The Pandemic as a Catalyst For More Inclusive Pedagogy in Field-Based Disciplines

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Abstract

The rapid switch to alternative modes of delivery at the onset of the COVID pandemic in 2020 left Ontario college faculty scrambling to engage students and provide experiential learning opportunities to satisfy course and vocational learning outcomes.

This paper presents case studies from Fleming College that illustrate the ways in which curriculum developed for remote, emergency delivery was situated within the framework of Universal Design for Learning (UDL). Using case studies from Fleming College, we demonstrate that efforts to embrace the culturally responsive and inclusive pedagogy that UDL models during the pandemic will remain relevant after the Covid-19 pandemic has subsided. What follows is a description and analysis of the pedagogical strategies and technology-enhanced techniques employed by Fleming faculty to adapt their curriculum and teaching practice to meet the needs of variant learners by incorporating the guidelines of UDL, including multiple means of engagement, representation, and action and expression (Wakefield, 2018). We suggest that these examples from the pandemic supported alternative learning and can continue to do so in ways that enrich the educational culture in Ontario's post-secondary system.

Keywords

Universal Design for Learning, experiential learning, field-based curriculum, inclusive pedagogy, disability, variant learners, post-pandemic learning, diverse learning, inclusive technology

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Introduction

The rapid switch to alternative modes of delivery at the onset of the COVID pandemic in 2020 left Ontario college faculty scrambling to engage students and provide experiential learning opportunities to satisfy course and vocational learning outcomes. Learners experienced myriad challenges to learning, among them family commitments, disabilities, lack of access to technology and infrastructure, inability to travel to Canada for schooling as well as poor physical, mental, and overall health. Faculty at Fleming College's School of Environmental and Natural Resource Sciences (SENRS), whose curricula focuses strongly on experiential, field-based learning, faced many difficulties in designing field-based experiences without access to "the field" in the traditional sense, for example, lab courses, field trips and placements. Paradoxically, access barriers to field-based experiences were commonplace for learners before COVID-19. Historically, faculty accommodated disabled learners unable to access the field-based curriculum with alternative assignments, which often meant inferior educational opportunities to support individual needs. With the onset of the pandemic, however, everyone had an access problem, including faculty. This created an urgent need for an innovative curriculum that met the needs of variant learners but without compromising academic integrity and rigour.

This paper presents case studies from Fleming College that illustrate the ways in which curriculum developed for remote,

***Innovation Spotlights** These are contributions that highlight innovative practices, approaches, or tools and provide accompanying evidence that speaks to the effectiveness of the innovation, including but not limited to an innovative teaching practice or an innovative methodology benefitting academia, industry, and community partners.

emergency delivery was situated within the framework of Universal Design for Learning (UDL). Using case studies from Fleming College, we demonstrate that efforts to embrace the culturally responsive and inclusive pedagogy that UDL models during the pandemic will remain relevant after the COVID-19 pandemic subsides. What follows is a description and analysis of the pedagogical strategies and technology-enhanced techniques employed by Fleming faculty to adapt their curriculum and teaching practices necessitated by the rapid switch to alternative delivery during the COVID-19 pandemic and ways in which those curricula met and continues to meet the needs of variant learners by incorporating the guidelines of UDL, including multiple means of engagement, representation, and action and expression (Wakefield, 2018). Although Fleming College promotes the use of Universal Design principles across all the disciplines to encourage and promote inclusive teaching practices for all students, it has not been adopted universally across the college. The pandemic showed us how changes to the curriculum could support all learners, increasing the level of understanding and application beyond what was being done before COVID closures. We suggest that these examples from the pandemic supported alternative learning and can continue to do so in ways that enrich the educational culture in Ontario's post-secondary system.

