

International Collaboration on a Sustainable Forest Management OER Online Program – A Case Study

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Forestry education has always had to adapt to global changes and accommodate students and society's needs. To address the issues of the day, forestry education has cultivated human capacity to understand the complexity of ever-changing environments, master resource management technologies, and engage in global issues. Educational technology and online learning are important in providing flexible, accessible, and effective forest education at the rate and scale needed within the forestry sector. The transition during the COVID-19 pandemic further illustrates the role of online learning in worldwide education. In this context, this paper shares a case study from the Sustainable Forest Management Online Program led by the Faculty of Forestry, University of British Columbia (UBC) and Partner Universities. This study shows that appropriately integrating educational technologies into an internationally developed and recognized high-quality curriculum is an effective way to create accessible and affordable forestry education in meeting the demand of evolving societal and environmental conditions.

Keywords: forestry education, online learning, educational technology, international collaboration, COVID-19

INTRODUCTION

The multitude of pressing global issues, including climate change, deforestation, and illegal logging, has underscored the need for forestry education to promote sustainable forest management practices that accommodate natural cycles and ecological systems, as well as maintain the long-term health of the land and the people (CCIED, 2016). Such practices may incorporate thoughtful and nuanced approaches, including community-based management and environmental conservation (Temu, Rudebjer, Kiyiapi, & Lierop, 2005). Given the complexity of these issues and their practice-based solutions, today's forestry graduates must be able to think strategically across disciplines and geographical scales, in addition to possessing a variety of skills (Längin, Ackerman, & Lewark, 2004). Globalization, technological change, economic uncertainty, shifts in societal values, global pandemic and other unpredictable pressures are requiring higher education to nimbly update the current forestry educational model to meet demands in content and delivery. In this context, online or digital learning technologies may be critically needed to provide accessible and relevant forestry education. Meanwhile, graduates facing unprecedented challenges in the field, may need to adopt a lifelong learning strategy and thus require technology-based distance education to do so (Owusu-Ansah, Neill, & Haralson, 2011). Digital, online and technology-based education may be greatly advantageous to forestry education and the forestry field by improving the access and the delivery of education, and the field's ability to adapt to shocks or stressors.

The advantages of online learning are many including flexible hours and location, cost effectiveness, borderless collaboration, as well as access to current information and educational resources (Allred & Smallidge, 2010), as observed during this pandemic. Online, educators can maintain synchronous and asynchronous instructions through webinars, videoconferencing, and blended or flipped approaches. However, development costs, accessibility, and concerns from faculty members, may hinder greater integration of web-based technology in higher education (Owusu-Ansah, et al., 2011). Despite the adoption of online learning, webinars and learning technology in many disciplines within Canada (Bates, 2017), and some adoption in American and European forestry education (Bogdanou, Starr, Weatherall & Leslie, 2013; Gleason, 2015), these technologies are far from their potential usage in higher forest education. As discussed by Längin, et al. (2004), the dearth of forestry online learning could be linked to a lack of resource input for small student target groups, or the apprehension that computer-supported learning would provide inadequate training in a very practice-oriented field of science. Yet online learning may allow forestry universities to be adaptable and fully meet the new demands in forestry education (Längin, et al., 2004).

This article attempts to discuss the effectiveness of a sustainable forestry management Open Education Resources (OER) program developed and implemented through international collaboration. The experiences and lessons learned from the practices can be used for colleagues in developing online learning programs and OER during this challenging time amid global COVID -19 pandemic.

PLANNING AND PRACTICES

A joint educational online program entitled *Innovative Sustainable Forest Management Education in the Asia-Pacific Region* (<http://apfecm.forestry.ubc.ca/sfm-online-courses/>), which began its phase I development in 2014, is a series of five online courses in sustainable forest management (SFM) with its content as OER. The program has been led by UBC Forestry in partnership with Beijing Forestry University (BFU), University of Melbourne (UM), University Putra Malaysia (UPM), and University of the Philippines Los Baños (UPLB) under the framework of the Asia Pacific Forestry Education Coordination Mechanism (AP-FECM) sponsored by the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet). The goal of the program is to improve access to education in the field of SFM, targeting enhancement of teaching quality, curriculum and research capacity among forestry universities, policy makers and practitioners in the Asia Pacific region (Innes, Wang, & Zeng, 2018). The AP-FECM sees the OER concept to be pivotal to the success of this endeavor.

