Chapter 18
Open Educational Practices Create Conditions for Developing Research Skills in Graduate Education

Barbara Brown, Michele Jacobsen, Verena Roberts, Christie Hurrell, Nicole Neutzling, and Mia Travers-Hayward
University of Calgary

Abstract

In this chapter, we describe the evaluation of a master's level program in education that was designed and delivered using open educational practices. Students developed research skills through layered assignments and multiple rounds of peer review, edits, and revisions of their work. Students engaged in self-reflection and idea-sharing using collaborative online spaces and social media. One research question guided this study: How do open educational practices support the conditions for student learning of research-based skills? Interview and survey data gathered from participants in year 1 and year 2 (n = 13) provided evidence that the use of open educational practices (OEP) created the conditions for graduate students' research-based skill development. We identify three key conditions that supported students with their learning, development, and continual improvement of research-based skills: (a) design of layered assignments, (b) formative feedback, and (c) peer learning. Study findings inform instructors and institutions on open educational practices, specifically how to create high quality, online learning experiences and design conditions that support graduate students in research skill development in post-secondary programs. Study findings contribute to the growing field of open educational practices.

Résumé

Dans ce chapitre, nous décrivons l'évaluation d'un programme de maîtrise en éducation qui a été conçu et dispensé au recours de pratiques éducatives ouvertes (PEO). Les étudiants ont développé des compétences en recherche grâce à des pratiques d'évaluations échelonnées, d'évaluations en boucle par les pairs, de révisions et de corrections de leur travail. Les étudiants se sont engagés dans l'autoréflexion et le partage d'idées en utilisant des espaces collaboratifs en ligne et les médias sociaux. La question centrale qui a guidé cette étude est de comprendre comment les pratiques éducatives ouvertes soutiennent les conditions d'apprentissage, tout comme les aptitudes à la recherche chez les étudiants aux cycles d'études supérieures? Les données tirées d'entretiens et d'enquêtes recueillies auprès des participants de la première et de la deuxième année (n = 13) d'un programme de maîtrise permettent d'établir que l'utilisation de pratiques éducatives ouvertes crée les conditions nécessaires pour le développement des compétences fondées sur la recherche. Nous identifions trois conditions clés qui soutiennent les étudiants dans l'apprentissage, le développement et l'amélioration continue des compétences basées sur la recherche : (a) la conception de tâches évaluatives conçues par étape (b), la rétroaction formative et (c) l'apprentissage par les pairs. Les résultats d'analyse offrent aux instructeurs et aux établissements postsecondaires des enseignements précieux sur les pratiques éducatives ouvertes. Tout particulièrement, cette étude démontre comment créer des expériences d'apprentissage en ligne de haute qualité et de concevoir des conditions qui soutiennent les étudiants dans le développement des compétences en recherche dans les programmes postsecondaires. Les résultats de cette recherche contribuent ainsi au domaine croissant des pratiques éducatives ouvertes.

Open Educational Practices Create Conditions for Developing Research Skills in Graduate Education

Demand for high quality online education and engaging learning experiences in post-secondary institutions is on the rise. During the pandemic, the number and type of online course offerings significantly increased, and many post-secondary institutions embraced online programming for academic and professional graduate programs that will likely continue to expand in the future. The quality of online education and the conditions for success are important considerations for students when making decisions and selecting programs and institutions. In professional graduate programs, practicing teachers and school leaders can develop research skills and become scholars of the profession (Brew, 2010; Jacobsen et al., 2018; Willison, 2014; Willison & O'Regan 2006/ 2019). Open educational practice (OEP) is a promising collaborative approach to teaching and mentoring for research-skill development and for designing high-quality online learning experiences in graduate teacher education contexts.

In this chapter, we describe a fully online graduate certificate, which was designed in 2017 as part of the graduate program. The program focuses on educational technology through four courses intentionally sequenced to develop students' research skills. OEP was integrated throughout the program design. In one course, students drafted a chapter that they continued to develop in a subsequent course. After completion of the certificate, students' chapters were published in a collaboratively developed open educational resource (OER). In this chapter, we describe a study that revealed three conditions that support research skill development: layered assignments, ongoing feedback, and peer learning. We learned from our study how OEP is a teaching and mentoring approach that supports students in developing research skills. We highlight the relevance of our research to the field of teacher education at the graduate level.

