A Large-Scale Study of Students' E-Service-Learning Experiences and Outcomes during the Pandemic

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We have no conflicts of interest to disclose.

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Acknowledgements

This project is substantially supported by the Service-Learning and Leadership Office at the Hong Kong Polytechnic University. This project is partially funded by a General Research Grant (PolyU 15600219) from the Hong Kong Research Grants Council and a Learning and Teaching Development Grant (LTG19-22/VTL/SLLO) from the Hong Kong Polytechnic University.

Abstract

Background: The COVID-19 pandemic resulted in strict social distancing and lockdown measures to contain the spread of the disease. These measures significantly impacted experiential pedagogies, including service-learning. Many teachers pivoted to e-service-learning. While past literature suggests that e-service-learning is as, or even more effective than, traditional service-learning, there are few large-scale comparative studies that support this claim.

Purpose: Our study fills the research gap via a large-scale study into student e-service-learning experiences and outcomes during COVID-19. **Methodology/Approach:** The study examines learning outcomes of students taking e-service-learning subjects during the early stage of the pandemic, i.e. the 2020/21 academic year, in a Hong Kong university, and compares their learning experiences and gains with a similar group of students who studied the same subjects from 2014/15 to 2018/19.

Findings/Conclusions: Results indicate that while e-service-learning is effective in enhancing students' cognitive and civic learning, it is less effective than traditional service-learning in facilitating civic learning outcomes.

Implications: Investigating students' learning experiences suggests that the quality of reflection and interaction with the community, which are critical learning experience components, may have been impacted by online communication. These factors may have played a key role in influencing the effectiveness of e-service-learning compared to traditional service-learning.

Keywords: e-service-learning, traditional service-learning, student learning outcomes, learning experience, covid-19.

Service-learning has traditionally been considered a “high-touch” pedagogy that involves students leaving the classroom to immerse themselves in the community and interact with diverse individuals to broaden their knowledge and understanding. However, the COVID-19 pandemic made social distancing and lockdown measures necessary, significantly impacting experiential pedagogies such as service-learning. Many teachers have adapted service-learning by transitioning service projects online, often with very short notice and while the relevant stakeholders are still adjusting to online learning and communications. Given the impact of the pandemic on students and service projects, it is important for the research community to study the effectiveness of online service-learning, or e-service-learning, especially when compared to the traditional service-learning held before the pandemic.

This study aims to investigate the effectiveness of e-service-learning during the COVID-19 pandemic and compare it with pre-pandemic traditional service-learning. Specifically, we seek to answer the following research questions: (1) Did students learn effectively from online service-learning during this period? (2) How does their learning compare to traditional service-learning in previous contexts? (3) If there are differences, are there any elements of the learning process which students perceive worked particularly well (or vice versa) that may account for these differences?

Our study is based on a large dataset of questionnaire responses collected from students from different disciplines and subjects at a large public research university in Hong Kong. We make the following contributions: first, we present a large-scale, multi-subject investigation into student learning outcomes in online service-learning; second, we perform a head-to-head comparison of online service-learning versus its traditional counterpart, across a large number of students and subjects: third, we follow up our investigations into student learning outcomes with an analysis of the student learning process, which is often neglected in similar studies.

Literature Review

Service-Learning

Service-learning is a pedagogy that has gained importance in higher education worldwide. It is defined as a "course-based, credit bearing educational experience in which students (a) participate in an organized service activity that meets identified community needs and (b) reflect on the service activity in such a way as to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility" (Bringle & Hatcher, 1995, p. 112). The term "service-learning" was first coined by Sigmon (1979) as an experiential education approach based on "reciprocal learning".

The roots of service-learning can be traced back to the philosophies of John Dewey, an education theorist who identified a connection between genuine, long-lasting education and personal experience, and, in particular, the role of reflective thinking in knowledge construction, or the "active, persistent and careful consideration of any belief" (Dewey, 1910, 1938). Kolb (1984) expanded on Dewey's conception of experience by introducing experiential learning, a cyclical process of experience, reflection and analysis that integrates new learning into existing conceptions. Freire and Ramos (1970) introduced the concept of critical pedagogy to reframe the teacher-student dynamic in service-learning as a knowledge co-creation and exchange relationship, rather than the traditional power dynamic of knowledge provider and receiver.

The effectiveness of service-learning in facilitating student learning outcomes is well documented. A recent systematic review by Salam et al. (2019) showed that service-learning facilitated students' academic achievement, cognitive development, communication and interpersonal skills, and civic learning. This is consistent with past meta-analysis studies that found statistically significant improvements in students' attitude towards self and learning, civic engagement, social skills, and academic achievement (Celio et al., 2011), positive changes in academic, personal, social and citizenship learning outcomes (Conway et al., 2009), and positive impacts on students' social, personal, and cognitive development (Yorio & Ye, 2012).

Several key success factors in service-learning have also been identified in previous studies. Billig (2007) covered some of these in a review, including curriculum integration, effective reflection, meaningful service and reciprocal partnerships. Mintz and Hesser (1996) highlighted the role of the community in service-learning, while also emphasising the need for rigorous academic standards, explicit learning outcomes and clear assessment. Ngai et al. (2018) used statistical correlation to analyse the student learning experience in service-learning, and showed that meaningful service that addresses authentic community needs, interesting and challenging service to students, structured and critical reflection; and sufficient preparation and support to students in service implementation are all highly correlated with student learning.

