Understanding preservice teachers' perceptions of service-learning when teaching educational technology to students with exceptionalities

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ABSTRACT

During an educational technology class in the spring of 2021, preservice teachers worked at an inclusive, state accredited private school as part of a required service-learning component. Preservice teacher candidates worked with middle and high school students, many of whom were identified with a disability, preferably referred to as an exceptionality. Prior to engaging in activities with K-12 students, preservice teachers were introduced to floor-robots and virtual reality environments during class. After gaining necessary skills and a greater awareness of how to incorporate educational technology into a learning environment, they were then required to teach high school students how to use the education technology devices. Over the course of the semester, preservice teachers wrote three reflections centered on service-learning and educational technology, including a pre-reflection, a midway reflection, and a post-reflection. Three independent researchers, using a thematic analysis approach, analyzed the data prior to meeting as a group to identify overarching themes and sub-themes.

Service-learning in higher education provides undergraduate students with opportunities, outside of academia, to learn more about themselves and their communities. At the same time, participating in service-learning can increase undergraduate students' understanding of civic engagement while enhancing academic performance. Jacoby (2015) described several ways service-learning augments a student's undergraduate experience, including enhanced "moral development, empathy, efficacy, sense of personal and social responsibility, and commitment to service during and after college" (p. 11). During the spring of 2021, undergraduate students majoring in education enrolled in an educational technology (ED Tech) course in the southwestern United States. All students participated in service-learning activities at a K-12 private school. As education majors, these preservice-teachers engaged in a service-learning project that was

tied to their major field of study. Although service-learning activities can be incorporated into college coursework that is not tied to a student's degree program, such as an English class where students volunteer in soup-kitchens and reflect on the experience, the activities in this course directly tied to students' major area of study.

The service-learning component embedded in the ED Tech class required preservice-teachers to spend 15 hours across a semester volunteering their time and expertise working with students with exceptionalities at an inclusive school. The K-12 school includes 92% of students identified with exceptionalities, including students identified with Autism Spectrum Disorder (ASD). Students who have been identified with ASD fall along a range on the spectrum. Students who are low on the spectrum may have more severe characteristics, while students who fall on the high end of the spectrum often perform at or above their same aged peers academically. However, they struggle with social skills (Heward et al., 2018).

During their time at the school, preservice-teachers worked primarily with middle and high school students who were high on the spectrum. After the pre-reflection was written, preservice-teachers met with the professor to learn how to use and engage with floor-robots and virtual reality (VR) headsets before beginning the service-learning activities. It was important that they felt confident in using the technology prior to teaching middle and high school students how to use the equipment. In the ED Tech class, 100% of preservice teachers were unfamiliar with floor-robots, and approximately 90% were unfamiliar with more expansive VR headsets. When using VR, students enter a virtual environment where they learn to manipulate items in a virtual world. For example, preservice-teachers learned how to enter the Anne Frank house and move through the rooms. To exit the house, they had to select the proper button on the handset from touch. Taking their new-knowledge, they taught the middle and high school students with a variety of abilities.

As stated earlier, service-learning activities do not necessarily have to be tied to an undergraduate students' major. However for this class, preservice-teachers volunteered in a school setting, which blurred the lines between service-learning and other required educational components typical of students majoring in education. One difficulty in using service-learning in this fashion is that at times, preservice-teachers would confuse service-learning with field experiences.

Service-Learning

Felton and Clayton (2011) provide a detailed description of how learning through service has evolved over the centuries, beginning with Thomas Jefferson's tethering of higher-education with a student's preparation for self-governance, to the more structured formats developed by Sigmon (1979), Erlich (1996), and Bringle et al. (2006). When students have opportunities to serve others, in whatever capacity that might be, and then reflect on the process at various points during the experience, the capacity for seeing the world through a new lens may be beneficial for all those involved (White, 2021). Jacoby (2015) noted that critical reflection is essential, but that facilitating critical reflection must be undertaken in a manner that allows students to reflect on how their actions can impact people and/or communities. Furthermore, those opting to embed service-learning into a course should use critical reflection to "lead

students to recognize the need and potential for social change, together with their own capacity to effect it" (p.44).