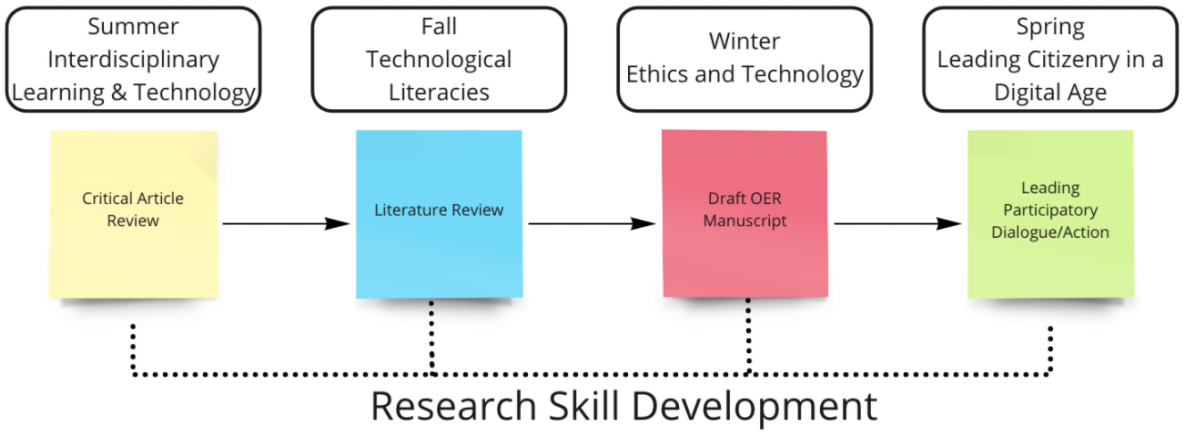
Research Context

Leading and Learning in a Digital Age is a four-course graduate certificate and stackable credential that can lead to a Master of Education degree. Instructors adopted the following definition of OEP in courses: "collaborative and pedagogical practices that involve the creation, use, and reuse of OER as well as participatory technologies and social networks to interact, learn, create knowledge, and empower learners" (Cronin, 2017, p. 18). This definition of OEP guided the design of each course and the learning tasks. Work students were asked to do focused less on content and learning via knowledge *borrowing*, and more on learning in collaboration with peers, course instructors, and external experts through knowledge *building* (Schwartz & Fischer, 2003).

The learning tasks in all four courses focused on students' developing research skills (Figure 1) and "were designed as a layered and supportive pathway to provide students with multiple opportunities to share their ideas and to receive ongoing and continual feedback" (Brown et al., 2021, p. 3). In contrast to disposable assignments that are often thrown away by the learner, renewable assignments are improved versions and valuable to audiences outside of the class through open publication and access (Wiley, 2016; Wiley & Hilton, 2018). Learning tasks were intentionally designed as layered and renewable assignments that spanned across courses, required multiple feedback loops with knowledge-building communities both inside and outside of the academic classroom, and resulted in openly licensed artifacts accessible to the broader community (Tietjen & Asino, 2021). Students had the option to remix and build on previous work and assignments as they progressed through the four courses in the program (layered). Students continued to build on and use their own openly published work during subsequent courses and beyond the duration of the program (renewable). Each of the courses provided students with opportunities to personalize the assignments to their professional contexts and interests (knowledge building).

Figure 1

Assignments in Four-Course Program



We drew upon Willison and O'Regan's (2007; 2006/2019) six facets for research skill development as a framework to connect the desired skills for scholars of the profession to the design of assignments students completed throughout this graduate teacher education program. The six facets shown in Table 1 enable research skill development. Table 1 maps the facets for research skill development to the layered, renewable, and knowledge building assignments in the program at the time of our study.

Our study draws upon data collected from student participants after they completed the four courses in the graduate certificate. Students were asked questions about the development of the OER manuscript during the third course of the certificate. This assignment was mapped to all six facets of research skill development. By design, the assignments in the first two courses lead up to the development of the manuscript in the third course. The assignments in the final course were interconnected and they leveraged the earlier learning tasks; thus, it was important to conduct our study only after the students had completed all four courses.

Table 1

Research Facets Mapped to Assignments in the Program

Facets Willison & O'Regan (2007; 2006/2019)	Learning Tasks Designed to Develop Research Skills
Facet 1: Embark on inquiry and so determine a need for knowledge/understanding	• Critical Article Review • Literature Review • Draft OER Manuscript
Facet 2: Find/generate needed information/data using appropriate methodology	• Literature Review • Draft OER Manuscript • Leading Dialogue/Action
Facet 3: Critically evaluate information/data and the processes to find/generate them	• Critical Article Review • Literature Review • Draft OER Manuscript • Leading Dialogue/Action
Facet 4: Organize information collected/generated	• Visual Synthesis • Literature Review • Draft OER Manuscript • Leading Dialogue/Action
Facet 5: Synthesize/analyze new knowledge	• Graduate Student Colloquium • Visual Synthesis • Literature Review • Draft OER Manuscript • Leading Dialogue/Action
Facet 6: Communicate knowledge and understanding, and the processes used to generate them	• Graduate Student Colloquium • Draft OER Manuscript • Leading Dialogue/Action