As the only SFM online program of its kind, the joint educational program provides world-class forestry education resources created and supported by leading professors and experts from internationally recognized universities around the world to over 15,000 users from over 90 international economies since 2016.

Program Development

Forming an international content expert team, with central instructional design support from UBC, the program followed a modified ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model to employ Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK) framework ensuring effective integration of technology into the content and pedagogy of course design and development.

The program aims to introduce updated SFM topics to global learners in an open learning environment. The course topics (changing landscapes of SFM, governance policy, community development, sustainable use of forest ecosystem services, forest resources management, ecosystem restoration and protection, etc.) were widely consulted with regional forestry universities and identified from reviews and surveys conducted by the AP-FECM, which demonstrated solid needs and interests of learners and larger societies. Content experts from regional forestry universities in the AP-FECM network were then invited to develop coursework. Together, these subject matter experts form an international collaborative development team with broad knowledge in diverse approaches to management, ecosystems and forest-types. While developing content, the international experts worked on content related to theory as well as local, regional and global practices as a case related to their assigned course, which has wider learning scope. Before course development, a three-day on-site course development workshop was held by UBC Forestry and UBC Centre of Teaching, Learning and Technology (CTLT) to conduct curriculum and course mapping, discuss applicable pedagogy, and introduce design principles for online learning using educational technologies. A team-based approach to content development, learning design and project management was established to support the entire program development combining knowledge of content, pedagogy and technology. During course development, instructional design and educational technology support were provided to help content experts in developing their online courses. Content experts received support in the form of content templates as well as through reviews and feedbacks on course outline, schedule, assessments, and module content.

As a result of these efforts, the final course design came to fruition. Each course features self-directed learning with content as Open Educational Resources (OER). Learning modules break down to topics for easy repurpose and typically consist of background information, video lectures, supplemental readings, self-tests, self-directed reflection questions, and self-directed discussions. This module-based format allows instructors to easily incorporate appropriate content into their own courses and allows institutions to customize and integrate the entire or 'parts of' each course to fit into their own education curricula and programs. This pedagogical model allows both self-paced learning and instructor-led learning to improve flexibility and learner engagement.

Program Implementation

The OER Course materials have been widely utilized or repurposed either partially or entirely by AP-FECM, participating universities, member universities of AP-FECM, and individual users in their learning, teaching, and research since 2016. Some examples of innovative pedagogical approaches of online teaching using the existing OER course materials include the following. In Course International Dialogue on Forestry Issues (FODE 003), learners were asked to preview the course content and bring questions to a classroom discussion held in a video conferencing session led by instructors at UBC as a part of undergraduate course. In Restoration of Degraded Forest Ecosystems and Forest Plantation Development (FODE 005), the lead professor in Australia blended the course materials into the University of Melbourne's Master of Forest Ecosystem Science. Graduate students experienced a combination of self-paced SFM online lectures, in-class discussions and hands-on fieldwork at a wide range of forest sites with fellow classmates. During 2016 to 2019, Sustainable Forest Management in a

Changing World (FODE 001), Public Relations and Community Development (FODE 002), and Restoration of Degraded Forest Ecosystems and Forest Plantation Development (FODE 005) were held as the open enrolment pilot courses. Learners were asked to study course materials and share localized practical experience in group discussions. They also conducted field work and present visual materials of local practices in relation to sustainable forest management and restoration of degraded forest, therefore exchanging practical and applicable knowledge have enriched experiential learning across the boundary.

In spring 2020, as the COVID-19 spreads globally, higher education around the world has been affected to varying degrees. Forestry colleges and universities in various countries encountered challenges when responding to the pandemic. The predominant obstacles facing these institutions may include limited high-quality online forestry education resources, a lack of teaching and operational experience in the development and implementation of online courses, and less online learning support for students with multicultural backgrounds, among others. Drawing from the previous experience in offering instructor-led online courses using the OER materials, UBC Forestry, with the support of APFNet, in partnership with 33 universities, offered a series of instructor-led online courses to students from Asia. There were 1565 cohort registrants, enrolled in the following courses: Sustainable Forest Management in a Changing World (FODE 001), Forest Governance, Public Relations and Community Development (FODE 002), International Dialogue on Forestry Issues (FODE 003), Restoration of Degraded Forest Ecosystems and Forest Plantation Development (FODE 005), Forest Resource Management and Protection (FODE 006), and two newly developed courses of the program phase II - Geomatics in Forestry: Data Collection and Management (FODE 009), Introduction to Urban Forestry in the Asian Pacific Region (FODE 012), and the Contemporary Topics in Forestry course – an additional course solely developed by UBC Forestry. The courses were again offered as an open enrolment, instructor-led, and free of charge session. They were delivered asynchronously with pre-recorded video lectures, supplementary open-access reading materials as well as collaborative learning activities such as weekly group discussions and reflection. A team-based approach was adopted in the course implementation and operation with over 30 instructors, teaching assistants and educational support experts from UBC and partner universities.