E-Service-Learning

Definitions & Taxonomy

Academic service-learning typically consists of two components: a *teaching* component, which is similar to a conventional course and happens in the classroom; and a *service* component, which involves a service project that serves as the experiential learning aspect. In e-service-learning, either the teaching or service component, or both, are partly or entirely conducted online (Jacoby, 2014; Waldner et al., 2012). This concept originated with the idea of "e-service" (Strait & Sauer, 2004), where educational institutions, students, community partners, and service recipients collaborate through virtual partnerships in their service placements.

Conceptually, there is no reason why service-learning cannot be successfully facilitated online. Most of the process variables that are known to be impactful in traditional service-learning, such as time, duration and intensity (Astin et al., 2000; Astin et al., 2006), interesting and challenging experiences (Clary & Snyder, 1991; Niemiec & Ryan, 2009), supervision and feedback (Niemiec & Ryan, 2009), and others, can be replicated in an online environment. Compared to traditional service-learning, e-service-learning has certain advantages. For example, students and projects are not limited by geographical boundaries. It also makes service-learning accessible to students with special educational needs, such as those with disabilities or who live remotely (McWhorter et al., 2016; Waldner et al., 2010). Some features, such as autonomy (Kohlberg, 1981; Niemiec & Ryan, 2009; Piaget, 1948) may even be more easily achieved in an online environment as it frees up constraints related to travel and location.

However, the online context brings about unique challenges with communication (Smeltzer et al., 2020) and technology (Bourelle, 2020), in addition to the usual challenges of workload and student motivation (Guthrie & McCracken, 2010; Waldner et al., 2012). As a result, e-service-learning is still uncommon, even in online education (Strait & Nordyke, 2015).

E-service-learning can be classified into several types, depending on the mode of delivery (online or onsite) of the teaching and service components (Waldner et al., 2012):

- In traditional service-learning, both the teaching and service components are delivered in-person, or onsite.

- In Type I e-service-learning, the teaching component is online, while the service is delivered onsite (i.e. the service project is similar to that of traditional service-learning).
- In Type II e-service-learning, the teaching component is onsite (i.e. in a regular classroom), but the service project is online.
- In Type III e-service-learning, both the teaching and service components are partially online.
- In Type IV e-service-learning, also known as Extreme Service-Learning (XE-SL), both the instruction and service are delivered online.

Table 1 presents the Waldner taxonomy.

[Insert Table 1 about here]

Student Learning from e-service-learning

Research on student learning from e-service-learning prior to the pandemic are limited. A systematic review of e-service-learning in major literature databases by Marcus et al. (2020) identified only two (out of 20) publications focusing on student learning outcomes. However, many past studies suggest that student learning gains in e-service-learning are similar to those from traditional (on-site) service-learning. Another systematic review of work published between 2010-2020 describing studies in Type II and Type IV e-service-learning shows that these two types of e-service-learning can enhance students' learning in a variety of aspects, including empathy, social responsibility, critical thinking, decision making, adaptability, and interpersonal, communication and teamwork skills (Faulconer, 2021).

A few studies have compared student learning between traditional and e-service-learning. McGorry (2012) compared the learning outcomes of 105 undergraduate students in traditional and online service-learning courses in the marketing discipline and found no significant differences. Schwehm et al. (2017) compared learning outcomes between nine university students in the US taking a traditional service-learning course with 103 students in Types I and IV e-service-learning courses and found that the students in the traditional course attained higher learning in the civic responsibility aspect, but there were no statistically significant differences in the other learning outcomes.

The COVID-19 pandemic popularised e-service-learning, leading to more studies on student learning outcomes from e-service-learning. Most existing studies report that e-service-learning

positively impacts students. Schmidt (2021) surveyed 18 students enrolled in a developmental psychology course with an e-service-learning component during COVID-19. Students reported a positive learning experience and perceived that it helped them develop various outcomes such as critical thinking and flexibility. Plata and Moredo (2021) reported similar findings from a study with 253 students, where results showed that the course was able to achieve its original objective and enabled students to learn about collaboration, teamwork, and civic responsibility.

In the Hong Kong context in which our study is situated, Leung et al. (2021) examined the learning gains of university students enrolled in two service-learning subjects during COVID-19. Findings indicated improvements in students' cognitive-behavioral competencies, positive identity, and service leadership quality. Lin and Shek (2021) compared learning gains of 130 students enrolled in a credit-bearing service-learning subject during COVID-19 with online instruction and e-service-learning (i.e. Type IV Extreme Service-Learning) with 86 peers who studied the same subject before COVID-19 and found similar positive impacts on students' youth development competences, service leadership qualities, and life satisfaction. Wong and Lau (2022) performed a similar study with 32 students enrolled in a management course with a e-service-learning component during COVID-19 and 44 peers who took the same course prior to the pandemic. Results showed slightly higher (albeit not statistically significant) learning gains from the e-service-learning version.

To conclude, past research suggests that e-service-learning is at least as effective a learning pedagogy as its traditional counterpart where student learning outcomes are concerned. However, most studies have two major limitations. First, almost all study small groups of students or focus on a single course, which calls into question issues of generalisability (e.g., Soria & Weiner, 2013). Second, most studies focus on the student learning outcomes without considering the student learning experience. As educators and practitioners, it is important to know not only the *what*, but also the *how* and *why*, for research to truly benefit our students.

