# Reflections on the Adaptation of a Postgraduate Degree in Water Management from In-person to Remote Delivery

Murray Clamen[1], *Emma Anderson[1], Johanna Dipple[1], and Jan Adamowski[1,2]

[1]*Department of Bioresource Engineering, McGill University, Macdonald Campus, Québec, Canada*
[2]*Brace Center for Water Resources, McGill University, Macdonald Campus, Québec, Canada*
*Corresponding author*

**Abstract:** In early 2020, the COVID-19 pandemic spurred the rapid adaptation of university course delivery to an online format. Though in-person delivery partially resumed in the Fall of 2021, future conditions may favor a return to, or addition of, remote delivery. It is therefore important for instructors, program directors, and institutions to capitalize on this learning opportunity and reflect on adaptation measures' successes (and failures) to inform future online course design. The reworking of McGill University's Master of Science Program in Integrated Water Resources Management (IWRM) provides a case study to evaluate the adaptation of remote teaching of water resource management. Informed by the Community of Inquiry (CoI) framework with a focus on preserving transferable skills, a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was used to evaluate the five core program components. This evaluation framework, which can be applied to most university programs, resulted in several widely relevant insights. For example, remote delivery can create opportunities for greater participation of international students as it eliminates the need for translocation costs. Likewise, a larger variety of guest speakers can participate remotely, giving students greater exposure to different water career paths and research perspectives, ultimately strengthening the program. However, several weaknesses pose threats to online learning. The standard in-person lecture-style format must therefore be amended to maintain engagement and facilitate student-to-student and student-to-instructor learning processes. Course components that can enhance the online experience include breakout rooms, discussion boards, frequent journals/feedback forms, online activities, breaks, virtual office hours, and multi-media presentations.

**Keywords:** *water management education, IWRM, Community of Inquiry (CoI), SWOT, transferable skills, COVID-19, remote learning*

Since December 2019, the SARS-CoV-2 (COVID-19) virus has expanded across the globe, causing millions of deaths and global socioeconomic disruption (World Health Organization n.d.). As a result, in 2020, the COVID-19 pandemic disrupted university course delivery, with universities worldwide rapidly suspending in-person lecturing and moving courses online to reduce the spread of infectious disease (Sahu 2020).

The shift to emergency remote teaching posed challenges to instructors, students, and their institutions due to differences in engagement, modes of learning, and social interactions. Many instructors were unprepared to use online strategies (Kimmons et al. 2020) and faced challenges related to new technologies, course structure development, materials, evaluations, fostering student engagement, and work-life balance (Pather et al. 2020; Aubry et al. 2021; Watermeyer et al. 2021; Wut and Xu 2021).

Students also faced challenges with the shift to online learning related to software and hardware, internet connection, physical learning environment, and time zones (Aristovnik et al. 2020; Gewin 2020), along with financial stress due to loss of income (Pather et al. 2020; Sundarasen et al. 2020). These challenges disproportionately impacted lower-

**Research Implications**

- Remote learning is a viable long-term option for teaching water resources management, with benefits for global cohorts and guest speakers.
- Adapting class materials online requires instructors to reevaluate and reimagine course structures to maintain value, learning processes, engagement, and transferable skills development.
- Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, as informed by the Community of Inquiry (CoI) framework, is a useful methodology for evaluating areas of excellence and those needing improvement in materials adapted online.

income students and those with worse Information and Communications Technology (ICT) infrastructure (Aristovnik et al. 2020). Students' social networks, which are important for buffering academic stress, were also impacted by public health measures (e.g., social distancing) (Elmer et al. 2020). Early studies suggest that COVID-19-specific stressors increased the prevalence of anxiety, loneliness, and depressive symptoms among post-secondary students (Elmer et al. 2020; Sundarasen et al. 2020). Institutions also faced major challenges. Research by Watermeyer et al. (2021) suggests that future student recruitment will increasingly be dependent on a university's digital offerings; to maintain admissions, programs must provide equal or greater value to students when programs are offered online (Krishnamurthy 2020).

Given these challenges, it is important for instructors to evaluate the successes and shortcomings of the rapid online adaption of courses and programs to improve future remote course delivery. However, doing so necessitates a theoretical understanding of learning processes and of the differences in modes of learning between remote and in-person instruction. The objective of this paper is therefore to develop a simple but effective framework to aid the evaluation of remote learning adaptation measures. As a result, this paper suggests the use of Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, informed by identified differences and challenges in remote learning and the Community of Inquiry

(CoI) framework, as an analysis framework. The developed framework is demonstrated through a case study on the rapid shift of McGill University's Integrated Water Resource Management (IWRM) Master's program from an in-person format to an online format during COVID-19. The paper's authors include the program director (and instructor), an instructor, and two teaching assistants. The framework was applied to the case study using the observations of the authors who were directly involved in and responsible for the rapid adaption of the analyzed courses to a remote format, as well as the creation and delivery of the analyzed courses both before and during the pandemic.