During the program implementation, our practices have moved from content-based teaching to learning-centered learning with student participation in discourse and co-creation of course materials. Bloom's Taxonomy, a hierarchical ordering of cognitive skills that can help teachers teach and students learn (Heick, 2018), was used to associate the learning activities in different offerings of the course with its course learning outcomes. Bloom's 'Taxonomy of Educational Objectives' (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956) increasing from less complexity to highest complexity includes six cognitive levels: remembering, understanding, applying, analyzing, evaluating, and creating. During the initial course offerings in 2016 and 2017, at the most basic level, students were encouraged to remember information in the course by completing self-test quizzes. They gained understanding on each topic with reading materials, then applied their knowledge in instructor-led discussions on generic questions. The 2016 and 2017 cohort groups did not engage at the evaluation or creation levels. In later course offerings after 2017, more focus was placed on using group discussion as an effective pedagogical approach to learning, which allowed students to compare their own experiences with their peers, therefore gaining practical and applicable knowledge from other countries in an engaging manner. Students were able to gain the knowledge and skills required to reach the highest level of the Bloom's Taxonomy learning objectives.

KEY OUTCOMES & LESSONS LEARNED

The SFM online program demonstrates the benefits of international collaboration on using online educational technologies supporting teaching and learning practices which enrich the learning experience and initiate international collaborations to shape higher forest education. Since 2016, the SFM online program has attracted over 15,000 learners including students, faculty members and professionals from over 90 countries around the world. Realizing the innovative approach employed, the program was

awarded the CNIE-RCIE Award 2016 in the category of Excellence and Innovation in the Integration of Technology in Educational Practices/Collaboration. Recognizing the contribution of forestry education in Asia-Pacific region, the program was the winner of the International Union of Forest Research Organizations (IUFRO) Best Forestry Education Award-Tertiary in 2019. These awards recognized the excellence in innovative educational practices and the use of technology to support and advance learning in forestry education. These awards also advocate the importance of multi-national multi-university collaborative efforts in today’s dynamic education landscape which enhance local, regional and global awareness of forest sustainability for educating future generation scientists, policy makers and practitioners.

Positive results were shown by a couple external program evaluations. The first evaluation was based on the user survey (70 completed responses) which analyzed the user experience on course design, learning outcomes, learner assessment, course materials, learning activities, lecture resource preferences, and course look-and-feel. The second evaluation covered the impacts of the SFM online courses, the online platform and the program on forestry education in the region, and its sustainability and feasibility for future development. Based on an analysis of the program evaluations, independent external report concluded that the development of a series of SFM courses for delivering essential knowledge and skills in sustainable forest management to global audiences was largely successful in achieving its objectives (Bigsby, H., 2016), and there were solid evidence showing the existing courses are viable with high quality (Xi, W., 2017).

Satisfaction on the successful delivery of the repurposed SFM online OER program could be found in sample post-course surveys. The program was designed to encourage and assist globalization and global cooperation in developing students’ careers in forestry. Of the 122 respondents who participated in the post-course surveys of FODE 001 in 2018 (N=80) and FODE 002 in 2019 (N=42) about 85% of the respondents either agreed or strongly agreed that the course advanced their knowledge of SFM in both their home country and abroad (Figure 1a). The program has met these outcomes as 91% of respondents either agreed or strongly agreed about their deeper understanding of SFM and expressed that they can apply their knowledge in their careers (See Figure 1b).

