

## **Using Technological Innovations and Interdisciplinary Approaches to Teaching Sustainable Development: A Virtual Residency Case Study**

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### **Abstract**

The use of educational technologies to bridge learning divides is an important topic in 21<sup>st</sup> century higher education. As an innovation to address this need, since 2017, Dr. Rhianna C. Rogers has coordinated SUNY Empire State College - Virtual Residencies (VRs), virtual, international exchanges that connect undergraduate, graduate, and international education courses via a three-week collaborative, cross-disciplinary online module. As part of a 2020-2021 SUNY Empire Institute on Mentoring, Teaching, and Learning (IMTL) research project, Rogers and colleagues Dr. Linda Jones and Dr. Mark Abendroth collaboratively built a VR around the theme "Learning for a Sustainable Future." This VR introduces students and faculty to the UN Sustainable Development Goals (SDGs) and the interdisciplinary concepts of environmental anti-racism, ecofeminism, and sustainability in political economy. Given the international component of this VR, specific emphasis will be placed on Climate Action (SDG #13) and Reduced Inequality (SDG #10), but students will have the ability to research other SDGs of interest. The "Learning for a Sustainable Future" VR will involve two weeks of analyzing SDGs and apply them to case studies from around the globe. Students will engage with interactive learning activities, such as case studies, videos, games, and synchronous/asynchronous panel discussions. The third week will highlight local, regional, and international organizations that have made important progress toward equitable, environmental solutions. This VR will help the SUNY Empire Sustainability Committee (SC), of which Jones and Abendroth are members, to engage students in academic and community sustainability projects in the State of New York and beyond. Our hope is that the combined work of the VR and SC will serve as an example for effective interdisciplinary instruction and as best practices for educators across the world who strive for inclusive education around sustainability.

### **Introduction**

In traditional learning models, educational institutions have mostly prepared students to perform certain social functions in a relatively predictable world. Whether through the limitation of case studies, reliance on particular schools of thought or a general failure to incorporate the latest trends in research, this model has limited the learners' ability to meaningfully engage with and contribute to the solution-making efforts of today's socio-cultural and socio-environmental issues. As we have seen in the COVID-19 era, the world is changing, and we can no longer accept "the same old same old." Today's students will have to deal with complex sustainability challenges, like global warming, food deserts, healthcare disparities, poverty, and social unrest, which require totally new skills and educational attitudes. The future of this world depends on the sustainable practices we implement today. To support new sustainable education practices, we need to educate people about their ability to influence sustainability processes in creative ways. This paper will use SUNY Empire State College - Virtual Residencies (VRs) model, a

virtual, international exchange that connects undergraduate, graduate, and international education courses via a three-week collaborative, cross-disciplinary online module, as a case study for effective interdisciplinary instruction.<sup>1</sup> Our hope is to share best practices for a proven learning approach that fosters informed sustainable development and action.

### **Developing an Effective Virtual Residency Model**

In 2017, SUNY Empire State College (SUNY Empire) adopted the innovative platform, Virtual Residencies (VRs), to create spaces for students to explore complex issues. The goals of VRs are to address the need for transformative learning experiences in order to prepare students to meet the complex environmental, social, and cultural challenges they are facing in their communities. Dr. Rhianna C. Rogers, an anthropologist and associate professor of interdisciplinary studies, is the creator and coordinator of the VR program, a virtual, international exchange that connects undergraduate, graduate, and international education courses via a three-week collaborative, cross-disciplinary online module. Since their creation, VRs have existed as a partnership between the college's Center for International Education and Rogers' Buffalo Project.<sup>2</sup>

As part of a 2020-2021 SUNY Empire Institute on Mentoring, Teaching, and Learning (IMTL) research project, Rogers has been joined by Dr. Linda Jones, associate professor in natural sciences, and by Dr. Mark Abendroth, associate professor of social studies education, to create the Fall 2020 "Learning for a Sustainable Future" themed VR. Our theoretical scope and content are intentionally broad, drawing from the UN Sustainable Development Goals (SDGs)<sup>3</sup> and the interdisciplinary concepts of environmental anti-racism, ecofeminism, and sustainability in political economy. During this three-week exchange, students will spend two weeks critically analyzing global sustainability practices through the lens of the SDGs. The third week will highlight cases in which groups of people have made important progress toward solutions and allow learners to apply course content to their own action-based microstudies. Given the international component of this VR, specific emphasis was placed on the Climate Action (SDG #13) and Reduced Inequality (SDG #10) UN goals, but students will have the ability to research other SDGs of interest. A highlight of this exchange is an international panel of speakers discussing the topic of sustainability in a session, which will be re-used as an Open Educational Resource (OER). All other discussions and assignments in the course will occur in an asynchronous format. This VR will be a catalyst toward meeting one of the goals of SUNY Empire's Sustainability Committee (SC), which is to include students in SC academic and community projects in order to build towards and promote sustainable policies and practices. Our hope is that the combined work of the VR and SC will serve as an example of effective interdisciplinary instruction. The remainder of this paper will highlight the programmatic

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<sup>1</sup> Since 2017, Rogers has conducted five themed Virtual Residencies (VRs), each lasting three weeks and involving participation from undergraduate, international, and graduate faculty and students of multiple courses across disciplines and countries.