Literature Review

In this section, we discuss the literature that informed our study. Traditionally, open learning has focused on the integration of Open Educational Resources (OER) which are "teaching, learning and research materials in any medium — digital or otherwise — that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions" (United Nations Educational, Scientific and Cultural Organization, n.d., para. 1). We examined the literature related to instructional approaches to co-creating an OER with students, such as OER-enabled, open pedagogy, and open educational practices.

OER-Enabled, Open Pedagogy

Wiley and Hilton (2018) emphasized the need for a common definition of open pedagogy that integrates OER as an essential component of the learning process, thus OER-enabled pedagogy. This often-cited approach has been characterized by using an open textbook in a course, creating assignments that can be used as exemplars after the course, and otherwise rethinking the assignment design process to consider sustainable assignments that are remixed and adapted beyond a course (Wiley & Hilton, 2018). Eight attributes of open pedagogy highlight the following actions: using participatory technologies; developing an openness for working with others; encouraging innovation and creativity; openly sharing of ideas and resources; participating in a connected community; facilitating learner's contributions to open resources; engaging in reflective practice; and contributing to peer review and open critique (Hegarty, 2015).

Open pedagogy is also characterized by "three pairs of explicit values: autonomy and interdependence, freedom and accountability, and democracy and participation" (Paquette, 2005, para. 4). In addition to a focus on individual accountability, open education is connected to early references to open learning (Rogers, 1969, as cited in Rogers & Freiberg, 1994) that suggest open

learning exhibits “common value directions which are of such kinds as to enhance the development of the individual himself, of others in his community, and to contribute to the survival and evaluation of the species” (p. 49). Examples of OER-enabled pedagogy or open pedagogy include teachers demonstrating pedagogical transformation by using and remixing OER (McGreal, 2017), increasing student empowerment through the creation of open digital content (Tonks et al., 2013), and enhancing understanding of instructor-led open learning design in digital contexts (Conole, 2013). Current examples of open pedagogy include engaging students as partners to update and add interactive features to an open textbook, as well as developing a Wikipedia-editing course where medical students improve the quality of entries on health-related topics (Guven et al., 2020; Sharma et al., 2021).

Open Educational Practice (OEP)

A contemporary construct of open educational practice (OEP) integrates ideas from multiple perspectives of open and networked learning in which learners can find, consider, and share knowledge for themselves and be part of a broader sharing community (Barth, 1969; Couros & Hildebrandt, 2016; Cronin, 2017; Jordan et al., 2017; Paquette, 1979). OEP can foster a connection between individual accountability and community responsibility that emphasizes a shared participatory culture in which “members believe that their contributions matter, and feel some degree of social connection with one another (at the least they care what other people think about what they have created)” (Jenkins et al., 2016, p. 4). While OER has been identified as an essential nexus for OEP, there are other influences that help students engage and actively participate in open learning processes in personally meaningful ways without emphasis on OER.

Consistent with Gee’s (2004, 2005) principles of learning design, the learner can be an active agent who builds knowledge within the learning process rather than a passive recipient of knowledge. Some argue that when people recognize that open knowledge can be enriched by

individual academic experience, they will feel more motivated to know and participate not just as an audience member but as a protagonist (Jordan et al., 2017). As protagonists of their learning, learners can become producers instead of consumers of knowledge (Schwartz & Fischer, 2003). In knowledge-building communities, the collective work of a group of learners and teacher(s) is focused on "improving the knowledge itself, rather than the contents of students' minds" (Scardamalia & Bereiter, 2010, p. 8). Scardamalia and Bereiter's (2014) knowledge building in community helps to describe the connections between social interactions, access to resources (content and people), and the participatory and collaborative learning opportunities with OEP.

Within an OEP approach, instructors and students are often co-designers in the learning process (Barbera et al., 2017). Jahnke et al. (2020) described co-design as a way for students to become active agents with the support of their instructor in using participatory pedagogies. In the literature, examples of co-design are emerging (Barbera et al., 2017; Paskevicius & Irvine, 2019; Sharma et al., 2021). DeRosa and Robinson (2017) described co-design as a combination of authentic, student-centred learning and open teaching practices. Studies in higher education demonstrate increased student engagement in connection to co-design experiences in a course or program, such as co-designing a course syllabus, a pressbook, a Wikipedia entry, or a video (Paskevicius & Irvine, 2019; Wiley & Hilton, 2018;). However, research is only starting to emerge that demonstrates how OEP can be used to help students develop research skills in teacher education programs (Trust et al., 2022). This study contributes to this emerging body of research by demonstrating how OEP in online graduate education courses assisted students in developing their capacity as researchers and scholars of their profession.