Research Framework and Questions

Our study addresses this research gap by conducting a large-scale study. Our premise is that, given a similar context (e.g. academic topic, assessment components, project nature, student

demographics, etc), the *modality* of service-learning (online vs face-to-face) has a differential effect on the service-learning experience, and the learning experience, in turn, will impact the learning outcomes.

We aim to answer the following research questions:

RQ1: Do students learn in e-service-learning contexts? To what extent did students' self-assessed intellectual and civic competencies change after an e-service-learning experience?

RQ2: If students do learn from e-service-learning, do they learn better or worse than in face-to-face contexts? That is, are there significant differences in students' self-reported learning gains between e-service-learning and traditional service-learning programmes?

RQ3: Since the student learning outcomes are affected by the learning experience, what, if any, are the significant differences in students' perception of their learning experience between electronic and traditional service-learning programmes?

Programme and Research Context

The current study is situated in a large public research university in Hong Kong, where an institutional mission for educating socially responsible professionals mandates that all undergraduate students be required to pass at least one service-learning subject as a prerequisite for graduation. All service-learning subjects are required to cover at least four intended learning outcomes that are common across all service-learning subjects, address a societal issue and link it to an academic topic within the discipline, include a service project with at least forty hours of contact with the community, and include critical reflection to link the project with learning. Students' learning and performance are assessed by a letter grade, which is required to reflect learning in the classroom and from reflection as well as performance during project delivery. Each subject carries at least three credits and may last for one or two semesters. The university's rigorous quality assurance process requires that all service-learning subjects be vetted and approved before the subject is first offered and before any major changes are made. A programme to train teachers in curriculum design and service-learning practice is also in place to ensure teaching quality.

Prior to the COVID-19 pandemic, all subjects were conducted in-person, with the instruction taking place in the classroom and the service project at various venues in the community.

The COVID-19 pandemic impacted service-learning in the same way as it did for other academic subjects. University regulations mandated that all classroom instruction be delivered online as far as possible, and social distancing regulations also caused many community organisations to shutter their services or to move them online during this period. As a result, all service-learning subjects offered during the pandemic would be classified as some form of e-service-learning.

Specifically, there were 25 service-learning subjects offered during the Fall and Spring semesters of the academic year 2020/21, spanning a variety of academic disciplines including arts and humanities, sciences and engineering, social sciences, business, and healthcare and nursing. In 19 subjects, students attended lectures online (usually using Zoom, Blackboard Collaborate or Microsoft Teams) and served the recipients online using similar platforms during their service project. Hence, these subjects would be classified as Type IV (Extreme) service-learning under the Waldner taxonomy. The remaining six subjects were run in a hybrid mode with either instruction or service at least partly online. For example, students in one subject would attend lectures online but laboratory sessions were held on-campus, and the service project was delivered to service-recipients in person. The Waldner taxonomy would classify these as Type III Hybrid service-learning.

Research Method and Process

Our research study is based on a head-to-head comparison of the student questionnaire data obtained from a large sample of the same service-learning subjects in the academic years 2014/15-2018/19 before COVID-19, and in 2020/21 during the first year of COVID-19. We employed a non-experimental research design, which is a systematic empirical inquiry commonly used in educational research when manipulation of the independent variables is not feasible (Johnson, 2001; Kerlinger, 1986). The objective is to discover associations between variables and establish preliminary hypothesised relations between variables for further investigation (Reio, 2016). Examples of non-experimental research include descriptive research, correlational research, and survey research (Khaldi, 2017).

Due to changes in the quality assurance mechanism of the university, the survey instrument employed to monitor programme quality via student learning gains was adjusted in 2019 prior to the outbreak of the pandemic. Hence, it was not possible to use the same instrument and the same research design for all the research questions. RQ1 used a single group pretest-posttest design to measure student learning gains by comparing changes in their self-assessment on a set of competencies before and after the e-service-learning experience. RQ2 and RQ3 used non-equivalent posttest-only comparative group design to compare e-service-learning and traditional service-learning in terms of the perceived learning gains and experience self-reported by students after their learning experience.

Materials and Measures Used

Student Self-assessed Learning Outcomes from Service-Learning (S-LOMS)

S-LOMS is an instrument developed for assessing student learning outcomes from service-learning. Students self-assess their competencies before and after the learning experience with items on a 10-point Likert scale (1: strongly disagree; 10: strongly agree). The instrument and has been rigorously validated in the local context, achieving satisfactory criterion validity, test-retest reliability, and internal consistency (Lau & Snell, 2020, 2021). The current study uses four learning domains: knowledge application (four items) and problem-solving skills (four items), which address students' intellectual learning, and empathy and caring for others (three items) and sense of social responsibility (three items), which capture students' civic learning. The corresponding reliability indices have been found to range between .87 and .96 in past studies (Lau & Snell, 2020)

The Student Post-Experience Questionnaire (SPEQ)

SPEQ was developed by the university's research team with reference to the past literature and the implementation context of service-learning subjects at the university. This questionnaire is administered after the service-learning experience and includes, among other things, the following sets of questions:

Self-Reported Learning Gains. This set of questions consists of nine items measuring students' self-perceived attainment of the intellectual (four items) and civic (five items) learning outcomes. All items are rated on a 7-point Likert scale (1: very little; 7: very much).