## Theoretical Framework

Evaluating remote learning adaptation measures requires a simple and effective evaluation framework informed by theoretical background about learning processes and skills development in the classroom, and how these are impacted by remote formats. SWOT analysis is a method of assessing and optimizing the effectiveness of an organization. This approach involves the identification of strengths, weaknesses, opportunities, and threats of internal and external environments to propose new strategies. The ideas behind SWOT were introduced in 1908 (Lorhke et al. 2021), gaining broader recognition in the 1980s by Stevenson (1976), Bower (1982), and Weihrich (1982). This framework has since been widely applied in the literature (Ghazinoory et al. 2011; Namugenyi et al. 2019). The simplicity and logical approach of SWOT allows for its application in a wide range of contexts, including learning and educational contexts (Chermack and Kasshanna 2007; Thomas et al. 2014) and digital environments (Ghazinoory et al. 2011). However, critics of SWOT analysis maintain that it is overly simplistic (Helms and Nixon 2010) and that it is used to justify a course of action that has already been taken (Chermack and Kasshanna 2007). Accordingly, SWOT is often applied with other methods to adapt it to a specific context (Ghazinoory et al. 2011; Thomas et al. 2014). This study uses the CoI framework to inform a SWOT analysis and tailor it to the context of emergency adaptation to remote teaching.

Developed by Garrison et al. (2000), the CoI framework presents a model for assessing online learning effectiveness (Garrison and Arbaugh 2007; Garrison et al. 2010). The increasing popularity of this model is attributed to its comprehensive approach and emphasis on the connection between learning and community. To assess online learning effectiveness, the CoI framework defines three elements – social presence, cognitive presence, and teaching presence – each of which is further defined by categories and indicators (Garrison et al. 2000). Social presence, which refers to emotional connection, emphasizes the importance of maintaining a social and emotional connection even through online interactions. Cognitive presence considers the ability of learners to think critically and derive meaning from what they are taught. Finally, teaching presence refers to the role of instructors in guiding learners' interactions to improve learning outcomes (Garrison and Arbaugh 2007). The CoI framework has been extensively applied since its inception and has been validated by scholars such as Arbaugh and Hwang (2006). The applications and findings of this framework are of growing importance due to the recent increase of online learning.

Both the SWOT analysis and the CoI framework have been used to independently assess a transition to remote teaching due to COVID-19 across disciplines and levels of education (O'Brien et al. 2020; Chiroma et al. 2021; Consorti et al. 2021; Oyarzun et al. 2021; Pham et al. 2021; Akbulut et al. 2022), though they have never been combined. Therefore, SWOT analysis informed by the CoI framework provides a novel approach to assess emergency adaptation to online learning. The application of the CoI framework to remote learning informs the SWOT analysis of the selected case study. This preliminary research can be divided by the three elements of the CoI framework.

**Maintaining Adequate Social Presence**

To maintain value, university courses and programs must foster effective online learning environments. The shift to digital course delivery can impact student-to-student and student-to-instructor interactions, which are important learning processes (Bernard et al. 2009). Information sharing is enhanced through effective social presence, referring to the student's level of emotional connection (Shen et al. 2009). Face-to-face interactions are usually more effective at fostering social presence, leading to better information exchange (Kuong 2014). The digital environment may change the way students and instructors interact, altering or reducing participation, which may be exacerbated by the challenges mentioned above.

Student-to-student interactions face challenges related to teamwork, social presence, and learning from peers (Popvich and Neel 2005; Wut and Xu 2021). Such interactions can be enhanced by encouraging students to meet outside of class (e.g., with Zoom, WhatsApp), using breakout rooms in class, peer evaluations, group work, and incentives (Wut and Xu 2021). Small group interactions allow students to connect and develop social networks (Bryson and Andres 2020).