<sup>2</sup> Rhianna C. Rogers. 2020a. The Buffalo Project. SUNY Empire State College. accessed on August 1, 2020, <https://rrogers.sunyempirefaculty.net/the-buffalo-project-an-ethnographic-study-of-western-new-york/>

<sup>3</sup> United Nations. 2020. "United Nations 17 Sustainable Development Goals: 17 Goals to Transform Our World," United Nations, accessed July 31, 2020, <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

framework, innovative technologies, and best practices used to create this interactive, international learning experience.

### **Adopting an Effective Online Learning Model**

The systematic development of deep learning (or the critical way to engage learners in applied learning skills and activities)<sup>4</sup> is one such way to teach learners about the importance of sustainable practices. In VRs, educational content is continuously evolving in order to reach different populations, including those challenged by their socio-economic status and access to technology. Inevitably, these new educational delivery methods are changing the way students learn and want to be taught. Educators are challenged now, more than ever, to find innovative ways to bridge the digital divide between educators and diverse student populations.<sup>5</sup> This is especially apparent when institutions take part in international student collaborations where student experience can be remarkably different across various cultural groups. The intentional use of multiple technologies in the VR format (e.g., Zoom, WhatsApp, Moodle, Google platforms, etc.) allows for multiple entry points for students who may not have the same access.<sup>6</sup> In many ways, VRs serve as a clear example of inclusive, sustainable education practices; one that can and should be used more broadly.

It is worth noting that when shifting from the physical to the virtual classroom, often the barometer of its effectiveness is based upon the level of classroom engagement and whether or not the students gained a positive learning experience.<sup>7</sup> Effectiveness can appear to be difficult to assess in online environments but much like assessing a live physical classroom interaction, and it can be easily measured through student comments and performance.<sup>8</sup> Positive results have been reported in past VRs through measuring student overall performance and engagement. For example, in the 2019 Global Studies VR, 68 of the 74 enrolled students (91.8%) completed 90% or more of the VR activities, whether required by their participating instructor or not.<sup>9</sup> Results indicate that online success does not depend on the mode of delivery, but more on preparation, design and facilitation of the educational content.

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<sup>4</sup> Robyn L. Philips. 2015. "Caught in the headlights: Designing for creative learning and teaching in higher education." PhD diss., Queensland University of Technology, 2015.

<sup>5</sup> Rhianna C. Rogers. 2020b. "Using Online Learning to Bridge Cultural Divides." Produced by Policy Outsider. *Rockefeller Institute of Government*. February 3, 2020. Podcast, 48:27. accessed August 1, 2020 <https://anchor.fm/policy-outsider/episodes/17--Using-Online-Learning-to-Bridge-Cultural-Divides-eaijil/a-a1cvfia>

<sup>6</sup> Jeannine Mercer, Katarina Pisutova, and Rhianna Rogers. 2018. "From mystery to mastery: Creating & enhancing the ultimate virtual classroom experience." In *2018 COIL Conference Proceedings*, pp. 112-124. 2018.

<sup>7</sup> Ibid.

<sup>8</sup> Florence Martin and Michele A. Parker. 2014. "Use of synchronous virtual classrooms: Why, who, and how." *MERLOT Journal of Online Learning and Teaching* 10, no. 2 (2014): 192-210.

<sup>9</sup> Rhianna C. Rogers. 2019. Unpublished Virtual Residency Report, AY 2019-2020. On file at SUNY Empire State College. 2019.

Some educators have described having positive student learning experiences when utilizing synchronous virtual meetings<sup>10</sup>, while others<sup>11</sup> experienced negative results. Ozgur Yilmaz conducted a study on 63 students in which half of them took traditional lessons and the other half participated in virtual sessions.<sup>12</sup> Test scores for the students taking virtual sessions were higher, though the perception of the online learning experience varied greatly. Within SUNY Empire's VR model, participating VR instructors reported that online classroom engagement increased given the interactive and collaborative nature of the experience. Instructors specifically noted that the reflexive elements of the VR model (e.g., Keynote panels, reflective discussion forums, building-block assignments, and a culminating call-to-action assignment) forced students to think creatively about the materials they read and how to apply them in the real world. As Justin W. Cook stated:

Among the effective methods to promote [engaged learning] is the development of a reflexive worldview, which constantly evolves awareness about factors shaping one's thoughts, habits and ideas about how the world works... In societies faced by injustices and inequalities, learning for social cohesion is a must. Only through creating stories of "us" that nourish communal spirit while acknowledging the inherent diversity can we hope for a peaceful run through this coming turbulent century. We are also living in a time when the development of soft skills like collaboration and communication is no less important than any practical skills acquired by students.<sup>13</sup>

Creating a sense of community in online instruction is an important part of the VR experience. When students feel that their voices are heard, learning increases drastically.<sup>14</sup>

### **Using the Global Learning Qualifications Framework (GLQF)**

An innovative feature of the Fall 2020 "Learning for a Sustainable Future" case study was the intentional adoption of the Global Learning Qualifications Framework (GLQF),<sup>15</sup> rubric for evaluating college-level learning. The GLQF is the culmination of over 90 countries and various organizations' perspectives of what is university-level learning (e.g., AAC&U Value Rubrics, Lumina Degree Qualifications Profile). As part of the academic team who created the GLQF, Rogers helped define the framework, which is organized into overarching constructs (i.e., Integration, Engagement, and Knowledge) and then used to measure student acquisition of knowledge across learning domains (Applied Knowledge, Integrated Knowledge, Specialized

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<sup>10</sup> Seiko Yasumoto. 2014. *Teaching and Learning in the Digital Era: A Case Study of Video-Conference Lectures from Japan to Australia*. International Association for the Development of the Information Society, 2014.

