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Building an Online Master's Program for Deep Learning in Sustainability

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**Keywords:** deep learning, online, distance education, executive education, business, graduate, sustainability

**ABSTRACT:** *Deep learning is seen as a way to maximize the benefits from sustainability education for both students and society. This chapter considers the University of Waterloo's Master of Environment and Business (MEB) program in relation to seven characteristics of deep learning. The MEB program is an executive education program that is mostly delivered online. Student survey responses show a high satisfaction with the program and highlight areas where deep learning is occurring. This chapter emphasizes that it possible to ensure deep learning in an online program and in a program's design (not just at the teaching activity/assignment level). The chapter ends by offering lessons learned for other online courses and programs.*

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## **Introduction**

Sustainability education is seen as a way to educate students about environmental and social concerns, while at the same time supporting a transition towards sustainability in society (McNamara, K.H., 2010). Deep learning is particularly relevant for education for sustainability due to the interdisciplinary nature and holistic insights needed (Warburton, K., 2003) and the desire to actually change organizations and systems (Fullan, M., 2006, Stirling, S., 2004). Deep learning is usually defined in distinction to surface learning; a deep approach to learning as one in which students “seek meaning in order to understand it” (Trigwell, K. and Prosser, M., 1991, p. 251).

The Master of Environment and Business (MEB) program at the University of Waterloo is designed for working professionals. Following a two-week residency period, the rest of the degree is online. Students come from different academic backgrounds, different workplaces, and different countries. What they have in common is a desire to build more sustainability related content into their existing or future job. Given that the program was designed from scratch, there was a great opportunity to prepare the curriculum and delivery to ensure deep learning.

This chapter details how the MEB program at the University of Waterloo encompasses seven characteristics of deep learning. The literature review explains deep learning. As context, the ‘environment and business’ degree, program design, course attributes, and student characteristics are explained. A table demonstrating how the seven key characteristics of deep learning are built into the MEB program is also presented. Throughout the results section, quotations which have been obtained from anonymous student evaluations demonstrate the value of specific assignments to students. Finally, lessons learned for other online courses and programs interested in deep learning are offered.

## **Literature Review on Deep Learning**

Deep learning is short for deep approaches to learning, and differs from a surface learning approach. A surface approach to learning is defined as one approach where students memorize mechanically in order to reproduce learning materials (Trigwell, K. and Prosser, M., 1991). By contrast, deep learning enables students seek deep meaning and understand learning materials (Trigwell, K. and Prosser, M., 1991). A Task Force on Innovative Teaching Practices to Promote Deep Learning at University of Waterloo identified seven characteristics which exemplify students’ application of deep learning (Ellis, D., et al., 2011):

- 1) retain knowledge and apply it to new and different contexts (also known as transfer);
- 2) relate ideas and make connections between new and prior knowledge;
- 3) see concepts, ideas and/or the world differently;

- 4) engage in independent, critical, analytical thinking in a quest for personal meaning;
- 5) regulate themselves as learners;
- 6) rely on intrinsic motivation to learn; and
- 7) engage in active learning by interacting with others and the course material.

Research suggests that when students take a deep approach to learning, they are able to better transfer knowledge (Ellis, D., et al., 2011). Related to the first two characteristics of deep learning, Halpern and Hakel (2003) identify ten basic principles that effective teachers can use to retain and transfer knowledge: 1) ensuring practice at retrieval; 2) varying the conditions under which learning takes place; 3) requiring learners to take information and present it in one format and re-represent it in an alternative format; 4) building on prior knowledge and experience; 5) recognizing students' and instructors' own epistemologies; 6) recognizing that experience alone is a poor teacher; 7) remembering that lectures work well for learning assessed with recognition tests, but work badly for understanding; 8) noting that the act of remembering itself influences what learners will and will not remember in the future; 9) being aware that less is more, especially when we think about long-term retention and transfer; and 10) embracing that what learners do determines what and how much is learned, how well it will be remembered, and the conditions under which it will be recalled (Halpern, D.F. and Hakel, M.D., 2003).

The third characteristic of deep learning is students “come to see concepts and the world differently” (Ellis, D., et al., 2011, p.7). Stirling (2004) equates the level of learning with the level of systemic change possible. Single-loop learning (or surface learning) does not change the values or perspective of the student. Double-loop learning, in contrast, is characterized by a change in frame which also leads to second-order change, which is a change in the system (Stirling, S., 2004).

Transformative learning, which Stirling (2004) equates to a third level even deeper than double-loop learning, is based in systems thinking and can actually lead to a paradigm shift. The Ellis et al. (2011) framework considers anything deeper than single-loop learning to be deep learning.

