine (in the case of this course, we used Unity as the engine of choice). What’s interesting about creating something that is interactive inside a game is the ability to change the parameters dynamically and observe how people respond. Apropos of the above fisherman’s dilemma problem, we no longer need to rely on role playing or verbal discussion to see if ethical choices are made. By putting players in the context of a game their choices are driven by the human instinct to compete and may therefore reveal a more nuanced ontology for ethical decision making in non-cooperative scenarios.

For instance, let’s say we want to figure out the best solution—is it maximum sustainable yield, or some other model? And more importantly, when do we implement this within a virtual environment with all the underlying systems? Is this a good way to teach people that the solution to these problems is more complex than they first realized? Or are we able to then see how people react to these scenarios and

<table>
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<th>Fisherman A/Fisherman B</th>
<th>Conserve</th>
<th>Deplete</th>
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<tr>
<td>Conserve</td>
<td>Both one-half of the present value of the sustainable harvest</td>
<td>Fisherman B receives total harvest, Fisherman A receives none</td>
</tr>
<tr>
<td>Deplete</td>
<td>Fisherman A receives total harvest, Fisherman B receives none</td>
<td>Both one-half of the present value of the total available harvest</td>
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Figure 3.1  A simplified payoff matrix for non-cooperative fishing.
gauge whether they respond to them in a positive way or a negative way? There’s a lot of value in creating these simulations of sustainable models in a VR environment in a way that is digestible and understandable for the user.

After asking students these types of questions I begin to leverage the elements of more traditional video game design, introducing ideas like core mechanics, state machines, and computer graphics. Core mechanics do multiple things for a VR simulation. They can operate the internal economy of your VR game, present active challenges to the player, accept player actions and detect victory or loss, operate the AI switch from game mode to game mode, and can transmit triggers for the storytelling engine (Adams, 2009). They may do all or some of these things. Furthermore, these core mechanics are what control “in-game economies,” which can be simplified versions of real-world economic systems.

Ernest Adams breaks down in-game economies in his book *Fundamentals of Game Design* into simplified terms. There are resources and entities, in which resources refer to any concept that can be measured numerically and entities are specific quantities of resource that are stored within an object or container. Almost anything in the game can function as a resource, and resources can be either tangible or intangible. In the case of *The Big Catch* scenario, for instance, a fishing trolley would be an entity, whereas the resource is a fish. Adams also outlines four economic functions, which manage the resources and entities within the game itself, known as sources, drains, converters, and traders (i.e., fisheries, hungry human populations, a market to sell fish for currency, and a store to buy upgrades for the fishing boat, respectively).

**Existing VR Projects Related to Sustainability**

VR artists, developers, and researchers have been exploring environmental sustainability as a subject for decades. VR is a particularly persuasive medium due to its immersion and interactivity. In 1993, VR artist Char Davies was exploring VR as an arena for questions about perceptions of nature and being and affirming our embodiment within the world itself. Her work was designed to allow participants to examine their perceptions of the world and allow them to have a philosophical experience within the virtual space. This experience wasn’t particularly scientifically accurate, and mostly relied on a series...
of visuals seen through embodied immersion to create a more artistically driven experience in order to get people to think critically about humanity’s relationship to the earth and nature (Davies, 1998).

Stanford’s Virtual Human Interaction Lab (VHIL) has been researching the use of VR for climate change education for nearly a decade, creating content for VR platforms and publishing papers based on studies of that content. Dr. Jeremy Bailenson, the founder and director of VHIL and author of the book *Experience on demand: What virtual reality is, how it works, and what it can do* talks extensively about climate change and its virtual representations. A core component of VHIL’s focus is understanding how to make content that emphasizes what VR should be used for, not just what it can be used for, to “strive for more than pure sensationalism or escapism in our entertainment” (Bailenson, 2019).

One such project studied the use of original 360 videos about climate change’s effects on earth’s oceans and compared them to traditional 2D video (Queiroz et al., 2022). The results showed, even without the use of embodied cognition (the ability to interact with the virtual environment), that VR increases the user’s sense of self-efficacy more than comparable media interventions. In other words, VR is more effective at calling the participants to action.

Researchers at VHIL also created an embodied VR application called the Stanford Ocean Acidification Experience (SOAE). David Markowitz and others used this application in a study and found that there was a change in knowledge about ocean acidification, which was linked with increased engagement and exploration of the virtual environments (Markowitz et al., 2018). In the study, participants were asked the yes-or-no question, “Would you like us to send you more information about ocean acidification?”; approximately 1/3 of the participants asked for more information. The results of this study showed that VR can be used in order to talk about complex topics related to climate sustainability and leads to increased engagement. Since its debut at the 2016 Tribeca Film Festival, SOAE has been downloaded in more than half of the countries around the world and has been translated into French, Portuguese, and Spanish. While the metrics about specifically who is playing SOAE, and for what purpose, is not known to the researchers at VHIL, I believed that showing this experience was an ethical imperative in the college VR classroom I was teaching at SCU, and I know of other institutions with VR labs that also showed this for the same reasons.
Course Structure