Student-to-instructor interactions and teaching presence face challenges related to feedback and clarification processes, and fair assessment of participation (Popvich and Neel 2005; Wut and Xu 2021). These interactions can be enhanced through active encouragement of participation through questions (Desai et al. 2009; Gewin 2020; Pather et al. 2020), including the use of polls, active chat monitoring, moderation of breakout rooms, and individual/group consultation sessions. Individual consultations are especially important for students who are struggling with online learning. Instructors can proactively identify potential issues by asking students about their learning environment (e.g., adequate wi-fi signal, quiet work environment) and continuously identify struggling students through frequent check-ins (Hart et al. 2018; Gewin 2020). In response to the identification of problems related to remote learning, instructors should maintain flexibility and compromise while ensuring they communicate and clarify expectations (Moorhouse 2020; Pather et al. 2020). Tracking student participation is also important, as remote learning may reduce student accountability and open opportunities for cheating (Lancaster and Cotarlan 2021).

**Maintaining Adequate Cognitive and Teaching Presence**

As outlined above, the CoI framework posits

that beyond social presence, cognitive presence (students' ability to understand and construct meaning from course materials) and teaching presence (the ability of teachers to facilitate cognitive and social presence) are also necessary for rich educational experiences (Garrison 2016; Tan et al. 2020). As with social presence, special considerations are needed to maintain cognitive and teaching presence online. Ensuring that educational programs continue to equip students with transferable skills, meaning the skills that are useful for students in future employment, was highlighted by Ng and Harrison (2021), who found that multi-modal teaching approaches and student self-reflection journals helped maintain student motivation. A multi-modal approach can include both synchronous (real-time) and asynchronous (self-guided) activities to maximize social engagement while providing additional flexibility (Bao 2020).

More generally, courses should be adapted and evaluated to promote learning objectives (Bryson and Andres 2020), which may be best facilitated through different teaching modes. Asynchronous and synchronous activities can support each other, facilitating extensive and intensive learning encounters, respectively (Bryson and Andres 2020). Students are more likely to gain satisfaction from activities that they perceive as purposeful; therefore, the importance of activities to the course's learning objectives should be emphasized. Overall, consideration of the CoI and maintenance of social, teaching, and cognitive presence can strengthen efforts to evaluate online course adaptations. For this reason, this paper suggests the application of SWOT analysis informed by the CoI framework, as described above. This analysis framework is demonstrated through a case study shown below.

## Case Study - The MSc in IWRM Program at McGill University Québec, Canada

### Overview of the Program

McGill University in Montreal, Canada, canceled in-person classes on Friday, March 13, 2020. Two weeks later, emergency remote teaching commenced, challenging instructors and students

to adapt quickly. While most classes returned to in-person or hybrid instruction as of Fall 2021, many remain online, and the evolving situation may necessitate a return to a remote approach. The situation impacted classes and degree programs, including the IWRM Master's program at McGill. The one-year, 45-credit, Master of Science (MSc) in IWRM aims to foster future water professionals. The shift online in March 2020 impacted the 2019-2020 cohort mid-program. For 2020-2021, the program was offered entirely online.

Outside of the COVID-19 pandemic, the IWRM program is delivered entirely in person, providing an opportunity to study the biophysical, environmental, legal, institutional, and socioeconomic aspects of water use and management in an integrated context. Annually, the program accepts between 25 and 40 applicants, coming to Montreal from diverse locations (e.g., Mexico, Brazil, United States of America, United Kingdom, France, Germany, India, Bangladesh, Rwanda, Nigeria, Australia, New Zealand, etc.) and backgrounds (e.g., humanities, science, engineering, law). The networks that students develop with their peers, professors, and guest speakers are a benefit of the program. Furthermore, the diversity of candidates provides a multitude of perspectives that expose cohorts to a range of global water issues and governance strategies.

Students end their degree by completing a 13-week, full-time internship on an integrated water management project; thus, students graduate with theoretical and practical knowledge to support them in their careers. Over 300 students have graduated from the program, obtaining positions in industry, consulting, academia, government, politics, and non-government organizations (NGOs) worldwide (e.g., United Nations, European Union, Food and Agriculture Organization, Oxfam, Environment and Climate Change Canada, AECOM, SNC-Lavalin, WSP).

### Emergency Shift to Online Teaching

When McGill shifted courses online during the Winter semester of 2020, lecturers had only two weeks to adapt their ongoing in-person courses to an online format. Students continuing their studies or starting a new program were informed that the University would continue operating

online. To compensate for the lack of in-person courses, McGill and the IWRM program quickly adopted the Zoom app as the main technology to facilitate online lecturers, seminars, and meetings. By the summer of 2020, Zoom was integrated with McGill's pre-existing learning management system, MyCourses, the online portal for students to access class documents, assignment submissions, grading, groups, quizzes, and discussion boards.