Accessibility in Field-based Disciplines

Introductory courses in scientific disciplines can be highly theoretical, with a strong focus on instruction and the lower order thinking skills of Bloom's taxonomy, such as knowledge and understanding (Airasian, et al., 2001). The application of this theory to a field location, however, is highly subjective and open to interpretation. Learners, therefore, construct meaning by applying their knowledge and understanding to real-life situations and reflecting on those situations – cognitive constructionism (Larson & Lockee, 2020). The goal of fieldwork is to foster exploration through hands-on activities; the emphasis is on process, not product. In field-based disciplines like natural sciences, fieldwork is an essential undertaking and one that lends itself to a cognitive constructivist approach because learners engage in the authentic application of their knowledge to real-world situations (Mogk & Goodwin, 2012). This supports deep learning in their field of study, reinforces safety standards, and familiarizes students with outdoor environments. This is particularly important for variant learners, including newcomer and international students, students from urban environments, and marginalized groups who might lack access to outdoor recreation. If learners do not have access to the outdoor environment, there is a risk that their field of study will be too theoretical and abstracted from the observational and immersive nature of the industry.

Marginalized learners are sometimes separated from field experiences because of physical, social, and institutional barriers (Carabajal, Marshall, & Atchison, 2017). The medical model of disability positions disability in the learner (Oliver, 1996); as such, students with disabilities are often offered alternative assignments that may not be immersive, field-based—written assignments are one example of this—or exempted from assessments altogether. This has certainly been the case at Fleming College, and students are deprived of opportunities for meaningful learning. The social model of disability considers that barriers to inclusion result from interactions between learners—who are on a spectrum of impairment as part of the human condition—and their social and physical environments (Shakespeare & Watson, 2002). In the social model, therefore, access to learning is impeded by curriculum design and not by limitations inherent in the learner. Disability advocates have, for many years, been trying to increase accessibility in field-based disciplines (e.g., the International Association for Geoscience Diversity), but have been hampered by the attitudes of employers and educators (Atchison & Libarkin, 2016), as well as concerns about liability, and financial and logistical constraints to implementation (Healey, Roberts, Jenkins, & Leach, 2002). With the onset of the pandemic, however, everyone experienced barriers to access, and both institutions and educators had to devise creative solutions to those barriers.

Universal Design for Learning

Universal Design for Learning (UDL) aims to meet the needs of diverse learners through curriculum design, as opposed to providing accommodation to individuals during the learning process (Rose, Harbour, Johnston, Daley, & Abarbanell, 2006). The social model of disability underpins UDL and strives to inform curriculum through a lens of inclusion at the design stage. UDL is based on cognitive neuroscience, the key tenets of which are multiple means of engagement (ways in which to recruit the learners' interest); multiple means of representation (ways in which the learner can interact with curriculum); and multiple means of action and expression (ways in which learners can demonstrate knowledge) (CAST, 2018).

Despite research confirming the efficacy of improving educational outcomes both for students with and without disabilities (Seok, DaCosta, & Hodges, 2018), uptake of UDL in post-secondary institutions has been slow (Tobin & Behling, 2018). Most

institutions, our own included, still adhere to a medical model of disability, where faculty provide students with individualized accommodations rather than designing accessible curricula (Kumar & Wideman, 2014). Although we have a small group of early UDL adopters at Fleming College, it is not implemented college-wide, and there is resistance to the implementation of UDL by some instructors. There are several reasons post-secondary faculty may be resistant to UDL course design. For example, they may have limited background in education or lack training and resources, and by extension, time. There are concerns that it will decrease academic rigour or integrity (Tobin & Behling, 2018). There is also an increasing number of contract faculty in Canadian academic institutions (Usher, 2020), our own included, who often do not have access to professional development opportunities to integrate universal design into their curriculum (Xie & Rice, 2020). The problem of inaccessible curriculum came to the fore in March 2020 when everyone suddenly had an access problem, faculty included. To address the lack of access to experiential learning, including field trips, scenarios, and identification skills, Fleming College faculty at the School of Environmental and Natural Resource Sciences (SENRS) developed alternative, field-based opportunities to facilitate student learning in an environment that was accessible to the learner.

Case Studies

Case Study 1: Conservation and Environmental Law Enforcement

The Conservation and Environmental Law Program teaches students how to understand, interpret, and apply legal concepts and regulations using a compliance-based approach to natural resource management. The practical application of legislation in scenario-based field applications is not easy to master in a regular face-to-face environment and requires a strong understanding and good judgement by the student. COVID restrictions forced faculty to reconsider how students would demonstrate these advanced skills remotely with everyday technology, including smartphones.