<sup>11</sup> Robert J. Koenig. 2010. "Faculty satisfaction with distance education: A comparative analysis on effectiveness of undergraduate course delivery modes." *Journal of College Teaching & Learning (TLC)* 7, no. 2 (2010).

<sup>12</sup> Ozgur Yilmaz. 2015. "The Effects of " Live Virtual Classroom" on Students' Achievement and Students' Opinions about" Live Virtual Classroom" at Distance Education." *Turkish Online Journal of Educational Technology-TOJET* 14, no. 1 (2015): 108-115.

<sup>13</sup> Justin W. Cook. 2019. *Sustainability, human well-being, and the future of education*. UK: SpringerNature, 2019. Accessed August 1, 2020 <https://www.sitra.fi/en/publications/sustainability-human-well-future-education/>

<sup>14</sup> Rhianna C. Rogers. 2020c. "Creating a Sense of Community in Remote Instruction." SUNY Remote Teaching Clinic. May 26, 2020. Video, 49:10. Accessed July 20, 2020 <https://www.youtube.com/watch?v=S6pYWZ97DNk&feature=youtu.be>.

<sup>15</sup> Global Learning Qualification Framework. 2015. SUNY Empire State College. Accessed on July 15, 2020 <https://www.esc.edu/global-learning-qualifications-framework/>

Knowledge, Learning Engagement, Communication, Sociocultural and Civic Engagement, Ethical Responsibility, and Information Literacy). The framework is structured to assess overlaps in learning from a holistic approach. The GLQF is content agnostic, providing overall learning outcomes that can be customized for specific applications.<sup>16</sup> The GLQF is presented from both the educator/evaluator and the student perspectives:

- The **educator/evaluator perspective** provides descriptors of university-level learning.
- The **student perspective** provides layers of prompts to help students build evidence-based ePortfolios and to place their learning within the framework.

Ultimately, the framework places the learner at the center and focuses on assessing the learner's evidence-based knowledge for university credit, but it can be used in other ways. Students' knowledge in any particular area may touch upon each of the eight learning domains, but in varying amounts and with great overlap as illustrated in Figure 1.



Figure 1. Global Learning Qualifications Framework

The adoption of the GLQF as an assessment tool in the Fall 2020 VR case study was a key to ensure the assessment of student learning was accomplished. This VR case study is the first to adopt this tool. It is our intention to revisit students' learning once the VR is completed to assess if the tasks assigned in the VR could be mapped to students' knowledge attainment as represented in the GLQF.

<sup>16</sup> Nan L. Travers and Amy McQuigge. 2013. "The global learning qualifications framework." *PLA Inside Out: An International Journal on Theory, Research and Practice in Prior Learning Assessment* 2, no. 1 (2013).

## Learning for a Sustainable Future: A Virtual Residency Case Study

The VR “Learning for a Sustainable Future” has been designed to provide students with a broad introduction to sustainability and sustainable development. As an international, interdisciplinary learning community, students are invited to explore the interdependent nature of environmental, social, and cultural systems. They are asked to consider ways that issues/challenges in one system ripple through the other systems, resulting in unsustainable conditions such as environmental degradation, poverty, and social unrest. They are also encouraged to consider the ways that solutions informed by scientific data and socio-cultural perspectives in one system impact the way other systems achieve SDGs. To encourage attainment of the 17 global SDGs, as outlined by the United Nations, by 2030,<sup>17</sup> we developed curricula that positioned creative thinking, effective decision-making, and reflection as guides to support the health and sustainability of systems. Throughout the VR, then, students are invited to reflect on their “sustainable worldview” and propose tangible solutions to systemic environmental, social, and cultural issues. The VR model works particularly well because the framework itself mirrors the complexities of sustainable development and the SDGs. In the VR, the learning community is comprised of members with different levels of learning, different cultural backgrounds, and different fields of expertise. As a result, there is an inherent diversity among the individuals participating in discussions focused on developing and evaluating sustainable solutions to unsustainable situations. A benefit of this experience is that by participating in the VR, students gain intercultural competencies from interacting with others who may not share their “sustainable world view.”