Students' Experience of the SL Programme. This set of questions consists of sixteen items measuring students' perception of their learning experience and pedagogical elements in their service-learning subjects, covering interest in the service project (one item), challenging service (one item), relation to study major (one item), effort put in service (one item), values and benefits of the service provided (two items); help and support received (four items), interaction with stakeholders (three items); autonomy in service (one item), reflection (two items). All items are rated on a 7-point Likert-scale (1: strongly disagree; 7: strongly agree).

Both sets of questions have achieved content and face validity, and satisfactory reliability for the intellectual (Cronbach's alpha=.895) and civic (.901) learning gains have been reported (Ngai et al., 2018).

Participants and Data Collection Procedures

Our study participants consist of 1,364 students (the "online group") enrolled in 17 of the Type IV (Extreme) Service-Learning subjects offered during the 2020/21 academic year and 3,846 students (the "traditional group") enrolled in the corresponding subjects from the 2014/15 to the 2018/19 academic years, which were then operated as traditional service-learning subjects. These subjects are from the following academic disciplines: accounting and finance, social sciences, biomedical engineering, linguistics, computer science, English, fashion and textiles, management and marketing, occupational therapy, and nursing. The nature of the projects were diverse: in some of the subjects, students designed and delivered short courses on topics such as language instruction, financial literacy, environmental sustainability, psychosocial skills, etc; in others, students worked with people with disabilities to develop tools to aid in daily living, rehabilitation and exercise; another project worked with non-government organisations (NGOs) to actualise their targets through campaigns to reach the general public. Most of the subjects had been taught by the same instructors during the period of study. As previously described, university policy requires that major changes in subject details, including the operating protocols, be formally approved prior to implementation. None of these subjects had submitted any major change requests during this time. Hence, we are confident that the context of the learning experience, including the academic topics covered, the social issue addressed, and the community served, remains similar. At the university level, no major changes were made to the university admissions policy or the local education system during this time; thus, we are also confident that the student background and demographics are similar.

S-LOMS was administered to students in the online group electronically via the university's online survey system at the beginning and end of their service-learning subject, and 697 matched pairs of data were obtained (response rate 51.1%). SPEQ was administered to both groups of students at the end of their service-learning subject via electronic or paper-and-pencil format, with 857 valid responses (response rate: 62.8%) from the online group, and 3,846 data points from the traditional group.

Approval for this study was obtained from the University's ethics committee. The purpose of the survey was explained to the participants, who were assured that their identities would be kept confidential, and their responses would not be known to the subject lecturers.

Analytic Strategy

Data analysis was conducted using SPSS version 26. Cronbach's alphas were calculated for all the scales to assess reliability, and descriptive statistics were derived for all relevant variables.

To answer RQ1, paired sample t-tests were used to compare the pretest and posttest scores of the S-LOMS responses from the online group.

RQ2 and RQ3 were addressed by using independent t-tests to compare the SPEQ gains and experience between the online and traditional groups. The comparisons were performed at both the student and subject level.

In addition to mean differences, we also report the effect size in terms of Cohen's d (symbolised as "*d*" hereafter) for all the comparisons mentioned above. *d* values of .2, .5 and .8 correspond to small, medium and large effects respectively (Cohen, 1990; Kotrlik & Williams, 2003), as suggested in previous work (e.g., Sullivan & Feinn, 2012)

Results

All scales achieved satisfactory reliability results of .90 or above. Female students accounted for 59.1% of the matched pairs and 59.2% of the post-experience responses from the online group, and 57.6% of the traditional group post-experience responses. The mean age of the online group was 21.1 (*sd*=1.8). Although this data is not available for the traditional group, as previously mentioned, the student demographics and background are similar across the two groups.

Changes in Students' Self-Assessed Learning Outcomes before and after e-Service-Learning [RQ1]

Table 2 compares the pretest and posttest scores of the online group on the selected four domains. The posttest mean scores on all four domains are higher than the pretest scores, indicating gains in self-assessed learning outcomes. Paired samples t-tests show that the differences were statistically significant (p<.001) on all four domains, albeit with small effect sizes. Among them, the domain of problem-solving skills (d=.39) and knowledge application (d=.33) exhibit larger effect sizes than sense of social responsibility (d=.25) and empathy and caring for others (d=.24) domains.

These results suggest that students can and do learn from e-service-learning.

[Insert Table 2 about here]

Comparison of Students' Retrospective Self-Reported Learning Gains between Online and Traditional Service-Learning Groups [RQ2]

Student Level Comparisons

Table 3 presents the descriptive statistics of students' ratings on the SPEQ learning gain items. The responses for both groups are all higher than five on a 7-point scale, suggesting that the students perceived that they do indeed learn from their service-learning experience. This is true for both online and traditional groups and is congruent with the aforementioned pretest-posttest comparison results.

[Insert Table 3 about here]

Table 3 also reports the independent t-test results of the comparisons between the online and traditional groups. The ratings given by the online group are statistically significantly lower on both the intellectual (p<.05, d=-.08) and civic (p<.01, d=-.13) learning outcomes, albeit with small effect sizes. This suggests that traditional service-learning is relatively more effective than the online service-learning instituted during the COVID-19 pandemic at facilitating student learning on those domains. On the item level, the ratings from the online group were significantly lower on "understand community problems" (p<.01, d=-.24), "commitment to serve" (p<.01, d=-.24), "apply knowledge to

deal with complex issues" (p<.01, d=-.12), "become a responsible global citizen" (p<.01, d=-.12), "solve real-life problems" (p<.01, d=-.11), and "become a responsible community member" (p<.05, d=-.09). However, the online group does rate one item significantly higher than the traditional group: "respect for people from different backgrounds" (p<.01; d=.12). The effect sizes are small on all the items.