After two field camps where students participate in outdoor enforcement skills were cancelled, learners created a scenario that modelled a reality television series, Northwoods Law, which follows Game Wardens from the United States as they investigate natural resource violations.

Learners were asked to create a video using everyday technology that depicted an enforcement scenario including a suspect, a vehicle, and a violation. They explained each step of their scenario with a voiceover on their video or by providing a separate presentation. The faculty provided a video exemplar, the rubric, and the course learning objectives. The students were encouraged to be creative, and, for pandemic-related safety reasons, they were encouraged to enlist members of their household.

Program coordinator and Fleming faculty member Kent Hodgin reported that the project results exceeded expectations. Students created excellent quality videos that met the learning objectives with creativity and detail. In her video "Fish Cops," student Kierstyn Bennett (2020) developed a scenario in which she approached an angler at a public dock to check their fishing licence, equipment, and catch for compliance. Learner feedback was extremely positive—they enjoyed designing and creating their video and sharing their learning with family members in the process.

This assignment replaced an on-campus assessment in which learners responded to a faculty-directed scenario. Although the on-campus assessment better reflects an actual enforcement situation to which conservation officers would respond, the alternative assignment provides learners with an opportunity to demonstrate advanced knowledge of procedures and skills while giving them the option to choose an environment in which they are familiar and comfortable. For students who struggle with anxiety in stressful situations, this is a suitable alternative to the in-person demonstration of skills using technology as a medium of delivery. Given its success, Faculty member Kent Hodgin plans to keep this assignment in the course as an alternative for learners who need accommodations for class absences, for variant learners who experience anxiety during an ordinary enforcement scenario, or as an alternative to the course final exam.

Case Study 2: Environmental Technician

Environmental programs focus strongly on identifying the 'bugs in the mud' or benthic macroinvertebrates. These are challenging concepts to teach in a virtual environment. Learners in SCIE 6 Aquatic Biology in Fleming College's Environmental Technician program were assigned to create an ecosphere—a closed ecological system powered by sunlight that can be stored anywhere, including in residence or in shared student accommodation. This assessment was designed to complement the course's field-based activity, reinforce identification skills and ecosystem thinking, and connect learners with the wonder of live invertebrates. Provided with an exemplar (Figure 1), a rubric, and a set of curated reference materials (Figure 2), learners collected water and vegetation from a lake or a river

of their choosing (Figure 3) in a 2L jug with a lid. Next, they observed the daily changes in their ecosphere over a four-week period. The assessment deliverables included journal entries and photographs (Figure 4-5) that effectively catalogued and identified the plant and macroinvertebrate species that lived and died in the ecosphere over the discovery period.

The open-ended journal format encouraged students to showcase their writing style and regularly featured personal anecdotes, multiple exclamation marks, and humour. Freed from the confines of technical jargon, international students performed remarkably well. The ecosphere's local focus allowed students to explore a location that could be re-visited, thus building a place-based relationship. Relationships were also forged with students' newfound aquatic 'pets.' Spurred by direct invertebrate observation and hypothesis generation, journal entries answered critical questions about how their bugs moved and were connected to the ecology of the jar. Students often asked how to best care for their charges beyond the assignment's due date, indicating an appreciation of benthic macroinvertebrates. Faculty member Erin McGauley, who teaches the course and designed the project, intended to inspire "wonder" in her learners, a goal that was achieved and reflected in student engagement and feedback. (Figure 6).

Case Study 3: A First Semester Geology Course

Learners entering eight different programs at Fleming College's School of Environmental and Natural Resource Sciences (SENRS) take an introductory geology course (GEOL 83, Earth and Atmosphere). This course introduces them to rock and mineral identification, geological processes, and fieldwork. Students who come to the college through the Ontario K-12 curriculum have limited exposure to geology—only soils and the environment in Grade 3 and rock and mineral identification in Grade 4 (Ontario Ministry of Education, 2007); as such, the content is unfamiliar. Geology is an immersive and observational science. Geologists immerse themselves in the environment they are studying rather than observing from the outside; therefore, access to field locations is important for developing observational skills and constructing new knowledge.