FIGURE 1A
LEARNER SATISFACTION ON KNOWLEDGE TRANSFER EXPRESSED AS %(N=122)

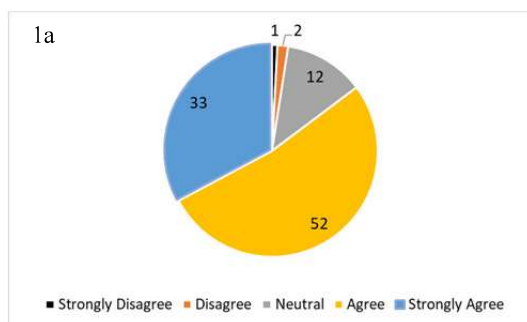
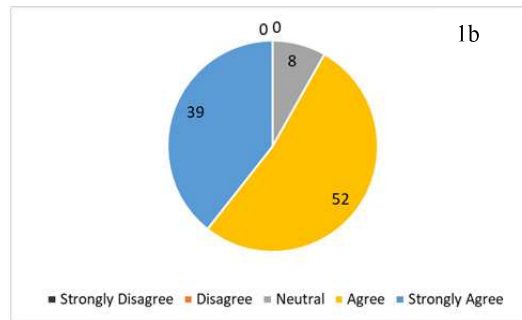


FIGURE 1B
LEARNER SATISFACTION ON KNOWLEDGE TRANSFER EXPRESSED AS %(N=122)



Overall, about 91% of respondents satisfied with the course and reported the online activities effectively enhanced their learning (Figure 2a). Over 80% of respondents expressed their interest on pursuing another e-learning course (Figure 2b.). Thus, user experiences in the SFM online program prove the effectiveness of online learning in forest education.

FIGURE 2A
LEARNER SATISFACTION ON KNOWLEDGE ACQUISITION EXPRESSED AS % (N=122)

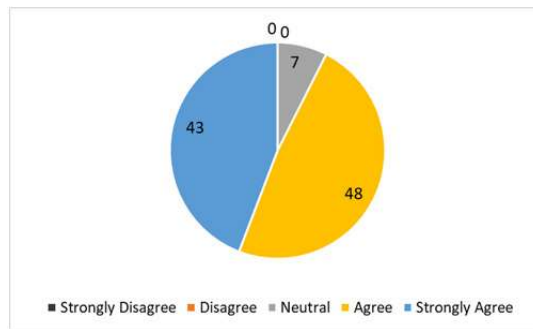
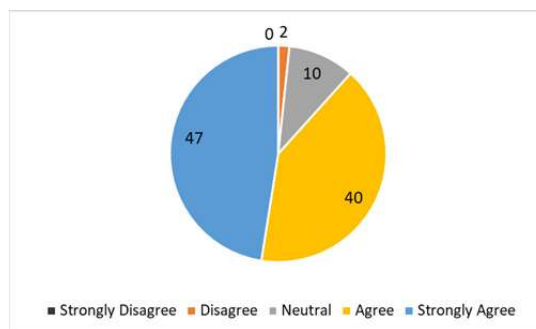


FIGURE 2B
LEARNER SATISFACTION ON KNOWLEDGE ACQUISITION EXPRESSED AS % (N=122)



To evaluate course quality and the level of overall satisfaction in the 2020 spring offerings, SFM knowledge acquisition, and confidence in the relevance of the course material was evaluated. Of 756 respondents, 80% of the surveyed cohort either agreed or strongly agreed that they were satisfaction for the courses. Of 775 respondents, 89% of the surveyed cohort either agreed or strongly agreed that the online SFM courses deepened or improved their knowledge of SFM (Figure 3a) and 78% of respondents

felt that they could apply this in their careers (Figure 3b). Given these results, it can be concluded that the SFM online course material is of satisfactory quality and relevance.

FIGURE 3A
LEARNER SATISFACTION IN KNOWLEDGE ACQUISITION EXPRESSED AS % (N=775)