The fourth characteristic - “engage in independent, critical, analytical thinking in a quest for personal meaning” (Ellis, D., et al., 2011, p.7) – is typical of any graduate level program. For example, the Graduate Degree Level Expectations in Ontario Canada (University of Waterloo, 2013b) concentrate on “a systematic understanding of knowledge and a critical awareness of current problems and new insights, a conceptual understanding and methodological competence, competence in the research process by applying an existing body of knowledge in the critical analysis of a new question or of a specific problem or issue in a new setting, [and] the ability to communicate ideas, issues and conclusions clearly” (University of Waterloo, 2013b, p. 1).

The fifth characteristic of deep learning is that students “regulate themselves as learners” (Ellis, D., et al., 2011, p.7). Self-regulation is defined as “not a mental ability or an academic performance skill; rather it is the self-directive process by which learners transform their mental abilities into academic skills” (Zimmerman, 2002, p.65). Self-regulation realizes the life-long goal of education as developing learning skills (Zimmerman, B.J., 2002). Research on self-regulation implies that students who are seldom given choice in study have difficulty in developing self-regulated learning skills (Zimmerman, B.J., 2002).

The last two characteristics of deep learning are: students “rely on intrinsic motivation to learn” and “engage in active learning by interacting with others and the course material” (Ellis, D., et al., 2011, p.7). Intrinsic motivation is defined as “the motivation for ongoing interaction with the environment” (Deci, E.L., et al., 1981, p. 1). Additionally, students’ ability and motivation have deep impacts on the quality of learning interactions (Kawachi, P., 2003). By being motivated to understand and engage in the topic, they will pursue deep learning (Warburton, K., 2003). Warburton (2003) offers three factors that influence this motivation: the learning environment (such as the online platform, teaching style, and opportunity for discovery); the course content (such as key concepts and themes, range of content, and personal relevance); and individual factors (such as prior experience, workload, and background knowledge).

There is a literature that considers deep learning that is highly relevant for online programs. In particular, teaching methods are emphasized. For example, a high level of communication and interactions among professionals and students contribute to effective teaching (Offir, B., et al., 2008). Also, students’ reflections have significant potential to promote deep learning (Lynch, R., et al., 2012). Self and peer evaluations can lead to better critical thinking and learning outcomes (Lynch, R., et al., 2012).

On a whole, integrated online course models can promote learning satisfaction and reinforce knowledge (Ke, F. and Xie, K., 2009). Online discussion can help teachers deepen teaching methods (Lee, H.-J. and Baek, E.-O., 2012), promote deep learning and have positive impact on memory rates (DeLotell, P.J., et al., 2010). Similarly, a framework for deep learning in online discussion indicates that dynamic online interaction promotes students’ learning skills and leads to deep learning (Du, J., et al., 2005).

Specific to sustainability, the value of deep learning is well understood given the complexity of the topics and the desire to support the transition to a sustainable society (Warburton, K., 2003, Stirling, S., 2004, Fullan, M., 2006). Effective education for sustainability will ensure student reflection, discovery and action research (Warburton, K., 2003). Involving students in professional learning communities has also been encouraged (Fullan, M., 2006). Stirling (2004) offers three levels of education & sustainability: 1) education about sustainability which leads to

bolt-on changes; 2) education for sustainability which leads to building in change; and 3) sustainable education which leads to rebuilding and redesigning.

While the literature states that reflections, self and peer evaluations, interacting with professionals, class discussions, and integrated modules are important, learning in the MEB program design has many more features, such as content delivery methods, assignment formats, team presentations, group reports, individual assignments related to workplaces, etc. There has also been considerable thought in the MEB design to ensure the students are able to enact change. This chapter, focused on deep learning, highlights how considering deep learning at the program design level instead of the individual activity or assignment level, ensures that the degree itself enabled a deep approach to learning.

### **Context: Master of Environment and Business (MEB) Program**

The Master of Environment and Business (MEB) is an online program “aimed at meeting the growing need for business sustainability professionals as a distinct group of knowledgeable, skilled, confident and motivated individuals with the information, tools and expertise to integrate environment with business in very practical ways” (University of Waterloo, 2013a, p. 1). Graduates are prepared for senior level and strategic positions in businesses, or in other organizations seeking to change (or influencing others to change) to more sustainable practices. “The MEB program offers students a MBA-equivalent degree through online courses with minimal on-campus study, and with course materials distributed over the Internet” (University of Waterloo, 2013a, p. 1).