In the fall of 2020, this newly developed course was delivered entirely online; and many learners accessed the course from outside of the province or country. Field-based courses were not an option, nor were field trips; thus, learners were instructed to "Adopt an Outcrop". They found a suitable field location that was safe and publicly accessible and applied their first six weeks of instruction to write geological field notes. This required them to construct a field sketch of the outcrop, collect field photographs, and develop a basic interpretation of the formation processes (Figures 7-8). Learners were provided with instructions, an instructional video (Hodge, 2020), a template, and an exemplar of a field location. This assignment gave learners the opportunity to apply theoretical knowledge in a practical field setting and develop a new understanding while being immersed in the environment. The focus of the assignment was not on whether students correctly identified or interpreted their chosen outcrop but whether they could apply their learning in a practical situation to produce an interpretation based on their observations and measurements. Students were graded on process and engagement rather than the accuracy of their interpretations.

According to their instructor Joanna Hodge, this assignment brought previously abstract concepts to life and changed the way learners viewed their environment. Many reported that theoretical concepts that did not make sense in class were clarified when working on an outcrop rather than diagrams and illustrations in textbooks, and others reported that getting their hands on actual rocks permitted a better understanding of identification and formation processes than studying images did. They practiced identification skills using tools they took to the field and measured and observed previously abstract concepts such as the physical characteristics of rocks and minerals. Some students reported excitement at knowing how their favourite hiking locations were formed, and a few switched their program majors to geology because of exposure to new learning in the course.

Student submissions were of high quality and illustrated evidence of student engagement. Because they could choose their own field location, the typical access barriers of geologic fieldwork such as minimum fitness requirements or inaccessible outcrops were removed. Learners submitted assignments from across Canada and the world. A few students experienced difficulties accessing field locations, primarily due to transportation challenges. For those learners, an alternative digital assignment was provided using Google Earth field locations and videos of unknown rocks to identify. Although these learners did not quite get the "hands-on" experience of their peers, they were able to achieve the learning outcomes using technology; however, this was an accommodation of last resort.