The goal of the class was to create a finished VR product which was to be an engaging experience designed to make the player think critically about sustainability issues facing society and the environment. For the first three weeks, students researched topics in sustainability and chose an idea as a subject for their project. The next five weeks focused on development. They developed a VR project that was designed to educate participants about their chosen topic and sustainability. During the final two weeks of the class, they conducted a small user study to determine if their designs were effective at conveying these ideas. The class was therefore broken into three sections:

1) Concept/Design
   - Form teams and begin designing the team’s project
   - Play VR Projects to gain inspiration for designing systems
   - Conduct background research and writing assignments

2) Production
   - Build out prototype of team’s VR game
   - Add art and features
   - Develop finished “Vertical Slice” of a game

3) Analysis
   - Develop user study plan
   - Create a video presentation, poster presentation, and short paper

Students spent the majority of the ten-week quarter developing the following deliverables: one VR project, built in Unity, compiled to an executable; one documentation video, which should highlight the concept, graphics, and features of the game; one short paper or abstract explaining the results of a user study conducted about the game; and one research poster. The course structure was designed to teach students about the concepts of designing a VR game from concept to completion. It covered the basics of using a game engine to develop the tools and environments needed to make an immersive virtual environment: understanding of basic programming, game engines and other tools, and 3D art and design.

Students also got a location-based learning experience to learn about the sustainable practices at the Forge Garden, a sustainable teaching
garden for research and food production on the SCU campus. After
the tour the class discussed what they learned and how they can draw
inspiration for their VR projects. After the Forge Garden field trip and
a lecture covering the foundations of sustainability, students looked at
their communities and studied where sustainability can be improved,
and what incentives could be in place to encourage more sustainable
practices. Students were then asked to create a slideshow presenta-
tion addressing a topic that is close to home and present ideas that use
game design or interactive technology to make their community more
sustainable. Students were expected to reflect and write on selected
readings (the previously mentioned papers by Anderson and Markow-
itz) and VR projects (SOAE) before presenting their proposals, which
required instructor approval before development began. The goal of
these assignments was not to teach the basics of VR development but
to teach them how to develop an ethical framework upon which they
will form their own understanding on the importance of sustainability.
VR technology, and technology in general, is designed to be ethically
neutral (implicit bias notwithstanding). Therefore, teaching the stu-
dents a more ethics-focused approach to their design projects was an
imperative to me as an instructor.

By creating a curriculum with scaffolding based on a specific topic
(sustainability), students had a specific goal that wasn’t directly tied to
just making something for entertainment. Ethically, I believe that it is
the goal of instructors to enable students to fully understand the impli-
cations of the things that they create. Lessons must go beyond game
design for consumption and entertainment purposes. Students need to
recognize the bigger picture: that their skills can be used to promote
the public good.

**Student Outcomes**

There was some resistance from the students at the beginning. Many of
them came into the VR class wanting to build applications that would
get them noticed by large tech companies or make something enter-
taining within the context of video games or gamer culture. A large
amount of the consumer interest in VR is linked to playing games.
Beat Saber is a rhythm game that is a perennial best-seller across most
VR platforms, and the companies who have been developing con-
sumer VR, such as Valve and Sony, are primarily interested in VR as
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a gaming interface. Meta’s head of VR, John Carmack, is a legendary game developer who became famous for co-creating the game *Doom* (1993).

Although the students were often reluctant to engage with the topic of sustainability initially, their reflections by the end were extremely thoughtful and showed a nuanced understanding of the course topics. Based on reports received after the course, students felt that the class was effective at teaching what they wanted to know about VR design while also giving them something to be passionate about beyond the scope of the class. Most students completed the course more engaged with the topics that they chose to focus on while developing their VR games. Although I used the topic of ocean sustainability as a starting point for the students, I allowed them to choose any topic they wanted as long as it related to sustainability. Here I will talk about three of the students’ team projects from this course.

**Robo Crop: A VR Game about Sustainable Farming**

One of the projects was a VR application called *Robo Crop*, which is a fictionalized farming simulator with a focus on crop rotation as a game mechanic. Beyond creating a simple farming game, the other goal of this project was to get players to understand concepts like the Tragedy of the Commons, a term originally coined by British economist William Forster Lloyd which theorizes that if a resource is given public access for free it will end up being exploited and depleted by those who use it, leading to its destruction (Lloyd, 1977). Players were asked to make decisions based on the needs of the public and shared resources, and then, by using temporal compression mechanics, the player would see the consequences of putting profit first (Figures 3.2 and 3.3).

*Figure 3.2* The simplified crop rotation mechanics utilized by Robo Crop.
In their final report, students claimed that among their user study participants, 33% expressed the belief that sustainable farming was more economically viable, and 42% considered sustainable farming as an issue of concern to them. General knowledge of the concept of crop rotation rose by 11.7%. The sample size was small (20 participants), and the study design was not rigorous, acting more as a pilot study that didn’t go beyond simple means and averages, but it did demonstrate to the students that they could create something that was capable of teaching people about challenging topics while still being entertaining.