Methodology

Design-based research is a methodological approach that incorporates characteristics of design-thinking as researchers and practitioners conceptualize and analyze complex problems of

practice, design and implement solutions, and evaluate local impact through iterative cycles of analysis and design, with the goal of generating design principles and theoretical insights (McKenny & Reeves, 2019) that advance knowledge and practice. Design-based research supported our ongoing efforts to continually evaluate and strengthen the program design for authentic research-based learning experiences. The following research question guided our design-based research study: How do open educational practices support the conditions for learning research-based skills?

In the first year of the study, 12 students were in the cohort, of which eight (n = 8) completed a survey. In the second year of the study, 12 students were in the cohort and five (n = 5) completed the survey. The survey data from participants in both years were combined for reporting on the development of research skills. In both years, data were collected from participants after they completed the four courses in the program. Participants were asked questions specifically about the development of the OER manuscript during the third course of the program. Participants were invited to reflect on their experiences in the four courses and their learning tasks, and to what extent these activities supported their learning and provided engaging learning experiences (e.g., receiving feedback from peers and outside experts, authenticity of the assignments, participatory activities leading up to the development of the resource, reflection activities, course resources). Open-ended survey questions asked participants to describe their experience and to provide details about aspects of the program that supported their learning and research skill development experiences. Some participants did not respond to all survey questions. A subset of participants who completed the survey also agreed to participate in individual interviews with a member of the research team. A subset of participants in year 1 (n = 5) and in year 2 (n = 3) agreed to be interviewed to provide further details and insights about their learning

experiences (see Table 2). Interview transcripts were sent to participants to review and verify the content. Pseudonyms were assigned to each transcript prior to analysis.

Analysis of year 1 and year 2 survey data involved reviewing the select-response data and calculating average responses. A review of qualitative data from interview transcripts and open-ended survey questions involved two cycles of coding (Miles et al., 2014).

Table 2

Total Number of Participants in Year 1 and Year 2

Year	Cohort Size	Survey Responses	Interviews
1	**12**	**8**	**5**
2	**12**	**5**	**3**
TOTAL		**13**	**8**

Each response to individual survey and interview questions was treated as a single unit of analysis. In the first cycle, descriptive codes were assigned to each individual response to capture the key idea(s) provided by each participant. In the second cycle, similar codes were clustered together and informed the development of themes. Four members of the research team were involved in the two cycles of coding and data analysis, followed by the convergence of the data sets from year 1 and year 2 that informed the development of themes. The extensive process of data analysis by multiple members of the team and convergence of the quantitative and qualitative data, and then synthesis of data to develop themes, provided a rigorous process for credible and trustworthy reporting on results.

Results

Data were synthesized into three themes that demonstrate how open educational practices (OEP) created and supported fertile conditions for graduate students' research skill development. Each of the three themes reflects one of the conditions that facilitate student learning of research-based skills. Interviews and surveys uncovered how the design of engaging, meaningful, and authentic learning tasks, supported by dynamic feedback and positive relationships with peers, enhanced student learning. Results demonstrate how three key conditions within this study supported students with their learning, development, and continual improvement of research-based skills: (a) design of layered assignments, (b) formative feedback, and (c) peer learning.

Condition 1: Design of Layered Assignments for Authentic Learning and Engagement

This graduate certificate was designed to offer students a series of layered assignments to support the development of graduate-level competencies as they progressed through the four courses in the program (Brown et al., 2021). The first two courses were designed to engage students in various topics related to educational technology as they completed a critical article review and literature review. In the third course students selected a topic for a chapter related to educational technology and ethics. Across both years of the study, over 90% of participants who completed the survey agreed that the authenticity of the assignments, including being able to pursue a topic of personal and professional interest and relevance, increased their learning and engagement. The following participant reflections illustrate how opportunities for authentic learning fostered greater engagement in their inquiry. One survey respondent commented that "the ability to determine the subject of the chapter created an internal motivation to complete the work. This motivation would not exist, or at least not be as strong, if the subject was assigned by the instructor." Another survey respondent noted "the ability to select a topic of personal interest allowed for a broad range of topics and personally I benefited from being able to concentrate in

this way." Participants indicated that having a choice for the topic of inquiry embedded in the design of the third course enabled them to deepen their learning of a topic that had intrigued them in earlier courses, or to engage in knowledge building relevant to their professional context.