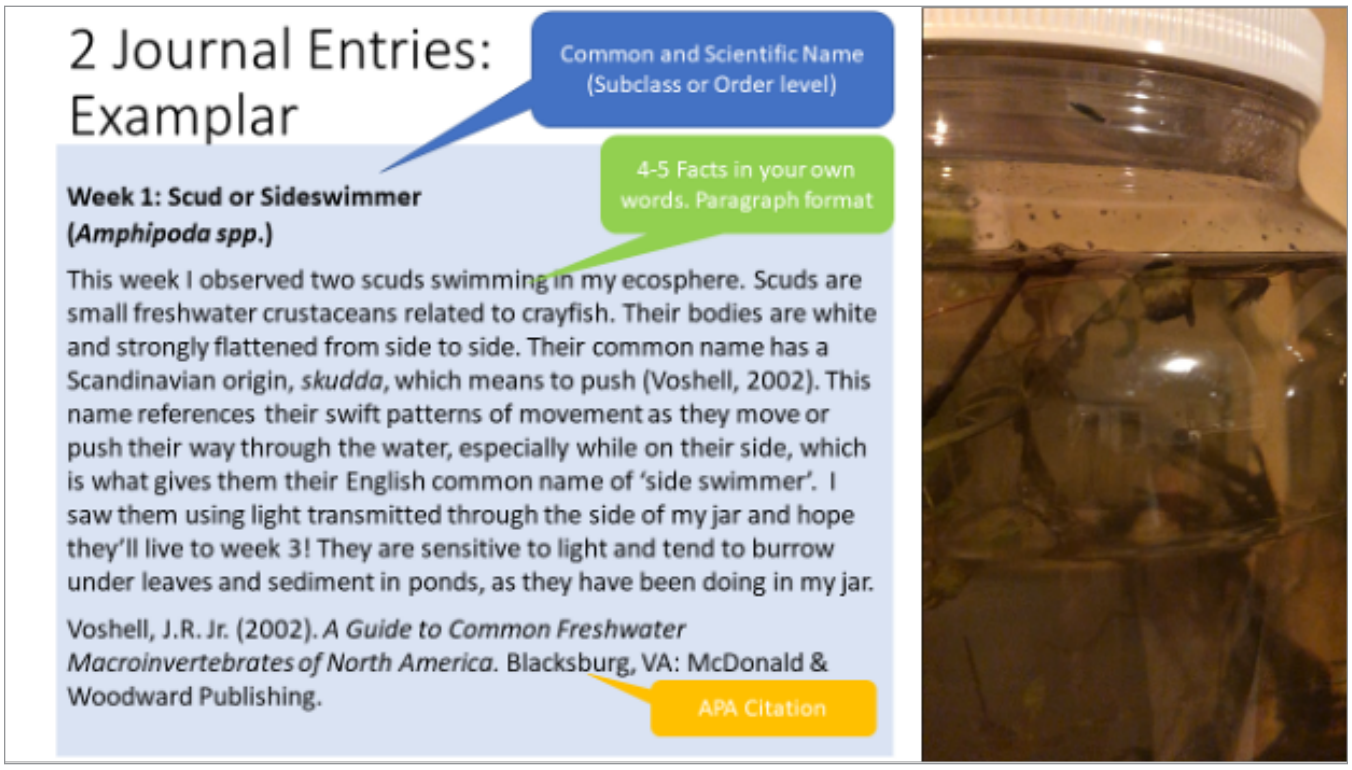

Figure 1. An exemplar journal entry provided to learners in Aquatic Biology, which included links to rubric items to scaffold learning (Erin McGauley, used with permission).

Figure 2. Curated reference material to scaffold student learning in inquiry-based labs (Erin McGauley, used with permission).