As the students are working professionals, most take the degree as a part-time program of study, with one course a semester. At this pace, it takes three years to complete the ten courses and two milestone conferences. In total, there are approximately 85 students in the MEB program. The first cohort of MEB students graduated from the University of Waterloo in October 2013. For more information about the program design see Table 1 and also the program website<sup>2</sup>.

	<b>Course Topics</b>	<b>Purpose</b>
<b>Foundation Courses (2 courses)</b>	<ul style="list-style-type: none"> <li>▪ Business Case for Sustainability</li> <li>▪ Sustainability for Business</li> </ul>	<ul style="list-style-type: none"> <li>▪ Know each other, professors and program</li> <li>▪ Common knowledge base</li> <li>▪ Academic skills</li> <li>▪ Teamwork and online skills</li> </ul>
<b>Core Courses (4 courses)</b>	<ul style="list-style-type: none"> <li>▪ Green Marketing and Social Accountability</li> <li>▪ Business Operations and</li> </ul>	<ul style="list-style-type: none"> <li>▪ Deeper knowledge</li> <li>▪ Introduction of content-based skills</li> </ul>

<sup>2</sup> For more information see: [uwaterloo/env/MEB](http://uwaterloo/env/MEB)

	<ul style="list-style-type: none"> <li>▪ Sustainability</li> <li>▪ Strategies for Sustainable Enterprises</li> <li>▪ Environmental Finance</li> </ul>	
<b>Electives (2 courses)</b>	<ul style="list-style-type: none"> <li>▪ Enterprise Carbon Management</li> <li>▪ Lifecycle Assessment and Management</li> <li>▪ Stakeholder Engagement, Collaboration and Partnerships</li> <li>▪ Sustainability Reporting</li> </ul>	<ul style="list-style-type: none"> <li>▪ How-to courses</li> <li>▪ Deeper content-based skills</li> </ul>
<b>Capstone (double course)</b>	<ul style="list-style-type: none"> <li>▪ Capstone Sustainability Project</li> </ul>	<ul style="list-style-type: none"> <li>▪ Applied project-based course; including a major research paper</li> </ul>
<b>Milestone Conferences (must attend two)</b>	<ul style="list-style-type: none"> <li>▪ Professional conferences with additional MEB side events</li> </ul>	<ul style="list-style-type: none"> <li>▪ Learn leading edge conversation</li> <li>▪ Interact with professionals</li> </ul>

**Table 1: MEB Program Design**

## Results

The MEB program was designed from scratch, and thus considerable thought was put into the design. The student and topic attributes lend themselves to deep learning in many ways. As the students are working professionals, this enables the use of authentic evaluation strategies and real world contexts. Assignments can be applied to their workplace, and the diversity of students ensures different perspectives are represented in class discussions. For example, some students work in large corporations, others in smaller companies, some in the non-profit organizations and others in the public sector. All have at least three years of work experience prior to starting in the program. There is also a wide variety of industries represented. Here is what one student had to say in an anonymous survey about his/her favorite part of the program:

*“...meeting a diverse group of peers and professors, which leads to interesting discussions and varied points of view”*

The ‘environment and business’ topics also provide opportunities to bring practical real-world content into the classroom. For example, the online platform allows the instructor to link to live websites for current case studies made up of video, web content, and even guest expert question and answers (on a discussion board). The students are challenged to apply critical thinking to the ‘real-world’ content they are reading. This quotation from the anonymous survey from a student about his/her favorite part of the program highlights the real-world content in the program:

*“I do find the content relevant and often tied to case studies which I enjoy. There is no doubt that the professors are leaders in this field and there are lots of real world evidence and exploration offered to students.”*

The MEB course and milestone conference attributes also have deep learning embedded in their design. For example, there is considerable choice in assignments and opportunity for students to self-direct their weekly engagement as it is asynchronous. Each course has an individual assignment and a team assignment; some of these allow for students to tie them to their workplace. For example, in the Introduction to Sustainability for Business course, students write a hypothetical memo to their CEO (or senior person). Some students are actually able to make use of this content for other work purposes. The final capstone project is a research project with a client, but which also must make an academic contribution. This quotation from the anonymous survey question about his/her favorite part of the program highlights how applicable this student is finding the content:

*“...the knowledge I gained regarding sustainability and what it means for organizations, from the fundamentals to the more specific details. A little more than half way through the program, I feel confident in my abilities to apply the knowledge I have gained in this program and have a successful career as a business sustainability professional.”*

