Chapter 7. Reflections on a Graduate-Level Engineering Service-Learning Project in a Virtual Reality and User Experience Course

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Abstract. This chapter summarizes the lessons learned in designing and implementing a graduate-level service-learning project in a virtual reality and user experience course. This type of cross-functional course and real-world collaboration provided a rich experience for graduate students (described in Chapter 6), although there were logistical issues that potentially hindered the collaboration and the learning process. This chapter provides practical recommendations to support the logistics of the course and to better align student learning with the intended outcomes.

University professors have the resources and flexibility to collaborate with community partners, and service-learning projects can be one way to broadly impact the surrounding community. While these collaborations can be rewarding, it is important to continually identify ways to improve these partnerships for the future. In this chapter, we discuss lessons learned from the service-learning collaboration described in Chapter 6, between graduate engineering students at a regional Midwestern university (Oakland University) and a local nonprofit organization (Michigan Youth Project) that serves middle school students from an under-funded school district in Pontiac, Michigan. Five graduate students were introduced to user experience (UX) methods and theoretical background of effective virtual reality (VR) and augmented reality (AR) experiences. To apply this knowledge, students learned Unity (3D development software), collected ideas from the community partner (CP), and collaborated as a team to develop a VR experience for the community partner. The community partner did not have a clear outcome in mind but requested a VR experience showcasing the history of Pontiac. Halfway through this collaborative project, the Oakland University campus closed due to COVID-19, resulting in a rapid transition to online learning and collaboration, and adjustments to the course objectives to account for these changes. Table 7.1 compares the original course objectives to the altered objectives as a result of COVID-19. Bold text indicates a substantial change from the original objective.

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Table 7.1. Course Objectives for Students

	Original	**Accepted**
1	Identify potential project and partner	**Selected from** faculty-provided options
2	Develop initial project prototype	Developed initial project prototype
3	Apply feedback from CP (three times)	Applied feedback from CP (**one time**)
	Collect data using UX methods	Collected **unstructured verbal feedback**
	Analyze data and synthesize into meaningful insights	**Discussed feedback and highlighted pain points**
	Refined AR/VR experience	Refined AR/VR experience
4	Present final AR/VR experience to CP	**Produced video** showcasing work

In addition to the project, graduate students completed several written reflections throughout the semester where they discussed their collaboration experience and further connected the course content to their project; at the end of the semester, they were interviewed to gather additional insights about the course structure and recommendations for future curriculum. As explained in Chapter 6, students faced the typical logistical challenges associated with project-based learning such as needing more time, interactions or communication, and resources. This chapter, based on graduate student feedback and the instructor's experience, focuses on specific recommendations for building a successful collaboration and effectively teaching UX methods to graduate students in the context of a highly technical application.

Lessons Learned

Understand the Strengths and Limitations of Your Community Partner

Community partners have a variety of skill levels, technology experience, and goals. When selecting community partners, *consider their specific needs and abilities*. In this case, the community partner was comprised of novices to VR technology without a specific use case. Therefore, there was a lot of flexibility in the project outcome, which students appreciated. However, because of the community partner's lack of technical expertise in VR and low expectations for the project outcome, students were less motivated in applying the formal UX process, which would involve actively and iteratively seeking feedback and information from the users. Instead, students used general guidance from the community partners to develop the VR experience and waited until they felt they had accomplished the objectives to show the product to the community partner. As the course format switched to fully online due to COVID-19, students were unable to hold more

face-to-face meetings with the community partner to showcase their project design, which they felt was integral to making the project successful. Therefore, they suggested that if the community partner was more experienced with VR technology, they could have more successfully collaborated remotely because of similar remote setups and more targeted feedback and questions. Depending on instructor course goals, there are circumstances where both novice and expert community partners are ideal. Prior to selecting a community partner, consider how their qualities will change project outcomes and the students' learning, application, and collaborative processes.

Define the Purpose of the Course/Project Clearly and Early

This course was designed to build a holistic course experience in which students both learn and apply VR/AR development skills and UX methods in the context of a social justice project. Since the formal course title and description did not include any reference to either UX methods or social justice, students indicated that their primary reason for taking the course was to build technical VR/AR development skills. However, through collaborating with the community partner, and especially interacting with the middle school students who are novice users, graduate students began to see the value in educating the community partner about VR/AR and that the positive impact was mutual. Designing a course that was mutually beneficial was a key part of the instructor's goals for teaching the class, and even though it was not part of the formal course title or description, students were receptive to participating in a project that had a positive impact on the surrounding community. For courses with a service-learning focus, sharing the reasoning for incorporating service learning in the class can help get students more excited about participating. That being said, having multiple course foci can also mean that unequal priority is given to different elements of the course. In this case, students did not prioritize finding a community partner, although this was part of the objectives. Instructors can help students better balance across multiple objectives by showing how each objective (in this case, VR/AR technical knowledge, application of UX methods, and social justice collaboration) directly corresponds to the course objectives. Therefore, by clearly articulating the course objectives at the beginning of the semester, instructors can help students establish their expectations and goals.