To support instructors, McGill's administrators quickly published frequently asked questions (FAQ) by instructors and training opportunities to support online teaching. The administration emphasized that lecturers should reflect on their courses' objectives, and how best to achieve them online. This was done for the core MSc in IWRM courses, which helped guide online adaptation.

## Core Courses in the MSc in IWRM Program

The IWRM program includes a mix of compulsory and elective courses, totaling 45 credits; this paper analyzes the adaptation measures of the five courses that are compulsory to the program. Each course is described briefly in terms of topic, format, learning outcomes, and online adaptation. The courses are shown in Table 1, including short-form names used in this paper.

### Water Policy (BREE 503: Water: Society, Law and Policy)

Water Policy is a one-semester course to familiarize students with water policy issues and equip them with the transferable skills needed to understand, discuss, and analyze water problems and policies. Topics include transboundary water management, IWRM, Canadian water policy, ethics, public involvement, Indigenous water issues, and international water governance.

The course, which includes one three-hour lecture per week, has three modules in which students (1) write and present a review of two journal articles (from pre-selected papers), (2) prepare a paper on an issue of choice, and (3) complete a written review of an assigned water policy book. Typical classes begin with student presentations, followed by lectures by guest speakers; roundtable discussions follow both. Given this format, the course puts a greater emphasis on peer-to-peer learning than traditional lecturing. The instructor acts as a facilitator, guiding dialogue about the policy issues associated with student presentations. Students are required to contribute to roundtable class discussions.

*Adapting Water Policy to an Online Format*. To adapt Water Policy online, specific issues needed to be addressed. The basic structure of the course could be maintained through Zoom if students could participate synchronously. However, as the MSc IWRM program was offered online in 2020-2021, some students stayed in different countries and time zones, creating challenges for scheduling. The 2020-2021 class was comprised of 17 students: three from Africa (Rwanda, Ghana, and Nigeria), two located in the U.S., and the rest from across Canada.

A short questionnaire was prepared and sent to students a month before the course to ascertain their expectations, availabilities, and technological capacities. The questionnaire was crucial to designing the adapted course, as it confirmed that everyone was capable of synchronous participation. If not, students could have participated asynchronously through pre-recorded presentations or class recordings.

Class materials, such as PowerPoints and readings, were uploaded to MyCourses in weekly modules, and students were encouraged to email the instructor with questions. Selection of the journal articles to review is easier in person, as it ensures that students have equal opportunity to select papers of interest while guaranteeing that

**Table 1.** Overview of the courses analyzed in this research.

| Shortform Name | Full Course Name | Course Code | Semester | Credits |
|---|---|---|---|---|
| Water Policy | Water: Society, Law and Policy | BREE 503 | Fall | 3 |
| Water Management | Watershed Systems Management | BREE 510 | Fall | 3 |
| Research Visits | IWRM Research Visits | BREE 655 | Winter | 3 |
| IWRM Internship | IWRM Internship | BREE 630 | Summer | 13 |
| IWRM Project | IWRM Project | BREE 631 | Summer | 6 |

there are unique presentations each week. Despite coordination challenges, this process was carried out successfully via email. Most students gave presentations using Microsoft PowerPoint through the Zoom share-screen function. Class recordings were uploaded on MyCourses for students to review.

A weekly reflection journal was added to the online format, where students were asked to comment on each class and make suggestions for improvements. Full class roundtable discussions were difficult to manage online, therefore, the breakout room feature in Zoom was adopted to create more manageable discussions. Post discussion reports were provided by a group representative to the class. The lecturer entered and exited breakout rooms to check on and facilitate discussions.

To replace traditional office hours, private Zoom meetings were available for students; these meetings also replaced the typical informal conversations before and after in-person class. While the grading scheme was not changed, all assignments were graded electronically. The journals were semi-voluntary; marks could be deducted if students failed to submit any material. Weekly feedback participation was almost always 100% and was easy to read and track due to the small class size (17 people).

### Water Management (BREE 510: Watershed Systems Management)

Water Management is a weekly three-hour class covering the purpose, content, and implementation of two main water management frameworks, IWRM and Adaptive Management (AM), and highlighting specific aspects of the planning processes including stakeholder engagement, modeling techniques, planning across jurisdictions, and monitoring and evaluation. The class is larger (40-60 students), as it is also open to senior undergraduate students. Case studies are used, along with guest speakers who differ from the guests in Water Policy. The course helps equip students to analyze water resource management issues and design appropriate water resource and AM plans. Transferable skills include problem analysis, strategic planning, data collection, synthesis, and teamwork.