Another design feature of every course is that they all have interaction with professionals about the course material. Sometimes this is done by pre-recording content, or through discussion board question & answer sessions. One of the advantages of the online format is the guest can be from anywhere in the world. Also, all of the MEB instructors have some practical experience that they are able to bring into the classroom. Every course also has student-led discussion boards and other activities. The milestone conferences require the students to participate in an MEB orientation, a social event, the main conference, and also to write a reflection. One student mentioned in the anonymous survey this comment about the guest expert discussion boards:

*“The expert discussions were an unexpected added bonus. It was such a privilege to interact with some of these experts and get the inside story on their work. [The guest experts] made the case studies so much more relevant and addressed the nuances not apparent in reading the websites.”*

In terms of the discussion boards, in each course these are tied to the weekly or biweekly content. A new board begins every week or two. This paces the students during the course, but also enables the conversation to stay active and for different students to lead different boards. This was an unsolicited comment that was posted on a discussion board in a course by a student to his/her peers:

*“Thank you dear classmates for all your contributions. I thought it was time – during November, the darkest month and half way through our three year program – to send a note of thanks for sharing your experience,*

*knowledge and insights. I am gaining so much from reading your views on our course content. I so appreciate reading your posts and wonder how we can all look at the same topic so differently. I've come to count on [these discussions for] expanding my knowledge."*

In terms of the online nature of the program, students tended not to comment on this as there was no in-person option. In general, students chose this online program so that they could work while in school and so that they could be located anywhere. Here is what one student had to say to a question about his/her favorite part of the program:

*Of most benefit has been the format - I would not be able to obtain this degree otherwise. The online format allows me to study abroad and interact at the level necessary to feel engaged in a valuable learning process.*

Using the deductive framework provided in Ellis et al. (2011) about deep learning characteristics, an analysis was conducted about the Master of Environment and Business design. Table 2 highlights these results.

<b>Deep Learning Characteristic (Ellis, D., et al., 2011)</b>	<b>MEB Design Features</b>
Retain knowledge and apply it to new and different contexts	<ul style="list-style-type: none"> <li>▪ Applied assignments and capstone project</li> <li>▪ Assignment formats, for example different teams focusing on different industries</li> </ul>
Relate ideas and make connections between new and prior knowledge	<ul style="list-style-type: none"> <li>▪ Program design builds on previous courses and experiences</li> </ul>
See concepts, ideas and/or the world differently	<ul style="list-style-type: none"> <li>▪ Course content</li> <li>▪ Student diversity</li> <li>▪ Negotiation exercise</li> </ul>
Engage in independent, critical, analytical thinking in a quest for personal meaning	<ul style="list-style-type: none"> <li>▪ Individual assignments</li> <li>▪ Reflections</li> </ul>
Regulate self as learner	<ul style="list-style-type: none"> <li>▪ Asynchronous design</li> <li>▪ Choice in assignments</li> <li>▪ Additional resources in each week's content</li> </ul>
Rely on intrinsic motivation to learn	<ul style="list-style-type: none"> <li>▪ Tied to workplace</li> <li>▪ Milestone conferences</li> </ul>
Engage in active learning by interacting with others and the course material	<ul style="list-style-type: none"> <li>▪ Discussions</li> <li>▪ Team presentations and reports</li> <li>▪ Engage professionals</li> </ul>

**Table 2: Key Characteristics of Deep Learning in MEB Program**

In summary, the MEB program is an online program which aims to facilitate deep learning on business and sustainability. In the MEB program, some assignments are designed to apply concepts in different contexts, and to build off prior knowledge. Also, student diversity helps students see concepts and ideas from different angles. Individual assignments, reflections and discussions increase students' engagement in independent, critical, and analytical thinking. Online assignments in the MEB and options available regarding assignments also enable students to regulate themselves as learners. The entire program only functions if students are intrinsically motivated to learn; so this is a criteria used as part of admission. In addition, the MEB has numerous interaction opportunities.

## **Discussion and Conclusion**

While these quotations were extracted from a survey to provide examples regarding deep learning, they do reflect the positive attitude that students have towards the program. In the 2013 survey - which had a 58% response rate - 92% of the students were satisfied with the MEB program and 100% were likely to recommend it to others. The main area for frustration for students about the program design is in regards to the virtual teamwork in every course. It is not surprising that some students do not like group assignments, but the virtual element (with students in different time zones) on top of working full-time makes these assignments harder to manage time-wise.

Using Waterburton's (2003) three factors that influence deep learning as a means of organizing this section, the following are some lessons learned through designing and implementing the MEB program.