Throughout the program, layered assignments guided and supported the students in reaching milestones towards the completion of their learning tasks. Participants described how layered assignments kept them engaged and helped them develop valuable communication and research skills by holding them accountable for their progression, while providing them with opportunities to give and receive formative feedback. During the interview, Jack explained, "I liked all the little built-in checks and the frequency of checks. I felt like that was beneficial in the final turnout of the product [OER Chapter]." Additionally, Ian described the variety of skills they were able to practice as they navigated through the layered assignments towards their final OER chapter: "in a chapter of this magnitude you have the opportunity to hone research skills and writing, analysis, assessment, what to include, what not to include, how to relate your particular chapter to personal experience."

In the third course, layered assignments were scaffolded by participatory activities that provided students with opportunities to research and synthesize knowledge in open and social online communities. Activities such as curating resources, engaging in public chats on Twitter, and blogging invited students to contribute their voice and experiences to wider knowledge-building networks that were focused on their topic of inquiry. The following two participant excerpts illustrate how open educational practices enabled their development of research skills by participating in, rather than borrowing or merely observing, the knowledge-building process:

> The [third] course was not conducted in isolation. The integration of Twitter and the publicly accessible blogs made the learning open to the world and therefore more authentic. The utilization of the wider #edtechethics community brought the

> possibility of engaging with others around the world who have been working on the topics and provided the opportunity to expand the student's Professional Learning Network. (Survey respondent)
>
> It was cool to connect with a bunch of people outside of the class, and I also helped build my connections, my learning network through that, so definitely a huge benefit there. What I really appreciated from the Twitter chat was the data that came after. (Interview with Robyn)

Participatory activities often involved interactions with people outside of the class, which students appreciated as an opportunity to expand their personal learning networks and to benefit from collaborative learning linked with their careers beyond graduate school. According to the survey, many of the participants (92%) agreed that connections to experts outside of the class enhanced their learning in the course. Participants reported they appreciated being able to connect directly with researchers and authors in the broader community through Twitter and blogs. Connections beyond the course made participants feel less isolated in their learning and broadened their ideas of what engagement could look like. Many participants described how the open environment of their course enabled them to engage directly with authors/outside experts in support of their inquiry.

> I had my draft chapter in a Google Doc…. And I was blown away that this person [author that was quoted in the chapter] had taken the time to comment on my draft.... That was a cool experience to be able to connect that way. And it just encouraged me to finish it….Very motivating. (Interview with Devon)

Overall, all of the participants agreed that layered assignments and the associated participatory activities engaged them in the research and writing process. In response to the survey, 92% of participants agreed that the participatory activities strengthened their communication skills; and

while the same proportion felt these activities engaged them in the course, 75% asserted that the activities supported their learning. The ongoing opportunities that course activities provided to connect students with experts outside of the classroom in real ways facilitated connection-building and helped learners to realize their research would be relevant to a broader audience, when it was published within the OER. With the open access and connections came added pressure for students who knew their assignment was renewable (that is, publicly accessible and openly licensed). However, overall, their writing experience in the context of open access was viewed by participants as a positive, uniquely authentic learning opportunity within their course-based graduate program.

Condition 2: Ongoing and Constructive Formative Feedback

The layered assignments and accompanying participatory activities gave rise to the second condition which enabled students to develop research-based skills: ongoing and constructive formative feedback. During the first two courses, students engaged in providing and receiving peer feedback on their learning tasks. During the third course within the program, students sought formative feedback from multiple sources (e.g., peer groups, instructors, outside experts found by students, outside experts found by the instructor, alumni) to support their inquiry. Results from the survey found that 92% of participant respondents agreed that feedback from their peers supported their learning, and about 50% felt that feedback from outside experts similarly benefitted their learning.