Subject Level Comparisons

Table 4 reports the descriptive statistics of the mean self-reported learning gains on the subject level and the results of the independent t-test comparisons between traditional and online modes. All items are rated higher than five on a 7-point scale, indicating that all subjects were successful in facilitating positive learning gains, as perceived by their students. Independent t-tests on the domain level show no statistical differences on both the intellectual (p>.05, d=-.01) and civic (p>.05, d=-.34) learning outcomes. On the item level, the ratings for the e-service-learning mode are statistically significantly lower in "commitment to serve" (p=.01; d=-.94) and "understand community problems" (p<.05; d=-.82) with large effect sizes but statistically significantly higher for "respect for people from different backgrounds" (p=.05; d=.71), also with a large effect size.

These results are consistent with the student-level comparisons and suggest that e-service-learning during the pandemic appears to be less effective than traditional service-learning, especially in promoting civic learning. The one exception is "respect for people from different backgrounds", which appears to be more effectively nurtured by the e-service-learning courses.

[Insert Table 4 about here]

Differences in Students' Experience between Electronic and Traditional Service-Learning Groups [RQ3]

Student Level Comparisons

RQ3 involves analyses over the SPEQ learning experience items. Table 5 presents the student-level descriptive statistics and independent t-test results. All items in both groups score close to or above 5 on a 7-point scale, suggesting that students generally had a positive service-learning experience. Independent t-test comparisons show statistically significant differences in 10 out of the 17 experience items. The ratings given by the online group are statistically significantly higher on "benefited the people I served" ($p<.01$, $d=.51$), "effort" ($p<.01$, $d=.16$), "good relationships with teammates" ($p<.01$, $d=.12$), "task autonomy" ($p<.05$, $d=.09$), and "motivated and supportive teammates" ($p<.05$, $d=.08$), while the ratings given by the traditional group are statistically significantly higher on "interaction with people served" ($p<.01$, $d=-.34$), "clear instruction for reflection" ($p<.01$, $d=-.33$), "service appreciated by community" ($p<.01$, $d=-.24$), "insightful feedback during reflection" ($p<.05$, $d=-.11$), "challenging and meaningful tasks" ($p<.05$, $d=-.10$). The effect sizes for all the differences are small, with the exception of "benefited the people I served", which has an effect size bordering on moderate.

[Insert Table 5 about here]

Subject Level Comparisons

The subject level analysis is similar. The ratings for all items are close to or above 5 on a 7-point scale. Further item analyses show that the ratings for the e-service-learning subjects are statistically significantly higher on "benefited the people I served" ($p<.01$, $d=2.23$), "effort" ($p=.05$, $d=.69$), and "motivated and supportive teammates" ($p=.05$, $d=.69$); but statistically significantly lower on "clear instruction for reflection" ($p<.01$, $d=-1.24$), "interaction with people served" ($p<.05$, $d=-.88$), and "service appreciated by the community" ($p<.05$, $d=-.82$). The effect sizes for all differences are large or close to large (see Table 6 for details).

[Insert Table 6 about here]

Discussion

Our study adopts a rigorous research design with large samples drawn from multiple academic disciplines to fill the research gap in e-service-learning. Overall, our results can be broadly summarised as follows:

1. Students did learn from e-service-learning, or, more specifically, Type IV Extreme Service-Learning, during the pandemic. There are significant increases in students' self-assessed learning outcomes, and post-experience feedback indicate that students reported having learned at least a fair amount. This is consistent with previous studies (Faulconer, 2021; Marcus et al., 2020). In other words, even though there may be no physical interaction between students and their service recipients, e-service-learning is still able to encapsulate key elements of service-learning and experiential learning.

However, there is greater improvement in cognitive learning (knowledge application and problem solving skills) than civic learning (empathy and caring for others and sense of social responsibility). This may not be specific to e-service-learning – unlike cognitive learning, civic learning is affective, is developed over time, and thus is harder to nurture through a single learning experience (Bringle & Clayton, 2021). But, e-service-learning may afford fewer opportunities for students to interact directly with the community, and the interaction that is afforded may be less immersive in nature. Previous work (Connor & Erickson, 2017) used the concept of *contact theory* to study affective learning from service-learning in students. They advocate for sustained, implied physical interaction between students and community recipients, which is not easy in online settings.

On the other hand, the unfamiliarity with online communications, especially at the beginning of the pandemic when the study took place, means that students oftentimes encountered unanticipated problems, especially with the technical environment. This generated more opportunities to apply and practice problem solving skills, which contributes to cognitive learning (Wong et al., 2021).

2. Compared with traditional service-learning, e-service-learning is less effective as a learning pedagogy. A head-to-head comparison between the same subjects, operated in traditional mode and e-service-learning mode, suggests that the traditional mode is better able to effect student learning gains, at least from the perception of the student. This difference is especially marked for civic

learning, in particular, on the items of understanding community problems and commitment to serve. This finding contradicts previous work (e.g., Lin & Shek, 2021; McGorry, 2012), which finds that students do not learn less in e-service-learning contexts. However, these studies analyse student data from one subject (albeit in different modalities) and with a similar project. These conclusions are also challenged by other studies (e.g., Angel, 2021; Schwehm et al., 2017) that find e-service-learning to be less effective.