`Service-learning can be undertaken during college coursework, but providing service to a community in need may take place outside of a college classroom as well. This might include providing services to a soup kitchen, assisting at a women's shelter, or working with Habitat for Humanity. Jacoby (2015) describes these types of experiences as "providing service, with no intentional link to reflection or learning" (p. 2). However, those who volunteer their services may still benefit through increased feelings of self-worth or a renewed purpose in life. This was the case with many of the participants during a recent service-learning project embedded in college coursework. Over the course of four months, during a time when Covid-19 decreased opportunities for engaging in K-12 classrooms, 14 preservice-teachers worked with middle and high-school students with exceptionalities as a required component of a service learning project. Preservice-teachers wrote pre, during, and post reflections of their experience, responding to specific questions to guide their responses and engage students in critical reflection. Jacoby (2015) noted that the desired form of reflection during service learning should be "*critical* [sic], reflection", which is the "process of analyzing, reconsidering, and questioning one's experiences within a broad context of issues and content knowledge" (p. 26). Jacoby noted that when students respond to questions during service-learning, questions should increase in complexity and guide students to higher levels of thinking and analyzing. Jacoby provided multiple sample questions, including: (a) "Have you changed as a result of this experience?' and, (b) "How did this experience make you feel?" (2018, pp 34-35). Three researchers across three disciplines reviewed student-participants' pre, midway, and post reflections separately prior to forming an overarching consensus theme. Results were positive, with researchers finding that college students were surprised at their own increased self-efficacy in working with high school students with exceptionalities.

Methods

The principal investigator (PI) collected qualitative data from 14 preservice teachers enrolled in a college course during spring 2021. Preservice-teachers completed a variety of assignments related to ED Tech, including pre/post surveys on self-efficacy in using technology, guided written reflections, with open-ended questions that students completed pre, during, and post service-learning activities, lesson plans that incorporated ED Tech into instruction, and online discussions about technology use in and outside of educational settings. End-of semester grades were recorded, and then students received a research study participation form from the PI, via email, requesting permission to use their assignments as part of the data.

Data collection for this study focused solely on preservice-teachers' service-learning reflections. A Thematic Analysis (TA) was selected as the design of this qualitative study because it provides flexibility and accessibility; and by using a TA, "you can legitimately focus on analyzing meaning across the entire data set, or you can examine one particular aspect of a phenomenon in depth" (Braun & Clarke, 2012, p. 58).

The PI and co-PIs determined to focus on students' reflections because these documents captured preservice teachers' thoughts more accurately than the lesson plans and other assignments during this service-learning experience. The research questions were exploratory, and the PI and co-PIs wanted to understand: (1) How do preservice teachers' perceive service-learning?, and (2) How do preservice teachers experience instructional interactions with students with exceptionalities? Using a TA, the PI and co-PIs analyzed the data separately, coding initially, and then identifying relevant themes. Although the research questions are not inter-dependent, the experience of working with students with exceptionalities through a service-learning project tie the two questions together.

Participants. Participants included 14 preservice teacher candidates. These students are non-traditional undergraduate students; and many have military ties, families, and jobs. Of the 14 students, seven students agreed to participate. After the first email was sent, two additional emails were sent to make sure that students had an opportunity to participate. As this course ended prior to summer break, and grades were already submitted, some students may have stopped checking emails. However, data from the seven participants was similar to their non-participating peers and provided enough information to accurately capture the essence of the experience for all students.

Procedure. Fourteen undergraduate preservice teachers completed pre, midway, and post service-learning reflections as part of their requirements for a service learning project during the spring 2021 semester. Following the end of the semester, preservice teachers received an email requesting participation in the research with a link to the informed consent. For each reflection paper, students responded to specific questions to guide their responses and keep them focused on the purpose of writing. As Jacoby noted, questions can guide student thinking; but importantly, if grading reflections, grades should be assigned after assessing "how authentically and deeply students think about their feelings" (2015, p. 40). The PI developed questions for each reflection with the intent to have students think more deeply about this experience for each paper.

For the pre-reflection, the PI wanted to gather information on students' understanding and potential previous experiences with service learning. Students responded to four questions that included one or two parts: (1) Think about the two terms separately and together-what does service mean? What does learning mean? (2) What is your current understanding of service learning? (3) What does the term service mean to you? What might you learn from providing a service to someone in need? (4) How can you use your knowledge to help others? How might serving others benefit you? These four questions prompted students to think about the benefits they might receive by providing a service to others.

The second reflection paper, written at the mid-way point, focused on the benefits that the middle and high school students might receive from service-learning, as well questions about the ED Tech. Preservice-teacher candidates responded to four questions, again with multiple components: (1) In considering the time you have spent at the school, how do you feel the community partner is benefiting? Be specific. How

has the role you have played benefited students, the school, and/or other stakeholders? (2) In considering the time you have spent at the school, how do you feel you might be benefiting? Be specific. (3) In thinking about students and educational technology, are the activities you have done benefitting students with exceptionalities? How so? (4) In this service-learning opportunity, do you belief that both you and the school are benefiting equally? Or do you believe that the relationship is benefiting one partner more than another? Be specific and provide examples.