Water Management follows a lecture-style format; PowerPoint presentations on the weekly topic are given, often followed by a guest lecture and question and answer session. Mandatory readings are provided online. Students are evaluated on the following: (1) an individual journal-style article about a water issue of choice, (2) class participation, and (3) a group watershed study and presentation. In the group project, students study a watershed and make recommendations to improve management and governance, and are encouraged to interview various watershed stakeholders. Students also perform a group participatory model-building activity, giving them insight into this unique stakeholder engagement tool.

*Emergency Adaption of Water Management Online.* Similar to Water Policy, the structure of Water Management lent itself to being adapted online. The class relies heavily on readings (asynchronous learning) and lectures (usually synchronous), which were easily transferred to the Zoom platform.

One main challenge was adapting the participation grading methods as some students could not participate synchronously due to time zones. As such, attendance was not recorded and participation grades were assigned based on the student's group project peer reviews. The size of the watershed project groups was also reduced from 4-8 members to 3-6 members to improve the ease of coordinating online. During lectures, students were asked to use the "raise hand" button in Zoom or to post in the chat to ask questions.

The submission and evaluation processes were moved to MyCourses, while communication was arranged through emails (and sometimes Zoom). A discussion board was created for each weekly topic to facilitate ad-hoc discussions. The participatory model-building activity was completed individually online, rather than in groups.

### Research Visits (BREE 655: IWRM Research Visits)

Research Visits is a course consisting of class visits to firms and agencies working in the realm of IWRM, as well as guest lectures given by experts from the field. Under normal circumstances, students have field trips during alternate weeks. During other weeks, the professor leads class discussions revolving around current issues and trends in water resources management. Examples

of regular speakers include staff from Environment Canada, the International Joint Commission, the United Nations, many NGOs (e.g., Winrock International), AECOM, SNC-Lavalin, Hydro-Quebec, local water and wastewater treatment plants, and professors from diverse universities (e.g., Alberta, Waterloo, Texas A&M).

While guest speakers are an integral component of other IWRM classes, this class goes further, providing students with insights regarding future career prospects. The lectures and shadowing experience provide students with networking opportunities and a better understanding of which career path would be best for them based on their interests, skills, and desired work environment.

*Emergency Adaptation of BREE 655 Online.* Unlike Water Management and Water Policy, the Research Visits course structure was negatively impacted, as COVID-19 restrictions canceled class visits. Instead, the classes comprised of guest speakers only and facilitated discussions through Zoom. Like the previous classes, assignment submissions were handled online. To resemble in-person courses, students were encouraged to ask questions to guest speakers through the chat or with the raised hand function. Finally, classes were recorded to accommodate others in various time zones.

### IWRM Internship (BREE 630) and IWM Project (BREE 631)

IWRM Internship and associated IWRM Project courses are critical components of the IWRM program. Although the internship and project occur in the program's final semester, students are oriented to the requirements and expectations of the internship from the beginning. The internship involves placement in a government, university, or private sector agency/organization full-time for thirteen weeks, where students must work on a research project related to water resources and prepare a formal report on the research performed. Students are responsible for finding their placements. The IWRM Project requires students to write a research paper or 'plan of action' regarding the work done in their internships.

IWRM Internship and Project aim to teach students how to transfer the knowledge they obtained throughout their MSc degree to real-world applications. Additionally, the classes give the students practical experience working within the realm of IWRM, emphasizing soft skills such as project management, teamwork, communication, professionalism, and knowledge acquisition and mobilization.

*Emergency Adaption of IWRM Internship/Project Online.* These classes were also heavily impacted by the pandemic in both format and results. Many of the 2019-2020 cohort students found their internships being canceled or significantly reduced in scope. As a result, the requirements for the internship and project were more flexible, with many students working independently on a research project under the supervision of their original host institution or a professor from McGill University.

## Results and Discussion

The SWOT framework was applied using the observations of the authors who were directly responsible for teaching and adapting these courses online to analyze the strengths, weaknesses, opportunities, and threats of the online adaptation efforts described above. The adaptation of each class is discussed together to aid comparisons and glean insights.

### Strengths

A strength of the online format is that it allows students to study from wherever they are, lowering relocation costs (Watermeyer et al. 2021). The formatting of both Water Policy and Water Management made online adaptation simple to design and implement, ultimately preserving learning outcomes. In both classes, asynchronous learning was facilitated through readings and lecture recordings, which helped accommodate students experiencing poor internet connections or time zone differences. A greater diversity of guest speakers was possible in Water Policy, Water Management, and Research Visits, as travel to McGill University was not required for participation. The online format offered students options to engage speakers, participants, and classmates through the chat function or video. Course evaluations revealed that students were enthusiastic about the guest speakers.