The following two excerpts of participants' responses illustrate how formative feedback enabled them to develop research-based skills, including gathering and analyzing relevant resources and communicating findings to a specific audience:

> The following aspects were key learning highlights for me. Key, timely, and ongoing support from my instructor who always took the time to help me link our theories

> discussed in class with relevant coursework/project; working on the chapter and receiving feedback from my instructors. (Survey respondent)
>
> It challenged me to make sure my voice was heard and understood, so I think that helped my communication skills, and being able to share my ideas and make sure they're clearly understood for the audience. (Interview with Sarah)

The use of open education practices meant students were encouraged to connect with and seek feedback from experts on their topic outside of the boundaries of their course community. Participant responses in the interviews converged around a common appreciation for the opportunities they had to pose questions directly to academics and other professionals, and whose work they were engaging with as they worked on their inquiry:

> It kind of forced me to seek feedback from people that I wouldn't normally have done so and that feedback really helped. I was able to connect with some people that I know who share some of my research and educational interests and who have sort of related perspectives…. That helped guide where I went. The external feedback was what helped shape my chapter ultimately. (Interview with Maria)
>
> Right from the get-go of the beginning of my writing to the end, [I] kept her in the loop and would bounce ideas off of her. The engagement was right there…. It felt like it wasn't just me writing this chapter. It was definitely the community approach, and it was the same with another colleague who was part of my feedback loop. (Interview with Robyn)
>
> For the [OER] pressbook, I had reached out to a former faculty member that I know who still researches everything under the sun, and he's always engaged. And I asked his advice where to start…. Then he got me in touch with a gentleman in the States, and I had this 45-minute conversation with somebody from [location redacted]…. I think it opened

> my eyes too, there's a community of people out there that will help other people learn. (Interview with Devon)

Balancing the amount of feedback given and received can be challenging for each individual student. While the responses highlighted in this section demonstrate how most participants found value in the multiple sources of formative feedback, some participants indicated they felt overwhelmed by trying to interpret and implement a wide range of feedback. While Robyn noted how their chapter benefitted from extensive formative feedback, they also acknowledged that this review and revision process was overwhelming at times:

> My document was littered with all these comments and things to consider. I didn't even know where to start with it, and so my colleague, my outside person, she sat down with me, helped me organize my thoughts, helped organize their comments.

Additionally, Devon indicated that peer feedback was not always useful and focused more on minor grammatical fixes instead of concrete feedback on the content, which would have been more valuable: "I think maybe in the beginning we would have benefited more from [learning] how to do feedback appropriately." Relatedly, a participant in year 2 commented in the survey that "much of the feedback I received attempted to expand my topic as opposed to focus on it. I would have liked to have had feedback like 'you should focus on this' as opposed to 'you should add this.'" Overall, participants found the ongoing and constructive feedback supported them with developing research skills for their inquiry, though their responses are a reminder that not *all* feedback is considered *useful* feedback. Participants reported they tend to prefer content-focused feedback that is narrow enough to not prompt a drastic shift in their inquiry (e.g., recommendations for significant additions once the research has already begun).

Formative feedback on students' inquiry did not end when the course or program did. The OER chapter remained in draft form as it underwent additional rounds of editing from the internal

research team and an external copyeditor. Participants continued to respond to and edit the chapter based on feedback received from these sources, including from a copyeditor before the final publication. Participants' engagement in formative feedback loops beyond the duration of the course reflected how they had a heightened commitment to ensuring that their original inquiry into a topic of interest was synthesized to the highest quality of writing for publication.

Condition 3: Peer Learning

This third condition of OEP that supported students with learning research-based skills was the experience of peer learning. The interview and survey data illuminated how participants reported that working on individual inquiries alongside peers with a shared and collective goal to contribute to an OER fostered a positive learning community. In the survey, 92% of respondents agreed that working with their peers supported their learning and engagement in the course. Given that students were co-producing an open educational resource, with each writer contributing a chapter towards a wider, collective product, this learning process challenged hierarchies and environments of competition that can often arise in graduate school classrooms. Instead of seeing others as competitors, participants reported feeling a sense of solidarity with one another. Sarah explained that "there's a bit of a teamwork thing. We're all going to either fail or pass this together." This sense of solidarity could explain why peer feedback was rated positively by 92% of participants who completed the survey after the program was completed. The following excerpts from participant responses demonstrate how peer learning served as a strong safety net and support system amidst what some felt was a high-stake learning experience. "I really benefited from my in-class feedback group. Not only did they help provide specific feedback, but they were also great motivators" (survey respondent); "two girls who just would randomly message me something that they had found that worked within my chapter, and vice versa. Even though my chapter was my

own, it felt like a community project" (interview with Robyn). Another survey respondent mentioned:

> Cohorting and peer feedback strongly supported my learning. I felt being in the same class with the same students developed a positive environment (even in an online class). Peer feedback was very helpful in our studio groups as it helped refine ideas and develop our inquires better. (Survey respondent)

An element of peer learning that the participants consistently reported they appreciated was the exposure to diverse perspectives, which opened new ideas that informed their research. In addition to sharing resources and ideas, participants appreciated having a peer support system to problem-solve collectively as they worked through challenging assignments and their inquiry. While perspectives were sometimes mixed on whether specific peer feedback was useful, most participants expressed an appreciation for having a smaller cohort that they could connect with during and outside of the course to share challenges, offer advice, and motivate one another to complete their inquiry. As this final condition illustrates, OEP can nurture the links between individual accountability and community responsibility, and create a shared participatory culture that engages peer groups in research-skill development.