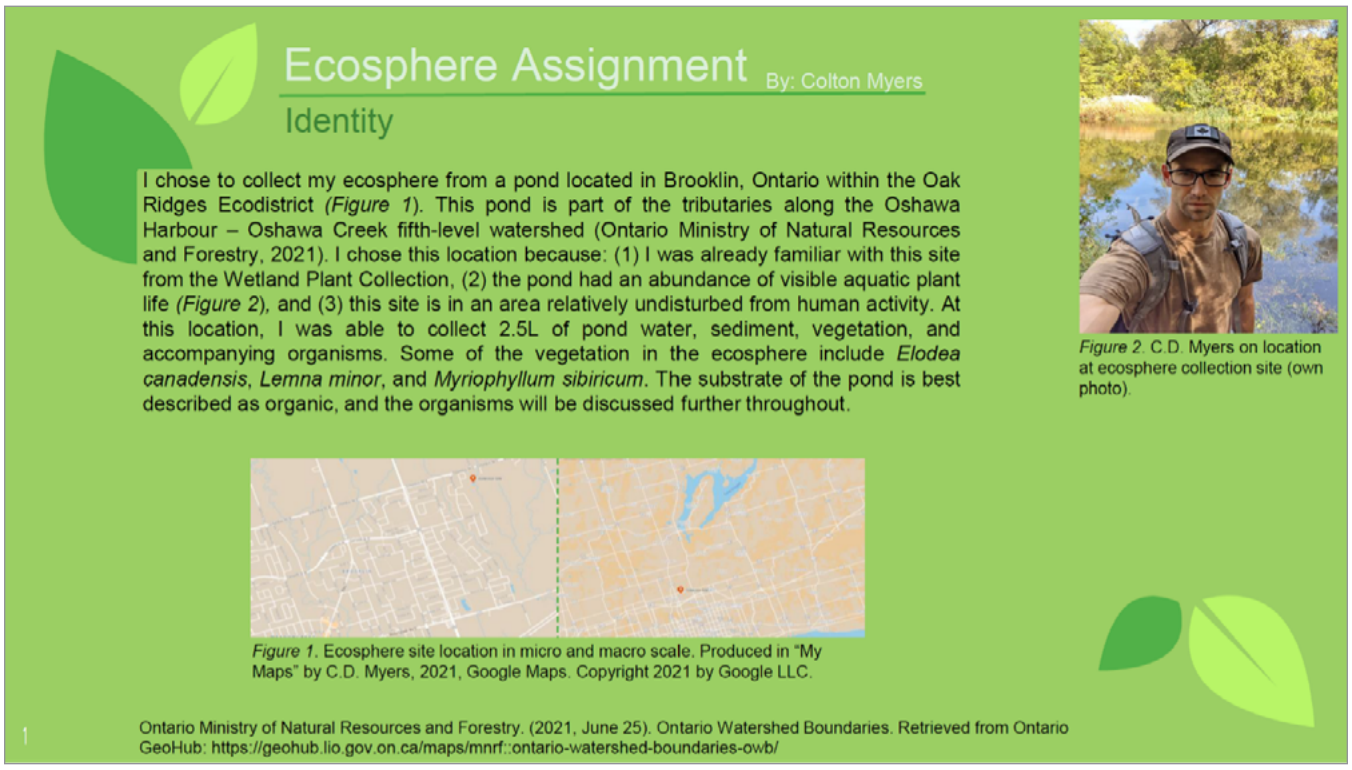

Figure 3. Location map and images from Aquatic Biology ecosphere assignment (Colton Myers, used with permission).

Figure 4. A student journal and photograph from Aquatic Biology ecosphere assignment (Vanesa Tunney, used with permission).

Journal Entry 2

Week 1: Crawling Water Beetle
(*Peltodytes duodecimpunctatus*)

During the second evening of ecosphere observation, several crawling water beetles were observed. These insects are oval with a rounded upperside, and have a yellowish color with black spots on the pronotum. This species is attracted to light and actively followed movements of the torch. The possibility of it thriving in the ecosphere is possible since Wade et al. (2017) notes that these beetles prefer shallow water, algae, and slow moving waters. It is likely that their rounded shape becomes cumbersome in rapids. I have observed them in my ecosphere holding an air supply bubble at the abdomen, allowing them to stay underwater for long periods of time.

Wade, S., Emmling, P. J., Pochert, C., & Bergschultz, L. (2017). *Wonderful wacky water critters*. University of Wisconsin-Extension, Cooperative Extension.

Figure 5. A student journal and photograph from Aquatic Biology ecosphere assignment (Oliver Kurz, used with permission).

Figure 6. Student learning. Wonder achieved! Feedback from the Ecosphere assignment met learning outcomes and promoted student engagement. The assignment will remain an integral part of the course to facilitate immersive and constructivist learning beyond the COVID pandemic (Erin McGauley, used with permission).