Connect Course Learning to the UX Process

In the interviews, students admitted that they never or rarely intentionally connected UX methods or theory such as personas to their project or data collection process. One student explained that applying methods was not useful because the community partner did not have a clear outcome in mind. Other students discussed the benefits of reflections, which required students to engage deeply with theoretical knowledge in the context of their applied work. As graduate

engineering students, they were intentionally given the freedom to direct the project and work with the community partner to determine the ideal outcome. However, this lack of structure may have contributed to students' informal approach. To more effectively integrate course content with real-world application and facilitate communication and collaboration, *grade artifacts of the process* in addition to reflections and project outcomes, for example:

- Identification of potential community partners (name, contact information, and rationale)
- Meeting notes from group meetings (weekly or twice a week)
- Meeting notes from community partner meetings (biweekly)
- Outcomes from application of at least two UX methods with the community partner (e.g., interview notes, design charette drawings, and contextual inquiry notes)

Provide Infrastructure to Help Students Develop Technical Knowledge

All students reported that the need to rapidly develop technical programming skills was a barrier to the project, so they offered several unique recommendations on how to overcome this challenge. For example, students requested a *dedicated graduate assistant* to teach technical skills, *co-requisite classes* in which one focused on technical skill-building while the other focused on the collaborative project, and further integration of external asynchronous resources like *YouTube videos*. In this project, individual programming abilities clearly limited students' progress. While these recommendations may be helpful, they may not be practical in every course due to cost, time, and curricular constraints. The important takeaway is that for a course like this, instructors should expect students to struggle with the technical component and attempt to *put infrastructure in place to help students* develop technical knowledge at the pace that works for them.

Start the Project Early in the Semester

Because projects like these are limited to a semester schedule, timing is an important factor. Even though students stated that they needed even more skills development, they also wished that the collaborative project started earlier in the semester. Even if students do not yet have the technical skills, they indicated that *early meetings could focus on relationship building*. For courses blending technical skill building and application, there will rarely be enough time for both. Therefore, instructors should facilitate introductions early in the semester even if students are not yet ready to begin applying their skills. In doing this, students can begin to develop relationships with community partners so they can simultaneously start planning while still building technical skills.

Teach with a Variety of Styles

In this course, the instructor used a combination of classroom discussion, supplemental videos, reflection assignments, and interviews to help students better connect theory and application in a new topic area for them. Students mentioned that this varied approach to conveying knowledge helped them become more interested in the course. In-class *discussions* helped students develop better understanding topics and each other's perspectives. *YouTube videos* helped tie the concepts back to the project. Written *reflection assignments* integrated theory and application through targeted reflection assignments. The semester ended with a formal *interview* (conducted by the second author), which students believed was important to evaluate a student's understanding of the course. When designing a course teaching both highly technical skills and in-depth application, instructors should still provide space and opportunities for students to engage with the content in a variety of ways.

Use Accessible Software and Hardware

Technology access was a bottleneck for this work. While Unity is a free software, it requires minimum computer specifications to work properly. Similarly, VR/AR hardware is not yet widely accessible, so it is improbable that students would have access at home. After campus was closed due to COVID-19, some students were unable to access the VR/AR technology. Students felt that having *more access to the lab* would have helped them do more and better work because the lack of lab access severely impacted their progress. When possible, instructors should use accessible hardware and software or prepare a backup plan with the knowledge that not having adequate access will make teaching this type of specialized systems extremely difficult.

Implications

As a highly technical domain for UX application, VR/AR class projects can bring additional challenges to a service-learning collaboration. This chapter provides several recommendations based on practical experience for a course where graduate engineering students partnered with a local nonprofit organization to design a VR experience for novice users. First, the instructor should understand the community partner's specific needs and abilities. Second, ensure that the students have a clear path forward by explaining the purpose of the course and connecting course grades to UX methods. Third, support student success by providing infrastructure, connecting them with the partner early, teaching with a variety of styles, and using software and hardware that are accessible. Our recommendations resonate with findings in previous service-learning research. For example, David Blouin and Evelyn Perry (2009) suggested that instructors should partner

with the community partner to develop the service component of their courses, share course objectives and learning methods with their community partner, and clarifies expectations and goals in writing.

Reference

Blouin, D., & Perry, E. M. (2009). Whom does service learning really serve? Community-based organizations' perspectives on service learning. *Teaching Sociology*, *37*(2), 120–135. https://doi.org/10.1177/0092055X0903700201