The overall reduction in class interactions proved to have some benefits. For example, in Water Management, the less interactive format benefitted students who faced technical difficulties; recorded lectures allowed students with unstable internet access to access class content they otherwise would have missed after the live sessions. Furthermore, these recordings allowed all students to revisit class content, which can be beneficial for students with learning disabilities (Maccini et al. 2002) as they can replay videos at slower speeds or multiple times, better facilitating cognitive presence. Finally, the pandemic situation established a new precedent for course recordings, even when in-person lectures returned.

The online format caused students to increasingly ask questions with email, which caused answers to be recorded, unlike in impromptu conversations. Students could also schedule one-on-one Zoom meetings, allowing them to ask numerous questions, facilitating student-to-instructor learning and teacher presence. For Water Policy, breakout rooms were integral for maintaining peer-to-peer learning and cognitive presence. Breakout rooms also gave students a space to socialize and form peer networks like in traditional classrooms. Furthermore, the weekly feedback forms helped to maintain student-to-instructor learning. For the IWRM Internship and Project courses, while students in the 2019-2020 cohort lost opportunities due to travel restrictions and the impossibility of in-person work, many students gained skills in working independently. Additionally, some students were able to work remotely with a university or organization that they otherwise may have been unable to work with due to financial considerations (e.g., travel to a foreign university).

**Weaknesses**

A significant weakness of online delivery was the lack of opportunities for impromptu face-to-face discussions. Some students felt uncomfortable asking questions in Zoom classes, limiting teacher-to-student interactions. Similarly, the online environment reduced impromptu socialization opportunities at the beginning and end of classes with peers and guest speakers. This is especially relevant as interactions with guest speakers often assist students in finding internships. Similarly,

many students preferred to have their cameras off, which reduced social connection and corresponding social presence (Castelli and Sarvary 2021).

Aside from the internship, the present authors also observed that roundtable discussions after presentations in Water Management, Water Policy, and Research Visits were less animated than previous years. However, the use of breakout rooms in Water Policy helped remediate this issue. Furthermore, in a larger class such as Water Management, it was difficult for the instructor to lecture, moderate the chat for questions, and look for "hands up" among over 40 individuals. As a result, some questions were missed during the lecture time. Some students found the three-hour lecture format to be tiring and wanted it to be more interactive. Multiple students felt the pandemic increased their workload, especially given the required reading for Water Management. Finally, while the Water Management discussion board had good intentions, students rarely used it, likely because participation was not mandatory.

In Research Visits, a lack of in-person site visits reduced students' exposure to different workplaces. While guest speakers partially made up for this, presentations are less interactive than physical visits. Additionally, students were less inclined to ask questions over Zoom than when taking a site tour.

The online presentations by students in both Water Management and Water Policy – a key aspect of both courses – were more challenging than in-class presentations due to technical challenges, internet connectivity issues, and maintaining overall focus. The quality of presentations was also slightly diminished; some students resorted to reading off slides instead of speaking naturally.

Regarding the internship, there were two identified challenges. The majority of students could not travel to their intended internship destination and missed out on in-person benefits such as close collaboration with the host and networking. In some instances, funding for the internship was no longer provided since the students were not 'on-site.'

**Opportunities**

Within many of the weaknesses, there are opportunities. For example, a solution for poor

connectivity or time zone differences is to pre-record presentations; however, this may take away from live presentation skill development. As was shown in Water Policy, having frequent breakout rooms and informal weekly reflections led to high levels of engagement in the class that rivaled in-person delivery. Given that students and instructors are now more experienced with online applications, there are additional opportunities to enhance class discussions. In Water Management, the use of interactive components, such as polls, quizzes, breakout rooms, and other technologies (e.g., online whiteboards), could reduce the monotony of the lecture-based class and improve engagement (Gewin 2020; Pather et al. 2020). However, as Water Management is a larger class, it would benefit from a teaching assistant to help with chat moderation and other interactive components. Adding more frequent short breaks could also help break up the class and keep people attentive.

Remote classes open opportunities for a greater variety of guest speakers, a key component of the program. Guest speakers can deliver presentations from anywhere, allowing for speakers from farther parts of Canada and the U.S. However, remote guest lectures could be continued if in-person classes resume.