Discussion

In the present study, data were gathered about students' experiences engaging in open educational practices (OEP) as they conducted an inquiry using research-based skills that led to the development of an OER. Participants identified three conditions that supported their learning and development of research skills: layered assignments, formative feedback, and peer learning. Study results provide new insights and understanding that can inform future program design and conditions in which OEP can be used to support graduate students' development of research-based skills in authentic, meaningful, and engaging ways.

Havemann (2020) discussed opening moves in education and how terms associated with "open" in education are used and interpreted in a range of different ways. Openness in education can be framed as an ecology or repertoire of practices: "Through this frame, a university is an ecology in which digital and analogue, and 'open' and 'closed' educational practices may well co-exist in interdependent, complementary ways rather than being positioned as opposite to each other" (Havemann, 2020, p. 6). The following discussion illustrates how openness and open educational practice was embedded in the educational approaches identified by students as supportive conditions for conducting an inquiry and developing research skills within a graduate certificate. The three conditions (layered assignments, formative feedback, and peer learning) were part of a broader ecological frame that included other open educational practices within the graduate program.

We draw on attributes of open pedagogy in our discussion of these educational practices, such as using participatory technologies, developing an openness for working with others, encouraging innovation and creativity, openly sharing ideas and resources, participating in a connected community, facilitating learner's contributions to open resources, engaging in reflective practice, and contributing to peer review and open critique (Hegarty, 2015). We also draw on the six dimensions of the Connected Curriculum Framework (Fung, 2017) for developing facets of research-based skills (Willison & O'Regan, 2007; 2006/2019) in our description of openness in layered assignments, formative feedback, and peer learning (see Table 1): students connect with researchers and with the institution's research; a through line of research activity is built into each programme; students make connections across subjects and out to the world; students connect academic learning with workplace learning; students learn to produce outputs directed at an audience; and students connect with each other, across phases and with alumni (Fung, 2017).

Layered Assignments

A through line of research activity was built into the learning tasks and course work in this graduate certificate, and for some students (e.g., those who published an OER manuscript) it even extended beyond the duration of the program (Fung, 2017). “The layering conception suggests that research is about uncovering or unearthing that which is hidden” (Fung, 2017, p. 21). The program offered layered assignments that were renewable so students could continue developing ideas as they progressed through each of the courses. Participants in our study discussed how layered assignments provided authentic learning experiences and engagement in embarking on an inquiry (facet 1) and developing research skills. Learner-generated topics of inquiry that connected to their workplace, including K-12 classrooms and schools, supported the authenticity of the assignments (Fung, 2017; Hegarty, 2015). The layered assignments also provided graduate students with accountability as they progressed through the program and continued to find needed information (facet 2), while critically evaluating information (facet 3), organizing information (facet 4), and synthesizing the new knowledge (facet 5). The layered assignments were strengthened through the participatory technologies used during the program (Hegarty, 2015). For example, in the third course, the participants discussed how OEP in digital spaces, such as Twitter and blogging sites, contributed to their inquiry and supported opportunities to communicate knowledge (facet 6) and engage with authors and outside experts. Participants acknowledged their growth in research skill development across all six facets described by Willison and O’Regan (2007; 2006/2019), when discussing layered and renewable assignments in the four graduate courses.

Formative Feedback

Participants valued the ongoing and constructive feedback received from peer groups, instructors, outside experts found by the students, outside expert connections through their instructor and alumni of the program. However, it was the formative feedback provided by their

peers that the majority of participants agreed (92%) best supported their learning. Peer feedback played a significant role which will be elaborated on and discussed in the next section. Formative feedback from many sources can benefit students when engaging in an inquiry and developing research skills. This finding is consistent with the literature that suggests a connected community can be involved in feedback and help with sharing ideas and resources (Hegarty, 2015) and that students can be supported through connections with each other and with alumni (Fung, 2017).

Participants discussed how formative feedback helped with finding needed information (facet 2) as well as analyzing and synthesizing it (facet 5). Participants also discussed how formative feedback did not end at the conclusion of the program and continued as they revised and refined their chapters for inclusion in the OER (Jacobsen et al., 2021). All participants agreed that receiving feedback from others strengthened their communication skills, which aligned with the sixth facet for research skill development to communicate knowledge and understanding, and the processes used to generate them (Willison & O'Regan 2006/2019).