A challenge and asset that we faced as we approached the design of this VR is that our backgrounds mirror that of the students who will be participating in this VR. We come from different fields of expertise (Anthropology, Social Science Education, and Environmental Geosciences), we come from different academic programs (International Education, School of Graduate Studies, and School of Undergraduate Studies), and we share a common thematic area of interest, research, and advocacy (sustainability and sustainable development). Because we are not approaching sustainability and sustainable development from a single discipline or through a single disciplinary lens, we adapted (re-imagined, re-envisioned, and revised) nontraditional approaches to our curricular design. In addition, the learning resources and learning activities that we selected and created for the VR are transdisciplinary in nature. This approach enables us to reach a broader audience, one that reflects different disciplinary foci, student interests, and socio-cultural perspectives.

### Backward Design for Transformative Learning

Backwards curriculum design is effective when desired outcomes are aligned with assessments and instruction. In the case of the VR, we aligned our desire to teach students the SDGs through the adoption of the GLQF. Using this framework, we then were able to map to appropriate course activities and specific assignments. Not all instructors in higher education receive formal training in strategies of curriculum and instruction. Without such training, they tend to teach the same way that they experienced instruction in college courses as students.

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<sup>17</sup> United Nations. 2020. “About the Sustainable Development Goals,” accessed July 31, 2020, <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.

For many this was a linear, teacher-centered approach, following a pattern of students preparing for a paper or test without any stated learning outcome(s) or course mapping from the instructor. Reynolds and Dowell-Kearns, in response, designed a tool that guides college instructors toward becoming more student-centered and more oriented toward backward design.<sup>18</sup> They found positive results when they observed backward design as applied in a college biology course for non-majors. The instructor reported better preparation of content and lectures, improved time management, increased student engagement, and more opportunities for feedback with students.

To help guide the design of the VR, we used a modified version of Backward Design, where learning outcomes are identified at the beginning of the curricular design process and a curriculum map is created, which aligns course-learning outcomes with learning activities. As shown in Table 1, we created a list of questions, which focused our selection of learning resources and creation of learning activities. The creation of a list of questions establishes a shared focus among collaborators. Responses to the questions serve as guides to curricular design.

Table 1. Questions Used to Guide Curricular Design

Questions Used to Guide Our Curricular Design	Design Components
<i>How can we introduce students directly to the GLQF so that they engage in metacognition as they work their way through conceptual learning of sustainability?</i>	Connections among learners, learning domains, outcomes and content of the learning experience.
<i>How can we introduce the 17 UN goals in a way that invites students to engage in discussion from their lived experiences in matters of diversity, equity, and inclusion?</i>	Selection of learning resources and creation of learning activities tied to specific UN SDGs.
<i>How can we be prepared if students push back against the values of equity in the UN goals, or against the consensus of the science community that climate change exists and comes from human activity?</i>	Inclusion of resources acknowledging the importance of having a “safe space” to discuss, mindfully and respectfully, complex, challenging issues. Inclusion of resources, which invite students to explore, question, and learn ways of critically evaluating research, data, and individually, socially, and culturally motivated behaviors.
<i>How can we provide the optimum challenge for a three-week learning experience that reaches effectively into some of the advanced levels in the GLQF?</i>	Reminder of the need to scaffold resources and learning activities to provide opportunities to self-evaluate their learning and direct their learning experiences.
<i>How can we create a learning experience which is relevant to students with diverse disciplinary backgrounds (anthropology, art, business, gender studies, ecology, economics, psychology, and technology) and accessible to students with diverse programmatic backgrounds (undergraduate, graduate, and international education programs)?</i>	Reminder that learning resources and learning activities need to span disciplines and highlight the inherent interdisciplinary nature of sustainability and sustainable development. A variety of resources and activities need to be offered to span levels of expertise—case studies, films, games, scholarly journal articles, websites, etc.

<sup>18</sup>Heather L. Reynolds and Katherine Dowell Kearns, “A Planning Tool for Incorporating Backward Design, Active Learning, and Authentic Assessment in the College Classroom,” *College Teaching* 65, no. 1 (2007): 17.

The questions established connections among the GLQF, the SDGs, and the characteristics of diverse members of this learning community. Once we had established clear, concrete questions that we wanted our VR curriculum to answer, we mapped our content back to the GLQF and SDGs, as shown in Table 2, an example of one of our curriculum mapping tables, which outlined learning outcomes and drove the design of this virtual residency learning experience. The map provided us with the ability “to see” where we wanted students “to be” at the end of the 3-week residency experience, guiding our selection of resources and creation of learning activities.

Table 2. Example Mapping of GLQF learning domains, outcomes, and SDGs.

Learning Outcomes				
Upon completion of this 3-week virtual residency module, the learner will be able to:				
CLO#	Learning Outcome: Evaluate their perspective while charting steps toward growth as global citizens for sustainability. (GLQF LDs*: Communication & Sociocultural and Civic Engagement—Lower Level)	Week 1	Week 2	Week 3
1.1	Communicate knowledge in a content area accurately, coherently, and clearly, informed by key concepts, techniques, and developments in the field		X	X
1.2	Demonstrate an awareness of and sensitivity to the needs and requirements for communicating with various audiences	X	X	X
1.3	Demonstrate insight into one’s own identity and biases and the influence they have on understanding and interacting with others	X	X	X
1.4	Demonstrate acceptance for and willingness to learn from diverse perspectives and backgrounds with different social/community groupings and audiences	X	X	X
<b>Totals Per Unit</b>		3	4	4

### Transformative Learning & Critical Pedagogy

As a goal of our case study, we hoped to create a space for transformative learning. Jack Mezirow advocated for a process in which an adult learner identifies a problematic frame of reference in one’s own point of view and moves to a more insightful frame through critical reflection.<sup>19</sup> This VR case study has transformative learning at its center. We want the students and faculty who are unfamiliar with sustainable development to change from being uninformed to being informed about the topic and, thus, engaged in continued learning beyond the VR and with civic action.