Finally, remote learning may create opportunities for people to join the program who could not afford both the tuition and living costs in Montreal, allowing more students to partake in a 'virtual global education' without barriers to immigration and travel (Krishnamurthy 2020). This is important, as water issues impact every area of the globe and necessitate a diversity of water resources practitioners. Furthermore, having the program online could help the program build international connections, giving students more opportunities to find internships in their own communities while helping them build impactful networks close by. Remote learning can also facilitate accessibility; for example, some workplaces visited during Research Visits, such as wastewater treatment plants, may not have been wheelchair accessible, potentially excluding students from participating.

## Threats

Simultaneously, unequal global information technology threatens the participation of some students (Aristovnik et al. 2020). Furthermore, if offered remotely, some potential applicants may question whether the tuition fees match the value derived online. Therefore, the program directors and McGill must either reconsider tuition costs or redesign program components to ensure that the value is maintained remotely, presenting a logistical and marketing challenge. A key aspect of this value is networking, both with peers and guests; however, this could be facilitated online through Zoom or an interactive software.

While remote learning can reduce barriers to participation, it can also reduce the quality of student participation. For example, it was easier online for students to not participate fully in group projects, class size limited group discussion, and student questions could get lost in the chat. Without proper adaptations, such as teaching assistants for larger classes, cognitive presence can be limited and students may be left with a poorer understanding of the material. During the internship, the professor and teaching assistant noted that students had difficulties staying self-motivated, falling short of expectations, and highlighting the need for greater engagement and accountability. However, most of these threats can be dealt with by minding key considerations, as discussed below.

## Key Insights

Through the application of SWOT analysis, as informed by the CoI framework and its three components (teaching, social, and cognitive presence), to evaluate the rapid adaptation of the IWRM MSc program online, various broadly relevant key insights were discovered.

To facilitate cognitive presence and set expectations, it is important for students to have early access to a **Course Outline** that reflects the course's remote delivery. This requires careful modifications to the in-person Course Outline from previous years. In all aspects of course delivery, including the outline, clear communication of requirements and expectations is vital and should be provided well in advance. Expectations should be reinforced periodically through lectures, emails, and class announcements.

It is also important to quickly reach out to students in a **personal way,** which facilitates student-to-instructor learning and teaching presence.

Moreover, providing ample opportunities for one-on-one meetings through scheduled office times or personal Zoom meetings is helpful, especially for struggling students (Hart et al. 2018).

It is often easier to engage students in person than online. Therefore**, demonstrating enthusiasm** for the course material cannot be overemphasized. Beyond adopting an enthusiastic demeanor, efforts are needed to ensure lectures are not monotonous. For example, slides can be modified to include more pictures and video clips. Exercises, such as group discussion or writing prompts, can be used to break up long lectures. Interactive software can also be used to facilitate group work and the co-creation of diagrams. Giving a varied course experience can help students avoid developing online learning fatigue, improving cognitive presence (Pather et al. 2020).

**Feedback,** through regular journal entries, feedback forms, or a mid-course questionnaire, is helpful to determine how the course is being received and what issues need to be addressed, especially since instructors do not receive the same social cues and informal feedback online as occurs in person (Desai et al. 2009; Gewin 2020).

To facilitate social presence and student-to-student interactions, smaller group discussions like **breakout rooms** can provide students with opportunities to socialize with their peers (Wut and Xu 2021). Students are often more willing to participate in smaller groups, facilitating greater engagement (Kim 2013). As students may not have the same peer support networks online as in person, it is important to be considerate of **psychological issues and direct** students to the university's mental health services. Program directors can further facilitate social presence by offering online events, such as meet and greets.

Overall, when transitioning an academic program to an online format, it is best to **expect the unexpected**; students will sometimes have technical difficulties, requiring rescheduling of presentations to future weeks. Preparation and foresight are key to handling these situations, which are almost guaranteed to arise. For example, if possible, having a backup guest speaker is beneficial.

**Breaks** are also important for both the lecturer and the students, especially if the class is three hours long. Students clearly communicated that it was important for them to have two breaks, one after each hour. Sufficient breaks are also an important aspect of avoiding online learning fatigue (Shoshan and Wehrt 2021).

Although it is preferred, not every student chooses to use the **video aspect** of online communication, and it is not possible to require them to do so. As a result, each class is likely to be a mixture of students appearing on camera and others not, with their screens black. This should be accepted; the most important indicators of student engagement are presence and participation, neither of which require video.

Finally, **prioritize student engagement online.** If students are not engaged (e.g., not asking or responding to questions), it can be useful to call on specific students. Consequently, students may be more alert since they are anticipating being called on. If certain students are not participating at all, it is important to reach out to them individually to establish a teaching presence through student-instructor interaction. Peer evaluation can also be used to encourage student-student interactions when working on group projects.