The final post-reflection, service-learning paper required preservice-teachers to think more critically about the entire experience. The PI developed questions that required preservice-teachers to think about the experience as a whole; and it provided them with opportunities to express the positives and/or negatives associated with service learning. There were a total of nine questions: (1) Was this experience different that you expected, or was it about what you expected? How so? (2) Do you feel that educational technology is a good option for student learning? Why/Why not? (3) When thinking about VR, do you think that meditation apps might be calming for students identified with Emotional Behavior Disorder or ASD? Justify your response. (4) Is VR a fad, or do you see this being present in classrooms within the next decade? Explain your thinking and state whether you disagree or agree with VR being in a classroom and why you agree/disagree. (5) Will you incorporate service-learning into your future classroom? Why/why not? (6) Whether you will or will not incorporate service learning, how might service-learning be incorporated into a classroom? (7) Of all the ED tech tools you reviewed, which one will you be most likely to incorporate into a future classroom and why? (8) Overall, did you find the service-learning beneficial for you personally? Or did you find it stressful? Please respond to both of these questions and explain your thinking. (9) Do you think students at the school benefitted from working with you in a non-academic environment? Why or why not? (10) What is one take-away from this service-learning experience for you? (11) What is one thing you would like me to know (positive or negative) about this experience. Why was it a positive or negative? The PI and co-PIs used different methods to analyze data and search for themes. The PI initially analyzed the data by hand, reading through the documents, identifying segments, coding segments, placing coded segments into groups, and then identifying a theme. The third co-PI used a similar method, separately from the PI. The second co-PI used NVivo qualitative software. After individual analysis was completed, the researchers met to discuss the findings and review the major themes. Two primary themes emerged from the post-reflection papers: increased pedagogical application and make a difference.

Results

The three researchers were provided with all data compiled into pre, midway, and post reflections. The researchers conducted individual analysis on each of the data sets to arrive at their own conclusions. The PI read through all participants' reflection multiple times, looking first at the pre-reflections, then the midway reflections, and then the post-reflections. During this time, the PI identified meaningful chunks of data, coding them into several categories and then merging the categories into themes. Various themes emerged from this initial data analysis for the pre, midway, and post

reflections. After an analysis of the pre-reflection service-learning reflections, the PI had 16 codes, which were subsequently moved into four categories and themed: Personal Growth, Giving, Purpose, and New Knowledge. The same analysis was performed for the midway reflections, with the midway reflection having 39 codes transformed into four themes: Real World Pedagogical Application, Game Changer, Beneficial, and Amazing SPED students. Finally, the PI concluded coding the data using the same analysis for the post reflections, which ended with 19 codes broken into five themes: Stressful but beneficial, New Pedagogies, Purpose and Caring, VR is the Holy Grail, and Pleasantly Surprised.

After the PI conducted a hand search of all reflection papers, a computer generated word count was pulled to make a comparison. For the pre service-learning reflection papers, the five most commonly used words included: service (n=64), knowledge (n=39), learning/others (n=38), and help (n=35). For the midway service learning reflection, the four most commonly used words included: students (n=105), school (n=36), technology (n=30), and learning n= (29). For the post service-learning reflection, the five most commonly used words included: students (n=157), experience (n=65), classroom (n=59), and technology (n=56). These words somewhat align with the themes (Table 1).
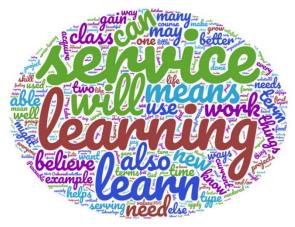
Table 1
PI themes and word count

Reflection	Themes	Most Used Words
Pre Service-learning	Personal Growth, Giving, Purpose, New Knowledge	service (n=64) knowledge (n=39), learning/others (n=38), and help (n=35)
Midway Service-learning	Real World Pedagogical Application, Game Changer, Beneficial, Amazing SPED students	students (n=105), school (n=36), technology (n=30), and learning n= (29)
Post Service-learning	Stressful but beneficial, New Pedagogies, Purpose and Caring, VR is the Holy Grail, and Pleasantly Surprised	students (n=157), experience (n=65), classroom (n=59), and technology (n=56)

The first co-PI used NVivo to analyze the data. NVivio (Edhlund, 2012) is a statistical software program that can be used to analyze qualitative data sets. The relevant themes that emerged included: (1) Pre-reflection: Definitions, Service Rewards; (2) Midway Reflection: Rewards, Site Information; and, (3) Post-Reflection: Expectations, Incorporating Service Learning, Service Learning Options, Service Learning Take Away, Tech Incorporation, VR Learning, VR Limitations, and VR Mediation.
The third co-PI reviewed the data used a method similar to the PI, along with the use of word-clouds (Figures 1 & 2) to gather a visual image of words used. The third co-PI addressed the research questions (RQs), tying the data analysis of each pre. During,

and post reflection directly to the two RQs. After analyzing the pre-reflection, the third co-PI noted that in relation to RQ1: The themes noted in these artifacts were difficult to identify due to the rather disconnected perceptions of the writers. This was a writing assignment meant to encourage a free or open writing style designed to get the students writing about the prompt.