When developing curriculum with a transformative focus, we must develop meaningful participation that encourages a diversity of voice. Instruction should encourage critical analysis and offer multiple approaches and solutions to the topic. For example, the science community is in consensus that climate change is caused largely by human activity and that irreversible catastrophic damage will be the result if humans do not act to reverse the rise of greenhouse

<sup>19</sup> Jack Mezirow, “Learning to Think Like an Adult: Core Concepts of Transformative Theory,” in *The Handbook of Transformative Learning: Theory, Research, and Practice*, eds. Edward W. Taylor and Patricia Cranton (San Francisco: John Wiley & Sons, Inc., 2012), 73-95.

gases.<sup>20</sup> Conversely, some religious communities argue that climate change does not exist and/or that its impacts are not as adverse as stated by science.<sup>21</sup> These opinions, most likely, will be represented within the student and faculty represented in this VR case study. Recognizing these perspectives is one way to create a dialogue across belief systems. Including these perspectives encourages critical thinking through the process of deliberative conversations, which are “meant to intentionally bring together individuals who represent diverse perspectives around a topic; sometimes difficult or controversial, to advocate for tangible, joint solutions that give a voice to all invested in the conversation.”<sup>22</sup> In this current time of a global unrest, we have chosen to focus around these difficult dialogues as well as the SDGs focused on “Reducing Inequalities” in addition to “Climate Action” to push towards inclusive and transformative learning.

As a byproduct of this VR and its goals, elements of critical pedagogy were addressed. The field of critical pedagogy suggests that education can and should be a student-centered and justice-centered endeavor.<sup>23</sup> Paulo Freire, who worked to bring literacy to marginalized populations in Brazil before a military dictatorship imprisoned him in 1964, developed a “pedagogy of the oppressed” that combined learner-centered strategies with intentional learning toward emancipation from unjust social conditions.<sup>24</sup> He used a word in his native Portuguese - *conscientização* - that roughly translates to English as “critical consciousness.” Freire asserted that education is never politically neutral, that it can be either oppressive or liberating. He contrasted what he called “banking”<sup>25</sup> with what he called “problem posing.”<sup>26</sup> In this model, we could “bank” VR students for three weeks with information about sustainability problems and possible solutions, but that would not be transformative; instead, it would just be a task of memorization and knowledge regurgitation. In that frame, students could complete the VR without considering their potential as critical, creative thinkers and change agents. We have chosen instead to employ problem posing to encourage transformative thinking and action. For example, one of the first tasks of the VR is to have students reflect on their current perspectives on sustainability and then having them jointly work towards a consensus definition of

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<sup>20</sup> Anthony Costello, Mustafa Abbas, Adriana Allen, Sarah Ball, Sarah Bell, Richard Bellamy, Sharon Friel et al. 2009. "Managing the health effects of climate change: lancet and University College London Institute for Global Health Commission." *The Lancet* 373, no. 9676 (2009): 1693; Sander L. van der Linden, Anthony A. Leiserowitz, Geoffrey D. Feinberg, and Edward W. Maibach, "The scientific consensus on climate change as a gateway belief: Experimental evidence," *PloS one* 10, no. 2 (2015): e0118489; Jeremy D. Sloane, and Jason R. Wiles, "Communicating the consensus on climate change to college biology majors: The importance of preaching to the choir," *Ecology and Evolution* 10, no. 2 (2020): 594-596.

<sup>21</sup> Randolph Haluza-DeLay. 2014. "Religion and Climate Change: Varieties in Viewpoints and Practices," *Wiley Interdisciplinary Reviews: Climate Change* 5, no. 2 (2014): 261-262.

<sup>22</sup> Rhianna C. Rogers. 2020a. The Buffalo Project. SUNY Empire State College. accessed on August 1, 2020, <https://rrogers.sunyempirefaculty.net/the-buffalo-project-an-ethnographic-study-of-western-new-york/>

<sup>23</sup> Mary Breunig, 2009. "Teaching For and About Critical Pedagogy in the Pos-Secondary Classroom," *Studies in Social Justice* 3, no. 2 (2009): 250 [pp. 247-262 for bib.]

<sup>24</sup> Paulo Freire, *Pedagogy of the Oppressed*, trans. Myra Bergman Ramos (New York: Continuum, 2000), 53.

<sup>25</sup> Banking is the oppressive process by which someone with schooling authority deposits knowledge into the students who are passive recipients.