**Tacological: A Sustainable Food Truck Management Sim**

Some students wanted to implement balancing the “three pillars” from the Bruntland Report as a core mechanic. One of these teams created *Tacological*, a game where players would manage a taco food truck, balancing the public’s perception of “green” restaurants with the financial management of running a small food truck operation. The goal was to create a VR game that educates users about the impact of food-service decisions on consumers, the bottom line, and the environment (Figure 3.4).

From their own user study, the students reported that the percentage of participants who valued food’s environmental impact rose from 18.14% to 59.09%, and the percentage of participants willing to pay more for environmentally friendly food products increased from 13.64% to 27.27%.
AdvocaSea: Clean the Ocean

The last sample project was called *AdvocaSea*. The objective of this game was to teach about the different types of ocean pollution, educate about the human side of environmental conservation and teach about different meanings of sustainability while delivering an engaging VR experience. In this project, the team sought to visualize the visible ocean waste as garbage floating in front of the player, as well as microplastics, which are ubiquitous in all oceans at all depths, absorb pollutants and toxins, and travel up the food chain. Microplastics are a much harder problem to solve, and what this team observed from their research is that most of the pollution in the ocean is smaller than the naked eye can see.

For this VR experience, players had two different states that they could be in: underwater, collecting trash and gaining PR or public relations points, and on a boat managing the player’s nonprofit ocean cleanup organization and using PR points to gain funds, purchase upgrades, and develop new ways to tackle the problems of microplastics. This was done to emphasize the importance of public activism, scientific research, and lobbying for change, which is just as important as (if not more than) just picking up visible garbage the player can see (Figures 3.5 and 3.6).

The impact of this project on this team was evident. One of the students went on to develop *AdvocaSea* even further as part of their capstone project (Dang, 2020). One of the students went on to say in an interview with the university marketing team that “*AdvocaSea* was special to me because it is a project that allows me the creative freedom as
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I love that I can combine my love for video games with my concern about climate change. Ocean pollution is an important problem that needs to be addressed because it affects us all and we are the cause” (Walsh, 2019).

I keep in touch with the students who worked on these projects. Most of them have graduated and have gone on to work for companies.
who develop games, VR applications, or various “metaverse” products. When I speak to them, they still tell me they think of this class when building things in their professional careers, and how much this class influenced who they are today. As instructors of higher education, I believe there is a certain ethical obligation to go beyond the conventional instruction of the classroom and challenge students in a way that not only teaches them the material but also helps them develop their own moral compass, making them better citizens of the world after they leave the classroom.

Conclusion

In the end, I had the opportunity to teach three sections after designing this course, one of which unfortunately occurred during the year all students were learning exclusively online due to COVID-19, away from the lab where previous students had access to VR hardware and computing resources. There were 32 students enrolled across those three sections, for a total of eight team projects. Interest in VR has only grown since then, especially as people look to VR as a potential tool in distance learning across all disciplines.

There is a shortage of “good” VR content being created, the kind with an emphasis on ethics driving the overall experience. My goal for this class was to help influence the next generation of VR designers and programmers into thinking beyond the usual need for consumption and entertainment in order to help bridge the content gap. Despite the limited number of students and sections, the individual student impact of this course is among the strongest I have ever taught. Many of these students are now working in VR and game design and have personally told me that this class is directly responsible for making them better designers.

Certainly, games are a huge commercial industry, and VR gaming hopes to grow along with gaming as an industry. As companies invest billions of dollars into VR and gaming, there’s little doubt that this technology has considerable staying power in 21st-century society. If we’re going to be teaching the VR game designers of tomorrow, I believe that there is an imperative to teach them how to effectively design something that engages users beyond simple, well-crafted, commercially viable entertainment, expand their horizons, and inspire them to try to leave the world a little better than they found it.
Special Thanks

I would like to thank Dr. Ryan Anderson for taking the time to teach me about sustainability and for being such a crucial part of the first ARTS 185 course. I would also like to thank Dr. Jeremy Bailenson for his support and guidance, and for his ongoing dedication to making sure VR is a force for good. And finally, I would also like to thank Em Dang, Vicki Lim, Maggie Schulte, Isabel Wu, Maddie Goliver, Andrea Horvath, Dipti Gupte, Cole Dennis, Sam Vivian, David Kerr, and Mohammed Khadadeh, whose student projects I referenced in this paper and were all exceptional and gifted students whom I had the pleasure of teaching.

Note

1 There’s some debate as to the exact interpretation of the “social pillar.” Social development is often limited to raising basic standards of living above poverty thresholds, whereas social justice is concerned with that and with the equitable distribution of wealth and power.

References

Foldit. (n.d.). Retrieved October 20, 2022, from https://fold.it/about_foldit