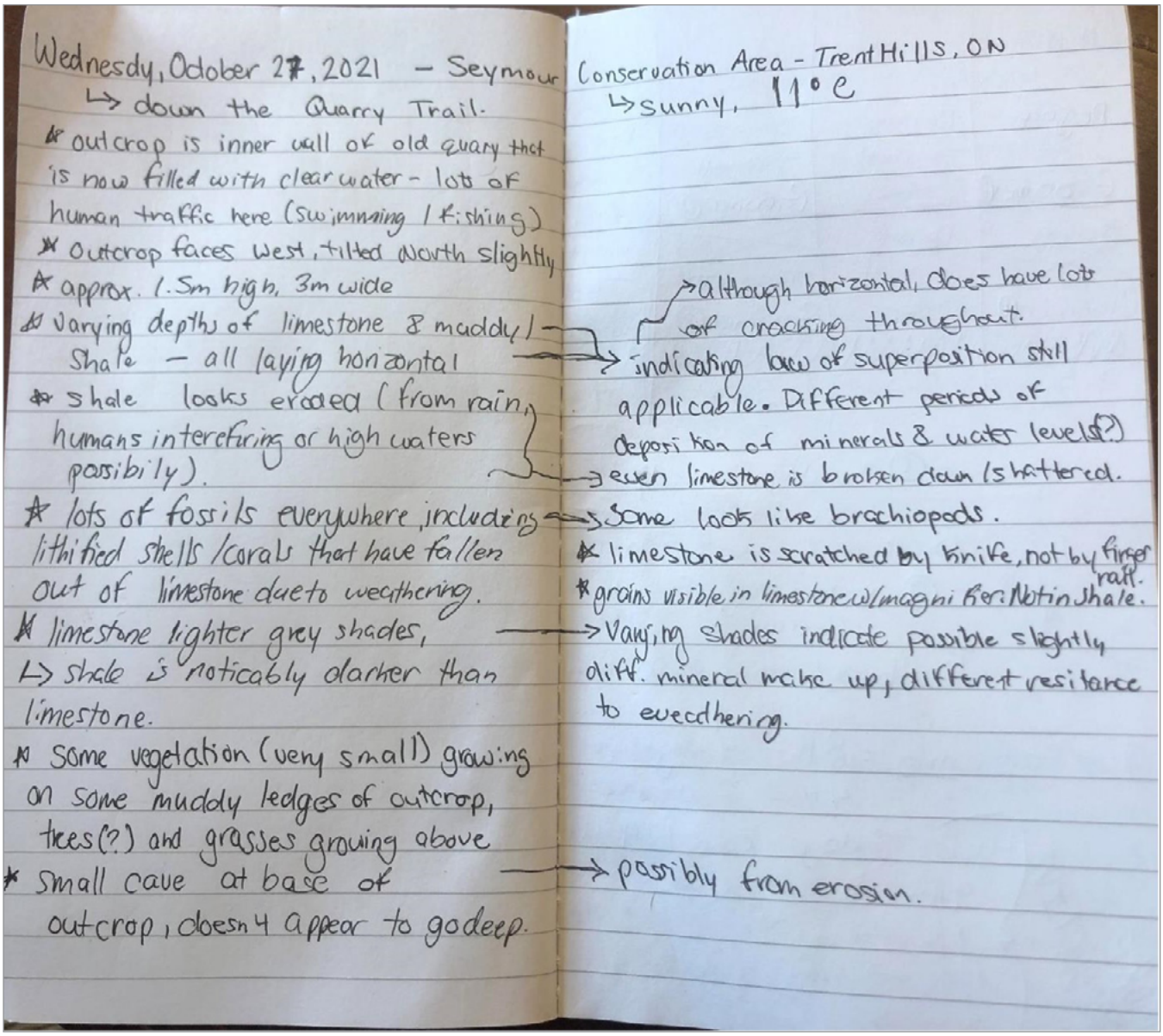

Figure 7. Student field notes submitted for GEOL 83 Adopt an Outcrop assignment demonstrating an introductory understanding of rock and mineral identification, stratigraphy, and formation processes (Ainsley Taggart, used with permission).

Discussion

Post-COVID Lessons

Despite the partial return to in-person education, students are still experiencing barriers to learning, either by the physical inability to access campus (e.g., accommodation shortages, cancelled public transit, high-risk COVID contacts, parental or filial responsibilities) or through illness and disability. In all three case studies discussed in this submission, curricula developed initially as a response to the pandemic have proven invaluable to accommodate learners without sacrificing the rigour of field experiences or jeopardizing course or program learning outcomes.

Equally important is that these opportunities provided experiential learning by affording students the opportunity to participate and learn no matter what their geographical location was or how they acquire knowledge. This is an assessment design benefit not otherwise afforded to these learners prior to the shutdown in March 2020.

Through these adaptations, we learned the following:

- Students for whom access to campus was a barrier could still meaningfully fully participate in the coursework and achieve the learning outcomes since