<sup>26</sup> Problem posing is the liberating process by which students name a problem and join with an empathetic educator in investigating why the problem exists and how to solve it.

sustainability. We then introduce them to the SDGs and encourage them to start with their current understandings and reflect on the expansion of learning in the three-week exchange. Although we have chosen critical readings and case studies, we also provide space for students to find further sources that speak to their quest for deeper learning. Using the GLQF as a guide for learning objectives, we have developed a curriculum that honors students as creators of knowledge and as critical thinkers with great potential to become change agents for social justice in a deeply troubled world. We aim to leave students not only with increased knowledge but also with skills and attitudes toward self-efficacy and global citizenship.<sup>27</sup>

### Learning Activities to Support Transformative Learning

Using the curricular map to achieve the overarching goals of the VR, we were able to create a learning environment that challenges and supports students in growing toward global citizenship. At the core of our assignments were the concepts we felt drove sustainability models and systems (e.g., sustainability advocacy, agency, critical thinking, civic action, social responsibility, ethics, diversity, and scientific literacy). Working backwards, we identified specific SDGs that would serve as the centerpieces for sustainable learning activities we would later develop. We conscientiously decided to approach sustainability and sustainable development through the SDGs, not through disciplines, to emphasize that challenges related to sustainable development. We believe that these issues cannot be addressed by the methodologies and theories of “siloes” disciplines or the philosophies or beliefs of one culture. This approach allowed us to synthesize environmental, societal, cultural systems/perspectives as they relate to sustainable development and varied implementation tactics across the globe. For example, for our first SDG, we chose SDG #13 Climate Action. On the surface, “Climate Action” may appear to be a “science” sustainable development initiative, but upon closer examination, it is discovered that in order for sustainable action to be successful, science-based mitigation strategies need to be integrated into the social and cultural contexts that require a sustainable solution. For our second SDG, we chose #10 Reducing Inequalities as our second SDG of focus. On the surface, “Reducing Inequalities” may appear to be socially and culturally attainable, but we found that if sustainable action is to be successful, science research and diverse stakeholder perspectives need to inform policy and practice. Using these observations as a frame, we turned our attention to the creation of the VR learning activities, which align with this transdisciplinary approach. Figures 2 and 3 illustrate our approach.

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<sup>27</sup> Michael W. Apple, "Paulo Freire, Critical Pedagogy and the Tasks of the Critical Scholar/Activist," *Revista e-curriculum* 7, no. 3 (2011): 13-14.

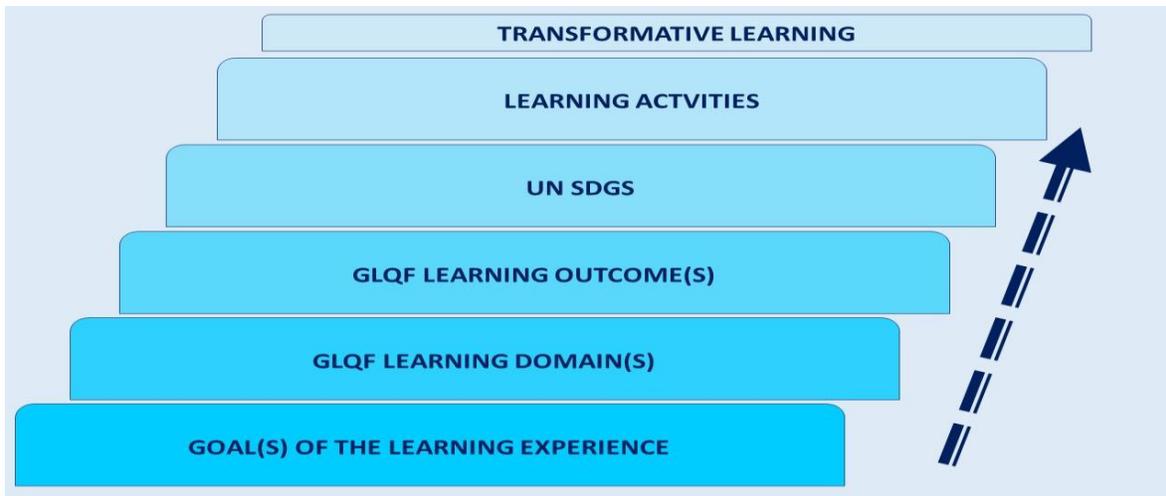


Figure 2. Mapping Process: This concept map illustrates flow of ideas through the curricular decision-making process. Step 1 identifies an overarching learning goal, which connects competency with content. Step 2 maps the GLQF Learning Domain to the desired competency. Step 3 shows how the GLQF Learning Domains are mapped to the Learning Outcomes that further describe the nature of learning relative to the desired competencies. Step 4 transitions from GLQF competencies to SDG competencies specifically related to the desired sustainability content area. Step 5 moves the mapping process towards transformative learning through the creation of competency-specific learning activities, which include resources that support learning during and after the learning experience and opportunities to apply learning to real world situations.