Figure 1
Word Cloud Pre-Reflection

After reviewing the samples of student writings, the key themes appear to be that students perceive service-learning as a positive growth experience. However, students also seemed to be more focused on why it is important to do service-learning and not the definition of service-learning. The five themes that emerged were: uncertainty, efficacy, opportunity, competency and personal satisfaction/pride. For RQ2, similar responses were noted, but there seemed to be less reflection on instructional interactions and more on the purpose of service learning. Four themes emerged, including: competency, experience, growth, reflection.

For the midway reflection for RQ1, the second co-PI noted that college students were more organized in their writing and described the impact they were having on middle and high school students' learning. Interestingly, students' midway reflections revealed a larger discussion on who was benefiting more, themselves or the middle and high school students. Themes appear to be: a sense of accomplishment, pride in their ability to pass on knowledge and skills, and the love of seeing students having a lightbulb moment. All students' reflections described a perceived mutual benefit as a result of the partnership and the opportunity to hone their tech skills while developing their instructional muscle memory to apply to their profession. Additional themes for RQ1 and RQ2 included competency and growth/experience, with more students reflecting on the purpose of service learning in RQ2, including an excitement to work with technology and students with exceptionalities.

The second co-PI analyzed the post-reflection with a focus on RQ1 and determined that these were markedly different from the previous reflections. Importantly, college students perceived a better understanding of what service-learning is, with the idea of a variety of service-learning classes that could be developed. Some

students expressed concern on the desire to incorporate service-learning into a future K-12 classroom experience, and they worried that bureaucracy and their own experiences might hinder the ability to incorporate service-learning into a k-12 classroom. However, students also noted an opportunity to make a difference in future students' lives, depending on the teacher/classroom needs. Several students found the service-learning to be a stressful experience due to Covid, unexpected winter weather, scheduling time to visit schools, and communication. They found these made for a distracted or confused experience, which aligns with other preservice-teachers' experiences when working during of Covid (Roman, 2020). Students also worried about having access to appropriate technology necessary to assist future students in understanding and applying concepts.

Notably, when analyzing students' post-reflections in relation to RQ2, the second co-PI noted that students found ED Tech as a great option for student learning. Students' reflections noted that they believed ED Tech ignited a passion in middle and high students' desire to learn more. Students were excited about the apps to explore and try out. However, a few students again noted some negatives related to scheduling and being confident of what was required.

After the PI and co-PIs individually analyzed the data and compiled themes, an overarching emergent theme was developed to best reflect the analysis of each researcher. The PI and third co-PI had the themes personal growth and positive growth experience respectively. These two themes merged to form theme of positive growth. The first co-PI had a theme of service rewards, while the PI had themes of giving, new knowledge, and purpose. The second co-PI had themes of personal satisfaction/pride and efficacy. An overarching theme of rewards was determined to best reflect these ideas. Table 2 shows the emergent overarching themes that were developed from individual researcher's themes.

Table 2

Compilation of individual analysis and emergent themes

Reflection	Themes: Researcher 1	Themes: Researcher 2	Themes: Researcher 3	Emergent Themes
Pre-reflection	Personal Growth, Giving, Purpose, New Knowledge	Definitions, Service Rewards	Positive Growth experience, Uncertainty, Efficacy, Opportunity, Personal satisfaction/pride, Competency	Positive Growth, Rewards
Midway-reflection	Real World Pedagogical Application, Game Changer, Beneficial, Amazing SPED students	Rewards, Site Information	Accomplishment, Pride in their ability, Lightbulb moments, Opportunity to hone their tech skills, Apply skills to their profession, Competency, Growth/experience	Beneficial, Pride, Competence
Post-reflection	Stressful but beneficial, New Pedagogies, Purpose and Caring, VR is the Holy Grail, Pleasantly Surprised	Expectations, Service-Learning, Benefits (Nonacademic), Service-Learning, Incorporation, Service-Learning, Options, Service-Learning Take Away, Technology Incorporation, VR Learning, VR Limitations, VR Meditation,	Make a difference, Stressful due to Covid, Access to technology, Apply concepts, Scheduling difficulties, Better communication of service-learning needed	Increased Pedagogical Application, Make a difference