### ***The learning environment***

Designing a program from scratch provides numerous opportunities to ensure deep learning at the program level. Much of the deep learning opportunities come through the learning environment. The online course designs, including the assignments, are a large part of that where deep learning can be structured into the program. For the MEB this includes the applied assignments, exercises, reflections, discussions, teamwork and guest experts. The students love the assignments that are applied to their workplaces and/or where they have significant choice. That said, for these assignments, effective feedback on these assignments from the instructor is critical for the student's learning. It requires the professors to be very comfortable with the material and the field to be able to comment on such varied submissions and provide meaningful feedback on the content.

Online discussions are an important tool for online courses to promote deep learning (Lee, H.-J. and Baek, E.-O., 2012, DeLotell, P.J., et al., 2010, Du, J., et al., 2005). In terms of the discussion boards, from both a student and instructor perspective, these are hard to 'time budget'. The more motivated the students are, the more posts they make, and the more they suggested additional links for their classmates to explore. Students who come into the conversation later in the discussion (due to work or home obligations), but before the deadline, can have trouble engaging in the conversation. Also, for the guest experts who log into the discussion board for the question and answer session, the number of questions waiting can be overwhelming. Even with careful discussion assignment restrictions, ensuring deep learning by all students through this activity can be challenging.

Interaction with professionals by the students is important (Offir, B., et al., 2008, Fullan, M., 2006). In the MEB program, this is not only done through the classroom and applied assignments, but also through milestone conferences. This mandatory degree requirement has added considerable value to this professional Master's degree program. The students learn the leading edge conversation, network with a large number of professionals, interact with each other (across cohorts), and see how the movement networks.

### ***Course content:***

The MEB was designed with both skills and curriculum in mind. The attributes of the graduating students and the knowledge to be learned were determined. Then the content to be covered at an introductory, medium and high level were mapped across the courses, ensuring that the foundation courses covered the base knowledge and skills needed by all students (thus accommodating various experience and training

backgrounds), while the core courses went deeper and the electives and capstone ensured a 'how to' level, including application. Compared to Stirling's (2004) levels of education & sustainability, the early courses teach the education about sustainability, while the rest teach the education for sustainability and the sustainability education. Students are challenged not only to know bolt-on solutions, but also how to build change from within, and redesign systems. They also learn what has worked (and not worked) and the challenges of being the change agent. For those who can directly tie the capstone project and other course assignments to their workplace, sometimes they apply course learnings to creating change immediately. The beauty of executive education is the opportunity for the students to already be in positions to effect change directly.

Now, as the MEB program starts to build the alumni network, and decide how best to leverage cross-cohort connections for larger transformational change, there are limitations. It is not part of the mandate of the MEB Director; rather the role is focused on recruitment/admissions, program improvements/maintenance and current student development. Alumni services are elsewhere in the institution, and more focused on donor relations. Building the alumni network and services to reach its potential is beyond the current capacity of the program team. That said, the MEB team is currently experimenting with easy-to-implement options.

Another note about course content is that business and sustainability is a dynamic field that keeps evolving. It is important to keep the courses current, even if most of the material is pre-prepared. The online environment has created some challenges in regards to staying current as all courses are prepared months in advance of offering. These challenges can be overcome through announcements and discussion posts.

***Individual factors:***

Perhaps of most importance to the MEB program design is the selection of students. These professional students gain about 50% of their learning from each other. Having students with at least three years work experience, and a direct interest in matching sustainability to their career have been important admission criteria that have led to the success of the program. The average age is 35, with a mix of junior, middle and senior managers. For example in each cohort, there have been some executive directors, chief executive officers and/or managing partners. About half of the class already works in sustainability-oriented jobs, including as sustainability coordinators, senior policy advisors, environmental officers, etc. The other students have relevant experience to offer the discussion on the management side, even if they are newer to the sustainability topics. These individual attributes enable deep learning.

In conclusion, the results provided in this chapter emphasize that it possible to ensure deep learning in an online program. They also provide evidence that it is possible to consider deep learning at the program level and not just at the teaching method/activity/assignment level.

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## **BioNotes**

Dr. Amelia Clarke's current research focuses on: campus sustainability; community sustainable development strategies; corporate social and environmental responsibility; collaborative strategic management; cross-sector partnerships; and youth-led social entrepreneurship. Amelia Clarke has been working on environment and sustainability issues since 1989. In 1996, she founded the Sierra Youth Coalition, and is proud of having launched their sustainable campus program. She is now a faculty member in the School of Environment, Enterprise and Development (SEED) at the University of Waterloo and is Director of the Master of Environment and Business (MEB) executive-education online program. Amelia Clarke also sits on the editorial board of the *Academy of Management Learning and Education (AMLE)* journal, and is an executive member of the Social Responsibility Division of the Administrative Science Association of Canada (ASAC). She holds a PhD in Management from McGill University.