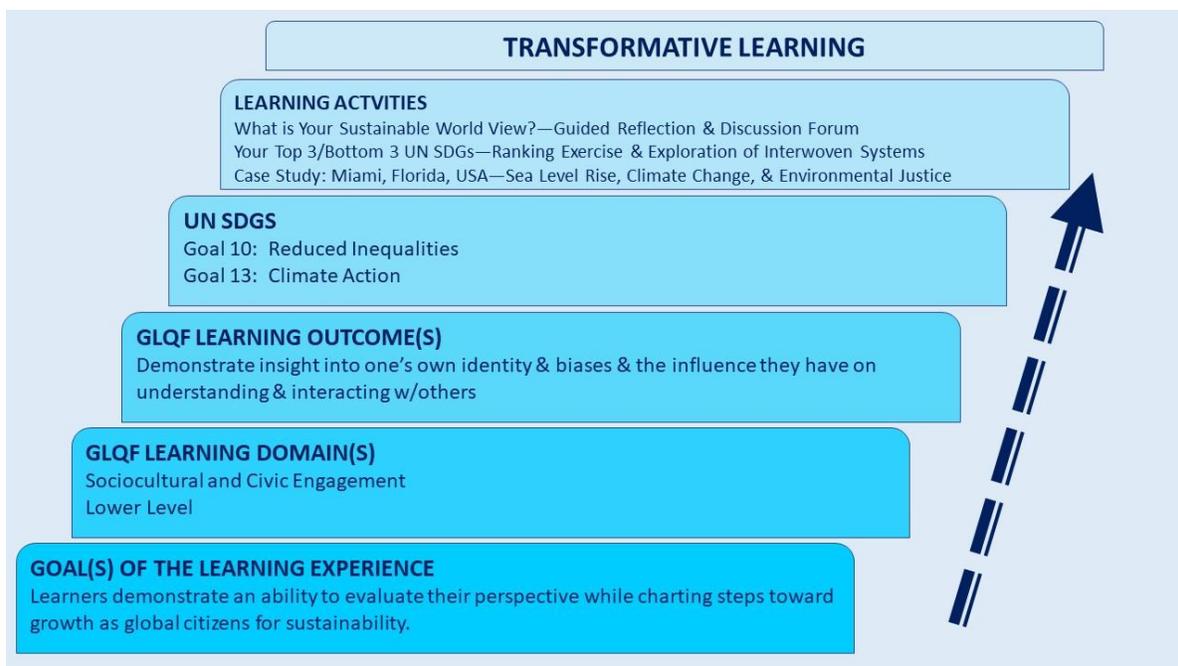


Figure 3. Detailed example of the decision-making process for one learning outcome in the “Learning for a Sustainable Future” VR.

As part of the design process, we noted two key GLQF learning domains, “Communication and Sociocultural” and “Civic Engagement.” Given our focus on transformative learning, we designed tasks in these areas to support the acquisition of sustainability knowledge.<sup>28</sup> Developing these domains in the VR is critical to facilitating mindful discussions that establish a learning culture supporting individual expression and self-reflection. Seatter and Ceulemans<sup>29</sup> make an important note that reductivism or attempting to capture the breadth of “what sustainability is” in one definition, is limiting and results in a narrow, unsustainable perspective. However, developing shared discourse<sup>30</sup> that possesses contextual meaning (i.e. “sustainability”) might mean something different in the transdisciplinary contexts of climate science, economics, and anthropology and “sustainability.” This is reinforced further when international contexts are added (i.e., perspectives on climate in United States, Lebanon, the Dominican Republic or elsewhere can vary greatly). Creating this deliberative conversation around perspective invites students to re-imagine “what sustainability can be.”

The three-week review of the SDGs is meant to provide a global, transdisciplinary view of sustainability and sustainable development. Throughout the experience, students are asked to choose, rank, and write about three of the UN SDGs. They are specifically asked to rank three most important and least important SDGs and compare with their VR classmates. The goal is to create a shared discourse related to sustainability and sustainable development that will inform learning activities throughout the VR, a concept that is further reinforced through the keynote panel presentation discussions and case study analyses. The case studies and assignments of the first two weeks prepare students for the final assignment. The first week involves students in defining sustainability and giving their perspectives on the UN SDGs.<sup>31</sup> The second week builds on students’ prior knowledge and initial work and expands on it with new knowledge from the keynote panel discussion and case studies.<sup>32</sup> The written assignment and asynchronous discussions of the second week allow students to reflect on how their ongoing work is changing or reinforcing their thinking. The culminating assignment in the third week is an essay in which the student uses one of two case studies chosen by the VR designers as well as one additional resource selected by the student to comparatively analyze sustainable practice in sets of communities. Using the SDGs as a guide for analysis, the student reflects on ways to become more sustainably focused in individual choices and through action toward defending or questioning a policy. During this final week, all students will share and reflect on this assignment in an asynchronous discussion. Our hope is that this cumulative work will have students making

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<sup>28</sup> Global Learning Qualification Framework. 2015. SUNY Empire State College. Accessed on July 15, 2020 <https://www.esc.edu/global-learning-qualifications-framework/>

<sup>29</sup> Carol Seatter and Kim Ceulemans. “Teaching Sustainability in Higher Education: Pedagogical Styles That Make a Difference.” *Canadian Journal of Higher Education* 47, no. 2 (2017): 51, [https://www.researchgate.net/publication/322553955\\_Teaching\\_Sustainability\\_in\\_Higher\\_Education\\_Pedagogical\\_styles\\_that\\_make\\_a\\_difference](https://www.researchgate.net/publication/322553955_Teaching_Sustainability_in_Higher_Education_Pedagogical_styles_that_make_a_difference)

<sup>30</sup> Ibid, 60.