Our conclusion is that it is possible for e-service-learning to be as effective as traditional service-learning, but this is not universal. In some contexts, if properly done, certain types of e-service-learning may be able to effect similar levels of learning outcomes as traditional service-learning. However, it appears that in general, across different kinds of subjects and projects, e-service-learning is less effective than its in-person counterpart where student learning is concerned (at least from our selection of subjects).

3. A possible reason why e-service-learning is not as effective is the quality of the student learning experience. Given the same service-learning subject with the same academic focus and service context, some pedagogies are less effective (or at least they are perceived to be less effective by students) under an online modality. Specifically, structured reflection was one area that suffered. Students in e-service-learning subjects were less likely to perceive that they were provided with clear instructions for reflection or received insightful feedback during reflection. Other learning experiences that were perceived as worse were the interaction with the community, the level of challenge of the projects, and the appreciation from the community. On the flip side, some pedagogies were perceived to be more effective: students perceived that they had a better teamwork experience, they have a stronger perception that their service is of benefit to the people they served, and they also report putting in greater effort.

It is in civic learning where e-service-learning noticeably underperforms vis-à-vis traditional service-learning. This makes sense in light of the poorer experience that students had with reflection: reflection is a key element in service-learning through which students critically evaluate their service experience and learn through re-examining their assumptions and values (Eyler, 2002). Subpar support in this area would very likely impact student learning. In addition, previous work has

identified that student learning is closely linked to their perception of the benefit that their service has provided to the community, and that their service is appreciated by the community (Ngai et al., 2018). However, students in e-service-learning reported that they had less interaction with the service recipients, and were less likely to perceive that their service was appreciated by the community (even though they were more likely to feel that their service benefited the community, but this may be a factor of COVID-19 when much visibility was given to community needs). Given these findings, it is not surprising that students evidence weaker civic learning in e-service-learning contexts.

These phenomena may be caused by both the medium (online communications) and the context (the pandemic). There has been much research into body signals, or the lack thereof, in online communication (Paradisi et al., 2021), and the "Zoom classroom" has been found to be detrimental to interpersonal communication (Katz & Kedem-Yemini, 2021). Given that many service-learning projects involve synchronous human interactions with the community, it is not surprising that students perceive a lower quality of interaction, which may lead to a perception that their services were not as appreciated by the community.

A lower quality of interaction also impacts students' engagement with their *teachers*. Previous work (e.g., Dias & Diniz, 2014; Nemetz et al., 2017) has emphasised the importance of interaction in learning, but maintaining interaction quality is challenging for e-service-learning (Stefaniak, 2020; Waldner et al., 2012). This is especially true for synchronous communications – for example, in reflection sessions, which have indeed been found to be difficult to execute in an online context (Smeltzer et al., 2020). Over a video conferencing link, both the teacher and the student may struggle to make sense of each other's body language, which obviously would have an impact on student engagement and teachers' perceptions of how much (or how little) students are engaged (Willermark & Islind, 2022). This, in turn, impacts how they interact with the students (Bergdahl, 2022).

Learning readiness may also play a role. COVID-19 happened very suddenly and unexpectedly, and the transition to online service-learning, in many cases, was made in a very short period of time and in very unstable circumstances. Some research into learning readiness of students during the pandemic shows that undergraduate students were, by and large, less well prepared compared to their

postgraduate peers (Tang et al., 2021). Our student subjects are wholly undergraduate, and many of them had trouble adjusting to this new way of learning, not just in service-learning.

Having said this, the context of the pandemic may also play a positive role in impacting the perception of the learning experience. Students did have a stronger perception that their service project was beneficial to the community, even while they felt that they were not as appreciated. They also perceived that their team members were more motivated and supportive, which made for better relationships in the team, and expended greater effort. During the early days of the pandemic, the needs of the society were acute, which led to a heightened sense of civic responsibility and increased awareness of the contributions provided by different sectors of society. This may have contributed to the fact that the ratings from the online group are significantly higher on “respect for people from different backgrounds”.

Implications

The first implication drawn from our study is that, in general, e-service-learning appears to be less effective than the traditional counterpart. When studied across multiple subjects in multiple disciplines and service project types, our findings show that e-service-learning underperforms in effecting student learning gains, particularly in facilitating civic learning. When most communication relies on online platforms, the quality of the interaction is negatively impacted, which impedes student engagement and consequently their understanding of the community and their empathy towards their service recipients. However, the fact that some previous studies have found otherwise suggests that, when properly managed, it is possible for e-service-learning to be similarly effective. Still, care must be taken to manage certain factors, as we shall describe below.

Second, our findings suggest some critical factors for teachers in e-service-learning programmes. It needs to be recognised that interaction online is challenging, and students and community recipients alike need to be prepared to interact online, to provide and to receive service. Additional effort may need to be expended to make up for learning that would have taken place implicitly in traditional service-learning. For example, students serving in poverty-stricken communities in a traditional service-learning course are often struck by the squalor of the living environment; such an experience is rather difficult to replicate online. Teachers may also need to intervene more actively to communicate the wishes and/or feedback from the community to the students – a handshake from a non-verbal community recipient, for example, cannot be communicated online, and students would need to be made aware of this feedback through indirect means.