## Conclusion

While many of the IWRM classes have now returned to an 'in-person' format, the rapid adaptation of the program online has shown that remote learning, or a hybrid approach, may be a feasible future for the program. Indeed, classes such as Water Policy continued to be offered online for the Fall 2021 semester. However, if online or hybrid classes are going to become a permanent fixture of the IWRM MSc program (or any MSc program), it will be important to build on the findings of the literature and SWOT analysis to ensure course objectives are met and transferable skills are preserved.

As was found in this study, remote teaching of water management can create opportunities for students to participate globally, eliminating the need for (often high) translocation costs. Similarly, online delivery can allow for a wider range of guest speakers, providing a more enriching experience and exposing students to greater career options. However, additional efforts must be taken

to preserve processes that facilitate learning. In many cases, the standard lecture-style format must be amended to include more breaks and varied activities. Furthermore, instructors need to pay attention to facilitating peer-to-peer interactions (and networking) online through, for example, breakout rooms. From a program perspective, it is important to rework not only classes but also other components (such as social activities) to preserve value and student experience. In the case of the IWRM MSc program, more work is needed to ensure that the internship experience is valuable for students participating remotely. Program administrators have determined that in-person internships remain a priority as these tend to give the students the most value, though they can take place globally.

While this paper focused on one water management program, both the information uncovered through the literature review and the evaluation tool combining SWOT with the CoI are widely applicable to other post-secondary programs. The developed framework is a particularly useful methodology for evaluating the adaptation of in-person classes to online formats, helping to identify areas of excellence and improvement and preserve transferable skills. Overall, this type of analysis is crucial to understand successes and areas for improvement, to maintain educational standards for both students and professors in future scenarios when courses are adapted to an online format.

## Acknowledgements

## Author Bio and Contact Information

**Dr. Murray Clamen** worked at the forefront of transboundary water resources management at the Canada – United States International Joint Commission (IJC) for over thirty years. Before retiring from the IJC in 2011, he led and participated in numerous Canada – U.S. water resource studies and assessments as an engineering adviser and Secretary of the Canadian Section. He currently holds an Affiliate Professorship at McGill University, where he teaches in the Integrated Water Resources Management (IWRM) Master's Program. He also sits on numerous Advisory Committees. Dr. Clamen completed a Ph.D. in Civil Engineering from Imperial College London. He may be contacted at murray.clamen@mcgill.ca or 21111 Lakeshore Road, Sainte-Anne-de-Bellevue, QC, Canada H9X 3V9.

**Emma Anderson** (corresponding author) recently completed her Master of Science (Thesis) in the Water Resources Research Group of the Department of Bioresource Engineering at McGill University. Before and during COVID-19, Emma was the teaching assistant for multiple classes offered in the Integrated Water Resources Management non-thesis Master's Program and the instructor for the Integrated and Adaptive Water Resources Management certificate course. Her research involved the application of a coupled human-water model to explore the impact of the water-energy-food nexus on residue-based energy in Pakistan. She may be contacted at emma.anderson2@mail.mcgill.ca or 21111 Lakeshore Road, Sainte-Anne-de-Bellevue, QC, Canada, H9X 3V9.

**Johanna Dipple** is a Thesis Master's Student in the Water Resources Research Group of the Department of Bioresource Engineering at McGill University. Her research explores alternative data sources for water quality data, including participatory data collection, and data sharing infrastructures to inform Integrated Water Resources Management. While new to this program, Johanna is now a teaching assistant for multiple courses in the Integrated Water Resources Management non-thesis Master's Program. She may be contacted at johanna.dipple@mail.mcgill.ca or 1111 Lakeshore Road, Sainte-Anne-de-Bellevue, QC, Canada, H9X 3V9.

**Dr. Jan Franklin Adamowski** is a Professor of Hydrology and Water Resources Management in the Department of Bioresource Engineering at McGill University, Canada. At McGill, he is also the Liliane and David M. Stewart Scholar in Water Resources, the Director of the Integrated Water Resources Management Program (which comprises an MSc program and Online Certification Program), and the Associate Director of the Brace Water Centre. Before coming to McGill, he was a Postdoctoral Associate at MIT. His teaching and research activities revolve around hydrology and water resources management. He may be contacted at jan.adamowski@mcgill.ca or 21111 Lakeshore Road, Sainte-Anne-de-Bellevue, QC, Canada, H9X 3V9.

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