<sup>31</sup> United Nations, “Sustainable Development Goals.”

<sup>32</sup> *Blockchain Island*, produced by Australian Broadcast Corporation (2018), Video streamed by SUNY Empire State College library; *Climate Activist Greta Thunberg on the Power of a Movement*, produced by NewsHour Productions (2018), Video streamed by SUNY Empire State College library; *Gathering Storm*, produced by The Years Project, Inc. (2017), Video streamed by SUNY Empire State College library; *Moyers & Company: Bill McKibben to Obama – Say No to Big Oil*, produced by Doctoroff Media Group (2014), Video streamed by SUNY Empire State College library; Sue Smorti, Madeleine Peters-Algie, and Cheryl Rau, “Engaging Student Teachers in Sustainable Praxis in Aotearoa/New Zealand,” *Journal of Teacher Education for Sustainability* 15, no. 1 (2013): 5.

commitments toward a future of social responsibility and global citizenship for sustainability, thus illustrating their transformative learning and adoption of a critical pedagogy.

### **Recommendations and Conclusion**

As this paper has discussed, the VR model offers learners a transdisciplinary way to engage across cultures. We hope that the “Learning for a Sustainable Future” case study will offer participants a path to contribute to the solution-making efforts of today’s socio-cultural and socio-environmental issues. We also hope that the inclusion of both the GLQF and SDGs enhances the retention of knowledge and its assessment. As we have seen in the COVID-19 era, the world is changing, and we can no longer rely on traditional learning methods to engage students online. Our future depends on how well we teach future generations and transform their sustainability practices.

To end this paper, we would like to offer a series of best practices in Tables 3 and 4 for those interested in creating their own VRs around sustainability:

Table 3. Collaborative Curricular Design for Sustainability Education: Best Practices

<p><b>Begin with Backward Design</b> Identify the goals of a learning experience at the start of curricular design. Place the curriculum development decision-making process at the core of your design to ensure that learning outcomes, learning activities, and resources are aligned and achieved.</p>
<p><b>Let Curriculum Mapping Be Your Guide</b> Once goals are identified, create a curriculum map/template that guides the alignment of learning outcomes and learning activities with the organization of content.</p>
<p><b>Embed Resources to Support Self-Directed/Student-Directed Learning</b> Articulate and define the research process for students so that they can envision how they might further investigate questions they develop and apply their learning in their communities.</p>
<p><b>Establish Expectations for Tasks—Create a Community of Learners:</b> Provide opportunities for meaningful contributions and include learning resources that strengthen writing skills, challenge their perceptions of others, and develop a deeper awareness of the topic. Guidance, in the form of a written document or video recording, can emphasize learning outcomes related to effective communication, sociocultural and civic engagement, and sustainable development.</p>

Table 4. Virtual Residency: Best Practices<sup>33</sup>

<p><b>Orient Instructors to the VR Experience:</b> Offer trainings on the VR platforms and paradigms used BEFORE implementation. Instructors who are part of this experience should be on-boarded prior to the start of the term. Introductory emails, tutorials, and other framing information should be offered as well as opportunities for questions and feedback.</p>
<p><b>Prepare Faculty and Students for Virtual Sessions:</b> For those participants who may be new to video-conferencing, online tutorials and practice sessions with tech support are very helpful.</p>
<p><b>Manage Virtual Sessions:</b> Students need to know what to do, whom to contact and how, if they have a technical or logistical problem, how to resolve the issue. Having an outline set upfront on procedures (e.g., computer and internet settings, required downloads, and rules of engagement - whether students should write in the chat box, raise their hand, or speak out) can help resolve common technical and logistical issues.</p>
<p><b>Emphasize Student Engagement:</b> Students could be better focused and actively engaged online when work is broken down in short intervals (chats, polls, mini-lectures) followed by discussion (see McAllister, 2009.)</p>
<p><b>Include Moderators in All Synchronous Sessions:</b> Having a moderator at the same time provides the instructor with technological support in the form of being able to monitor attendance and help struggling students.</p>
<p><b>Record and Share of Synchronous Sessions:</b> Logistics and technology to record sessions and provide access to recordings for students must be planned in advance, including technical aspects of downloading, uploading, converting and sharing large video file, recording to the cloud vs. the faculty's local computer, recording sensitive or personal information, ADA compliance issues, and college policies of sharing recordings outside of the institution (as is often the case with international collaborations)</p>

We hope this case study and VR best practices will serve as an example for effective interdisciplinary instruction and encourage educators to develop more inclusive learning platforms that truly engage students in sustainable development. These “best practices” can also inform the rapid transformation of traditional classrooms into effective virtual learning environments during times of crisis, serving as a sustainable solution for higher education.

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<sup>33</sup> Adapted from Jeannine Mercer, Katarina Pisutova, and Rhianna Rogers. 2018. "From mystery to mastery: Creating & enhancing the ultimate virtual classroom experience." In *2018 COIL Conference Proceedings*, pp. 112-124. 2018.

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