Discussion

The two research questions that the PI set out to investigate included preservice teachers' perceptions of service-learning and their responsiveness to working with students with exceptionalities. The service-learning primarily took place in a non-academic setting. Although the PI developed the questions prior to the start of service-learning, working with innovative educational technology was an element that might have made this project more engaging. Likewise, the undergraduate students who participated reflected on a mutually beneficial learning experience because they believed all stake-holders (college and middle/high school students) benefitted equally. After separate data-analysis by three researchers, emergent themes developed for pre, midway, and post reflections. The merged themes from three separate analyses

include: (1) Pre-reflection-Positive Growth, Reward; (2) Midway reflection-beneficial, Pride, Competence; and, (3) Post-reflection- Increased Pedagogical Application, Make a Difference.

In a review of all emergent themes, including individual rater themes and over-arching final themes, there was a general consensus that college students found service-learning to be beneficial for all involved. Jacoby (2015) noted that "planning and implementing a cocurricular [sic] service-learning experience that participants view as worthwhile is critical if the desired outcomes are to be achieved" (p. 146). This is noteworthy because the PI designed the service-learning to incorporate ED Tech; this tied directly to course student learning outcomes. However, if service learning had taken place without the inclusion of innovative ED Tech, would students have found the experience as beneficial? That is less clear.

Overall, students did find the experience to be much more valuable than they originally anticipated. For example, students responded positively to the question about whether they intended to incorporate service-learning into a future K-12 classroom, and noted in post-reflections that: (1) "The service-learning approach helps students find a purpose for learning"; (2) "I believe that the primary reason for incorporating service-learning into a curriculum is to fully understand a particular topic"; and, (3) "There are many ways in which service learning can be incorporated, and I think it would largely depend on the teacher and classroom needs".

However, during data-analysis, it was noted that students found scheduling service-learning into an already full schedule difficult; and this was made more difficult with the added influx of Covid safety measures and a terrific winter storm that shut down the area. Likewise, several students noted difficulties in communication. For example, one student noted: "I feel that service-learning would have been easier if it there were prescheduled days with a clear task or objective for which we could sign up". All students met with the partnering school principal on a first visit to the school. They were all told to schedule the days and times that worked best for them. Furthermore, the floor-robots were left at the partner school for students to check out and use in classrooms. All undergraduate students were required to attend a training session for floor-robots and VR headsets prior to using them with middle and high school students. Still, based on students' reflections, clear goals with explicit communication and set days/times might increase students' experiences more positively.

Conclusion

Service-learning was primarily a beneficial activity for undergraduate students. Felton and Clayton (2011) noted that service-learning is "most effective at generating significant educational outcomes when" (p. 81): (a) there is a collaborative community partnership; and, (b) goals, reflections, and community experiences complement each other. The PI took part in a service-learning workshop for one semester prior to beginning service-learning. During that time, the PI met with a group of other faculty who were also planning to embed a service-learning opportunity in a college class. The PI carefully planned the experience so that student learning outcomes were addressed, reflection questions built upon each other and required more critical-thinking from pre to post reflection, and that the community partner had a stake in working with us to meet

their needs. Any faculty interested in developing a service-learning course should take time to plan a course with careful consideration given to a number of factors, including identifying and working with a community partner. Likewise, developing reflection questions that address the goals of a service-learning project, as well as the learning outcomes in a course, may assist students' awareness and understanding of how service-learning can be used in a given discipline such as education. Jacoby (2015) noted that "carefully designed final reflections can help students to recognize what they learned, what big questions remain, and what next steps they can take" (p. 147). Continued use of service-learning to strengthen students' awareness of civic responsibility is important. For preservice teachers, that can be critical. Jacoby (2015) noted that the success of service-learning in college is dependent on preparation K-12 students receive. Thus, it is imperative that preservice teachers take part in effective service-learning projects that deepen their own understanding of the purpose and promise of service-learning. Importantly, Chambers and Lavery (2012) noted that preservice teachers may experience a deeper understanding of social-emotional learning and be better prepared for a career as an educator when they engage in service-learning. Chambers and Lavery (2012) concluded with the idea that "Service-learning units act to strengthen pre-service teachers' capacity to empathize, be resilient, use initiative, reflect on one's own practice, grow as an individual, develop and hone leadership skills and become more competent and capable practitioners" (p. 135). More research on preservice teachers' attitudes toward service-learning is needed to add to the research base.

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