While most participants reported they appreciated having multiple channels through which to receive feedback, some discussed the challenges related to the quantity and quality of formative feedback. Some participants indicated that their experience with receiving and actioning feedback from different sources was overwhelming at times, while others suggested it would have been helpful to explicitly teach peers how to provide constructive, content-centred feedback. The timing and type of feedback as well as the capacity of those delivering feedback, and expectations for using feedback, should be considered in OEP.

Peer Learning

Students worked alongside peers in a cohort through the four courses and the same group of students were enrolled in the four sequential courses. Embarking on inquiries (facet 1) in the company of peers offered students an opportunity to share diverse perspectives, ideas, and

resources (Hegarty, 2015). Participants explained how they received valuable support from their peers, who would often help them with locating relevant research related to their inquiries (facet 2). Through peer feedback — which most participants agreed supported their learning — learners were supported with critically evaluating their research (facet 3) as well as organizing and synthesizing their findings (facets 4 and 5) for dissemination in their final chapter. Overall, the interview and survey data reveal that participants perceived that the opportunities to work alongside peers and receive peer feedback, as they developed their inquiries, supported their learning and enabled them to develop research-based skills.

The emphasis on peer learning reflects attributes of OEP, which include developing an openness for collaborating with others, openly sharing and critiquing ideas, resources, and other scholarship, and participating in connected learning communities (Cronin, 2017; DeRosa & Robinson, 2017; Paskevicius & Irvine, 2019). Graduate students felt motivated to continue developing their research skills knowing that they were in a connected community of peers working towards producing a collective output as an open pressbook (Jacobsen et al., 2021). The emphasis on collaboration with peers meant that graduate students had a strong support network that became particularly valuable as they progressed with their inquiry, which many felt was a challenging experience that pushed them out of their comfort zone. Establishing a positive learning community with their peers helped graduate students develop the confidence to engage in knowledge-building as active participants and "protagonists" of their own learning.

Conclusion

This chapter provides evidence and examples from design-based research and practice on how Open Educational Practice (OEP) can be used to teach research-based skills to graduate students in authentic and engaging ways. The research question guiding this study was: how do open educational practices support the conditions for learning research-based skills? This question was examined using design-based research, a methodology that enables researchers and practitioners to collaborate on iterative design, implementation, and evaluation of solutions to complex problems of practice as a means of uncovering new theoretical insights and design principles for practice. Data from surveys and interviews with graduate students revealed how OEP activated three conditions through which students developed research skills — the design of authentic layered assignments; frequent opportunities for formative feedback; and ongoing, supportive peer learning.

These three conditions for learning were explicitly embedded in the design of the four-course graduate certificate program — Leading and Learning in a Digital Age — to reflect the principles of OEP, which were understood as "collaborative and pedagogical practices that involve the creation, use, and reuse of OER as well as participatory technologies and social networks to interact, learn, create knowledge, and empower learners" (Cronin, 2017, p. 18). Each condition encouraged graduate students to become co-designers of their learning as they developed research skills; this meant having the agency to pursue a topic of personal and professional interest, seek feedback and insights from within and outside the boundaries of their course, and develop an appreciation for the social process of knowledge-building alongside their peers. Graduate students appreciated how the layered and renewable assignments enabled them to develop research-based skills and expertise that were transferable across courses to their culminating inquiry project. The ongoing opportunities to seek formative feedback from a wide community of sources — including

outside experts, academics, instructors, and peers — were seen as valuable to students, and in some cases led students to connect directly with the authors of research they were engaging with for their inquiry project. Finally, graduate students reflected how peers supported their learning and engagement through sharing ideas and resources and supporting one another with challenges that arose as they completed their inquiry project.

Overall, OEP emphasizes authentic learning tasks which highlight disciplinary expertise where learners, seeing themselves in the discipline or the professional community of practice, can make personally relevant connections to their learning. Students are encouraged to transition from an observer of learning to an active participant in the learning process as a "protagonist," and this transition helps foster confidence and lifelong learning. This study is particularly significant to scholarship in teacher education given the current educational landscape in which there is a growing demand for innovative approaches to open and online learning. The results can inform faculties of education and instructors in pre-service, in-service, and graduate education on open education practices and principles. They can also demonstrate how to design and enable high-quality, open and online learning experiences and create the conditions for student teachers, practicing teachers, and school leaders, who are graduate students, to develop research-based skills in ways that are personally and professionally authentic and meaningful. Additionally, this study contributes to the growing field of OEP and research-based skill development in online professional graduate programs.

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