Third, teachers themselves also need to be aware that body language and non-verbal communications that they relied on to facilitate or assess engagement in traditional service-learning contexts may not work as well in online environments. This may contribute to student perceptions that they did not receive clear instructions or insightful feedback. Knowing the limitations of online communication platforms, it behooves teachers to explore different synchronous or asynchronous tools, rather than to simply move an in-person reflection online. Bringle and Clayton (2020) rightly point out that e-service-learning is not simply about adding a community service component to an existing course or relocating an existing service-learning course into a virtual format.

Limitations and Further Studies

The current study is subject to several limitations.

First, the two groups are non-equivalent as the participants were not randomly assigned to a group, but rather belong to different cohorts. Despite that, we would argue that the two groups are roughly comparable, as they were enrolled in the same subjects in the same university, which has not changed its admission policy during this time. The subject syllabi in both periods largely remained the same, and the instructor did not change in most of the cases. Hence the two groups of students are broadly similar in demographics, and were following a similar curriculum but with a different delivery mode.

Having said that, community needs do change, and the five years that elapsed between the beginning and end of the period under study is a significant amount of time. Even though teachers usually try to reuse material and preparation to minimise workload, it is inevitable that there will be *some* changes in the course contexts and the operation protocols, including the material covered in class and the activities undertaken during the service project, between the different offerings of the subject during the period of study.

Second, although the differences in learning gains between the two groups can be explained by the empirical evidence from the learning experience, the current study cannot provide conclusive proof of the causal relationships between the two sets of variables. Future studies could attempt to establish a direct relationship between student learning gains and learning experience through quasi-experimental design by assigning students into different projects, or adopting a more controlled design, such as randomly assigning students into e-service-learning or traditional service-learning in the same subject taught by the same instructor, to minimise confounding factors such as student self-selecting bias and instructor input. Some previous research in fact highlighted the issue of self-selecting bias. For example, Coates et al. (2004) showed that while online students *overall* underperform relative to their in-person counterparts; students who *selected* to learn online performed better in an online class than if they had been forced to learn in-person.

Third, the current study drew samples from a single university, thereby limiting the generalisability of the findings. Future studies can provide more convergent evidence by replicating our study in other settings.

Fourth, the current study only compares Type IV extreme service-learning and traditional service-learning, but this is a very rough classification: there is much variation even under these two categories in terms of how students and the community interact (Ngai, 2022). Future studies should address this issue by differentiating the different types of e-service-learning when investigating the experiences and learning gains that they provide.

Finally, this study took place under the context of COVID-19, during which there was much instability and uncertainty, which would have definitely impacted student learning as well as teacher preparation. A future study could replicate this research in a more stable period, with less uncertainty and better support for planning and execution.

Conclusion

This study investigated the effectiveness of service-learning when it was moved online during COVID-19. We conduct a rigorous large-scale, multi-disciplinary analysis of student learning gains in e-service-learning subjects during the pandemic and compared them against the same subjects in traditional service-learning (i.e. face-to-face) mode before the pandemic. We found that e-service-learning is effective in facilitating student learning. However, contrary to previous work, a head-to-head comparison shows that it is less effective, particularly in facilitating civic learning outcomes. Further analysis of the student-perceived learning experience suggests that the quality of reflection and interaction with the community, which are two critical components of the learning experience that are likely to be impacted by online communications, may have been key. We discuss implications on future development in similar programmes.

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Table 1

Types of e-Service-Learning under the Classification by Waldner et al. (2012)

	Instruction	Service
Traditional Service-Learning	Onsite	Onsite
E-Service-Learning Hybrid Type I	Online	Onsite
E-Service-Learning Hybrid Type II	Onsite	Online
E-Service-Learning Hybrid Type III	Online/Onsite	Online/Onsite
Extreme Service-Learning (Type IV: XE-SL)	Online	Online

Table 2

Results of Paired-Sample t-tests of Students' Pretest and Posttest Score on their Self-Assessed Learning Outcomes of the Online Group

	Online (n=697)						
	Pretest		Posttest		Paired Sample t-test Results		
Learning Domain	$\bar{X}$	SD	$\bar{X}$	SD	$\Delta\bar{X}$	*p*	*d*
Knowledge Application	6.90	1.47	7.40	1.52	0.50	<.001**	.33
Problem Solving Skills	6.84	1.42	7.41	1.49	0.57	<.001**	.39
Empathy and Caring for Others	7.71	1.47	8.06	1.45	0.35	<.001**	.24
Sense of Social Responsibility	7.44	1.53	7.82	1.51	0.38	<.001**	.25

Note: * significant at .05 level; ** significant at .01 level.

Table 3

Results of Independent t-tests comparing Students' Retrospective Self-Reported Learning Gains from Service-Learning, Online vs Traditional Group (Student-Level Analysis)

	Independent t-test					
	Traditional Group (n=3,846)		**Online Group (n=857)**		**Test Results**	
	$\bar{X}$	SD	$\bar{X}$	SD	*p*	*d*
Learning Gains						
Intellectual Learning Outcomes	***5.36***	***.89***	***5.29***	***.97***	***.04****	***-.08***
Understand linkage b/w SL & subject content	5.28	1.10	5.26	1.12	.52	-.02
Apply knowledge to deal with complex issues	5.34	.98	5.23	1.05	<.001**	-.12
Solve real-life problems	5.41	1.02	5.30	1.07	.01*	-.11
Think critically	5.42	1.00	5.38	1.06	.35	-.04
Civic Learning Outcomes	***5.55***	***.85***	***5.44***	***.98***	***<.001****	***-.13***
Understand community problems	5.63	1.02	5.39	1.08	<.001**	-.24
Commitment to serve	5.62	.98	5.38	1.12	<.001**	-.24
Become a responsible community member	5.52	.97	5.44	1.10	.04*	-.09
Respect for people from different backgrounds	5.45	1.03	5.58	1.06	<.001**	.12
Become a responsible global citizen	5.51	1.00	5.39	1.12	<.001**	-.12

Note: * significant at .05 level; ** significant at .01 level.