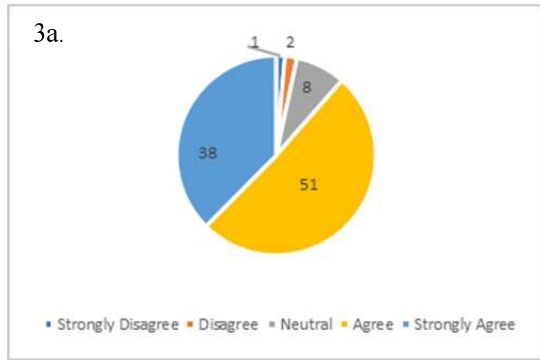
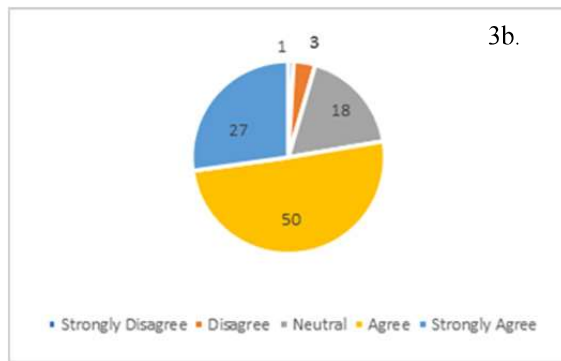


FIGURE 3B
LEARNER SATISFACTION IN KNOWLEDGE ACQUISITION EXPRESSED AS % (N=775)



To evaluate the pedagogical model and design of the courses, the perceived effectiveness of online discussions, and difficulty level was surveyed. Of 760 respondents, 84% felt that online discussions were effective (Figure 4a), and 77% felt that the course difficulty level was also appropriate (Figure 4b). As such, the SFM online course program continues to be an example of a well-designed program that delivers quality education online.

FIGURE 4A
LEARNERS SATISFACTION IN ONLINE DISCUSSION % (N=760)

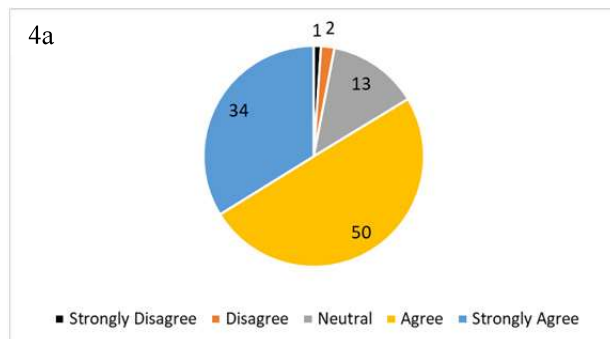
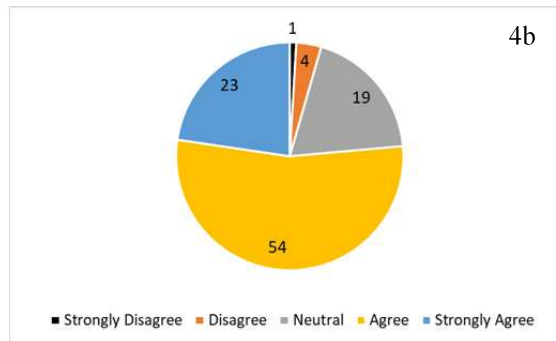


FIGURE 4B
LEARNERS SATISFACTION IN ONLINE DISCUSSION % (N=760)



CONCLUSION

The case study of the SFM online program showed that the integration of online technology, content and pedagogy is an effective way to produce new teaching and learning methods in higher forestry education. This approach provides a flexible form of forestry education within dynamic conditions (including pandemic), supports the student learning experience and ensures wider public access. This case study demonstrates the potential of online educational technology to cost-effectively facilitate an internationally recognized and accredited forestry education program. This case study also demonstrates the possibility for online education to deliver the unparalleled experience of a borderless education. In the SFM program, subject matter experts from the Asian-Pacific Region contributed their knowledge of multiple forest types and practices, providing learners not only a more global understanding of forestry and SFM, but also a nuanced understanding of local approaches. During the COVID-19 pandemic lockdown, the beneficial flexibility of the SFM program was even more prominent, as ongoing SFM courses continued to provide forestry education online when classroom-based courses stalled. The combination of educational technology, content and pedagogy generates an improved form of forestry education that addresses current issues, and supports knowledge sharing as well as interactions of peers and professionals around the globe. However, a significant amount of time and resources must be invested in the development and involvement of effective online courses. A team-based approach, sufficient preparation for course development and operation, ongoing financial, instructional and technical supports are critical components for the success of the international collaborative forestry education program. We hope this joint effort provides a foundation for and inspires others to pursue future explorations in online, digital and technology-based forestry education that will strengthen the forestry field and improve its resilience to shocks and stressors.

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