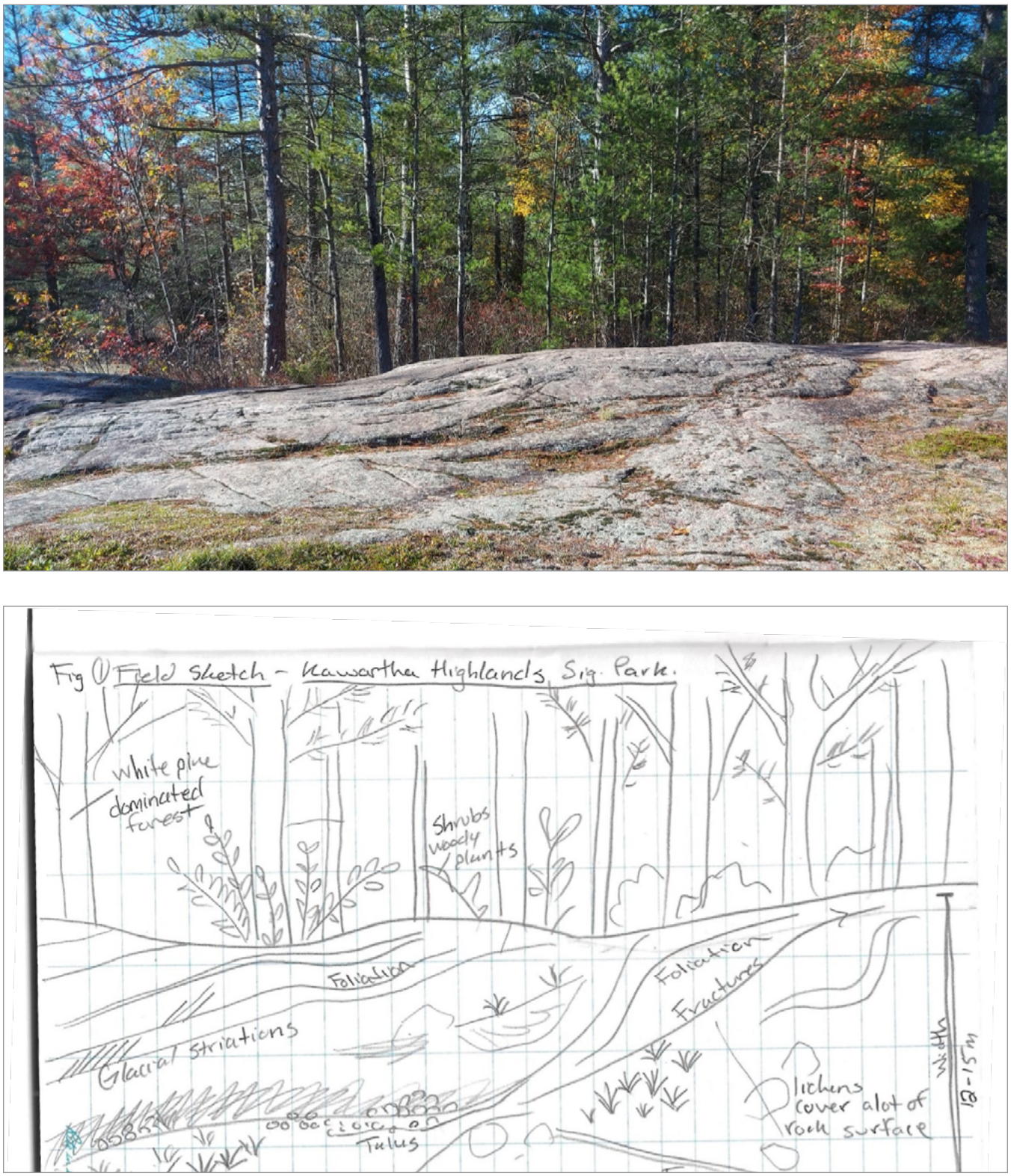

Figure 8. Field photograph and accompanying field sketch indicating geologic relationships submitted for GEOL 83 Adopt an Outcrop assignment (Julia Marshal, used with permission).

options for self-determined locations are included. This was a benefit for international students stranded outside of Canada by the pandemic and for students with disabilities who could complete the work at locations more accessible than typical field locations.

- Students with learning disabilities or neurodivergent learners could complete the assignment in a longer period than that usually afforded by a lab class, negating the requirement for extensions or extra time accommodations.
- The individual nature of the assignments, as opposed to "worksheet" or "correct answer" type assignments, meant that faculty could accommodate late submissions without sacrificing academic rigour or integrity.
- Structuring these assessments according to the three tenets of UDL—multiple means of engagement, representation and action, and expression—gave students ownership of their learning and led to a deeper understanding of the content than a purely instructive, classroom-based approach.

Some students still experienced barriers. Access to or familiarity with technology was an issue for some learners, and for learners who struggled with time management and lacked executive function, the self-directed nature of the assignments was a barrier. On balance, however, these additions to the faculty 'toolkits' have shown all the faculty at Fleming College that it is possible to meet learning goals in alternative and creative ways. In all cases, faculty who designed and developed these assessments plan to continue to implement and adapt them to F2F delivery, either as replacements of previous assessments or as supplementary assessments to accommodate variant learners. Student engagement was high, and the assignments met and exceeded the learning goals. This will provide opportunities for variant learners to successfully complete courses and programs with SENRS at Fleming. By providing options to demonstrate understanding, the faculty will be able to reach more students and share their passion for their field of work.

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