Table 4

Results of Independent t-tests of Students' Retrospective Self-Reported Learning Gains from Service-Learning, Online vs Traditional Group (Subject-Level Analysis)

	Independent t-test					
	Traditional Service-Learning Subject (n=17)		**Online (Type IV Extreme) Service-Learning Subject (n=17)**		**Test Results**	
	$\bar{X}$	SD	$\bar{X}$	SD	*p*	*d*
Learning Gains						
Intellectual Learning Outcomes	***5.32***	***.23***	***5.31***	***.19***	***.97***	***-.01***
Understand linkage b/w SL & subject content	5.22	.26	5.26	.21	.62	.17
Apply knowledge to deal with complex issues	5.30	.23	5.26	.19	.56	-.20
Solve real-life problems	5.35	.26	5.33	.21	.76	-.11
Think critically	5.40	.20	5.41	.22	.82	.08
Civic Learning Outcomes	***5.52***	***.22***	***5.44***	***.20***	***.33***	***-.34***
Understand community problems	5.59	.22	5.40	.24	.02*	-.82
Commitment to serve	5.60	.22	5.39	.23	.01**	-.94
Become a responsible community member	5.52	.22	5.46	.22	.43	-.27
Respect for people from different backgrounds	5.40	.28	5.59	.23	.05*	.71
Become a responsible global citizen	5.46	.25	5.38	.21	.33	-.34

Note: * significant at .05 level; ** significant at .01 level.

Table 5

Results of Independent t-tests of Students' Learning Experience, Online vs Traditional Group (Student-Level Analysis)

	Independent t-test					
	Traditional Group (n=3,846)		**Online Group (n=857)**		**Test Results**	
	$\bar{X}$	SD	$\bar{X}$	SD	*p*	*d*
Interested in the SL project	5.08	1.41	5.11	1.30	.57	.02
Benefited the people I served	4.77	1.23	5.39	1.11	<.001**	.51
Prepared me for service	5.49	1.01	5.42	1.16	.09	-.07
Motivated and supportive teammates	5.52	1.05	5.60	1.11	.04*	.08
Enthusiastic & passionate teachers	5.67	1.07	5.60	1.10	.10	-.06
Interaction with people served	5.61	1.05	5.24	1.30	<.001**	-.34
Support available when needed	5.50	1.03	5.47	1.12	.48	-.03
Challenging and meaningful tasks	5.56	1.00	5.46	1.11	.01**	-.10
Task Autonomy	5.51	.99	5.60	1.02	.03*	.09
Good relationships with teammates	5.42	1.05	5.55	1.08	<.001**	.12
Service appreciated by community	5.66	1.02	5.42	1.13	<.001**	-.24
Effort	5.56	.97	5.72	1.01	<.001**	.16
Clear instructions for reflection	5.64	.97	5.30	1.20	<.001**	-.33
Insightful feedback during reflection	5.43	1.03	5.31	1.22	.01**	-.11
Service closely related to major	4.86	1.49	4.94	1.48	.15	.05
Interaction with teachers and students	5.46	1.02	5.40	1.12	.14	-.06
Challenged me to try new things	5.56	1.07	5.52	1.13	.31	-.04

Note: * significant at .05 level; ** significant at .01 level.

Table 6

Results of Independent t-tests of Students' Learning Experience, Online vs Traditional F2F Group (Subject-Level Analysis)

	Independent t-test					
	Traditional Service-Learning Subject (n=17)		**Online (Type IV Extreme) E-Service-Learning Subject (n=17)**		**Test Results**	
	$\bar{X}$	SD	$\bar{X}$	SD	*p*	*d*
Interested in the SL project	5.14	.32	5.15	.27	.98	.01
Benefited the people I served	4.78	.31	5.40	.25	<.001**	2.23
Prepared me for service	5.48	.27	5.36	.49	.37	-.31
Motivated and supportive teammates	5.47	.31	5.64	.18	.05*	.69
Enthusiastic & passionate teachers	5.63	.24	5.59	.32	.66	-.15
Interaction with people served	5.55	.33	5.20	.46	.02*	-.88
Support available when needed	5.48	.23	5.43	.33	.58	-.19
Challenging and meaningful tasks	5.53	.27	5.48	.24	.60	-.18
Task Autonomy	5.50	.29	5.62	.28	.23	.42
Good relationships with teammates	5.44	.25	5.58	.21	.07	.64
Service appreciated by community	5.65	.22	5.41	.34	.02*	-.82
Effort	5.57	.26	5.75	.25	.05*	.69
Clear instructions for reflection	5.65	.24	5.31	.31	<.001**	-1.24
Insightful feedback during reflection	5.37	.26	5.28	.34	.37	-.31
Service closely related to major	4.81	.46	4.76	.41	.79	-.09
Interaction with teachers and students	5.42	.32	5.40	.25	.83	-.08
Challenged me to try new things	5.52	.28	5.53	.20	.91	.04

Note: * significant at .05 level; ** significant at .01 level.