

A Virtual Exchange Tool-Kit: From Micro-Credential Settings to Full Study Programs

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The paper presents a perspective of online education with emphasis upon the European Educational Framework Level 7 (MSc), incorporating the full chain of Bloom's Taxonomy Levels (BTL), in an open-source repository structure that allows for a complete sharing and re-use of educational material from different sources. The paper illustrates how a significant number of teachers from different universities have started to develop small, individual, online digital learning units (modules), which thereafter are "stacked" together to create larger units (lessons). The basic units include automatically corrected assignments, whereas the more advanced (higher BTL) modules include peer discussions and instructor feedback. The paper illustrates how, through international collaboration, these "lessons" can be constructed into digital courses and "short programs", accessible to both university students and professionals. It presents how these short programs, built up by shareable material from a number of teachers from different countries, can then be used in university settings in countries with emerging economies. The programs would count for academic credit, first in a "micro-credentials setting", but also later in full two-year academic MSc degrees. The concept is based upon the UN Sustainability Goal Number 4 that Quality Education is a Human Right. It relies upon voluntarily sharing and re-using Open Educational Resources from many different stakeholders in a not-for-profit perspective as it simultaneously spreads knowledge to groups that otherwise might not find such open resources. It also demonstrates, in a pilot subject "energy", the contemporary possibility for "global but local" high-quality MSc-level education.

Introduction

Digital education has the potential to disrupt the educational landscape worldwide. It can enhance the development of emerging economies. It can modify the traditional university landscape, creating enormous opportunities for learners globally to access high-level education in as yet inaccessible forms.

This type of education is still in its infancy, and "traditional teachers" are normally unable to grasp its implications and unprepared to accept the widespread impact that machine-learning, augmented/virtual reality, and artificial intelligence

may have on the teaching profession. It is clear that a "one-to-one" education, including aspects of it such as hands-on laboratory work, travel for exploration of different cultures, and direct student-to-tutor interactions in the form of case studies, dialogues, and peer discussions, is exceptionally good and efficient. Such education is, however, also very expensive, and often environmentally unsustainable, as a lot of travel would be included, especially for international, common university programs. Today online education can offer a very realistic alternative, and with the progress of learning analytics, artificial intelligence, and virtual/augmented reality, online education can soon become a real alternative to a "physical, on-campus" presence. It will also offer a much-needed possibility for enhanced cooperation between educators from different cultures.

Background

Education is the key to development. The global world faces unprecedented societal, environmental, and other challenges. The significant majority of research-based university teachers are still in the "advanced economy" countries, whereas the largest number of potential students, and other types of learners, are in the "emerging economy" countries. To eradicate societal injustices there is a need to educate a significantly larger portion of the younger generation in emerging economy countries than the traditional university systems can assimilate, while retaining the nationally recognized quality these universities already have.

Open Educational Resources (OER) have been developed over many years. The first and most widespread example is, of course, the traditional textbook. Years ago, many institutes began to develop different kinds of learning materials, such as written text, radio- and TV-broadcasting. Such initiatives started to become "computerized" in the 1980's and 90's, began to catch on in the early 2000's (with the Massachusetts Institute of Technology, notably, offering all of its educational material online), and exploded online in the early 2010's as the Massive Online Open Course (MOOC-) platforms started to appear.

In the process there have been a number of "Open Universities" created (Open University UK being the first in 1969, with The Open University Sri Lanka the first such university in Asia, established in 1978). These open universities have delivered a great service to their countries and citizens by offering courses of different kinds, ranging from vocational training to 2nd, and in some cases, 3rd cycle (MSc resp PhD levels) education. Of course, the courses are often also offered in a life-long learning perspective.

However, "remote" or "distant" education has generally been looked upon as not offering the same quality as a traditional on-campus university can. This perception seems still to be the case, although the contemporary technical advantages related to fast, online, digital delivery have opened a lot of opportunities over the last few years. The pedagogical/didactical progress has clearly not followed the technical development and most "e-learning" done at universities (and far from all universities use such features) is still considered significantly less valuable than an on-campus degree, even if the exams and assignments the students take might be exactly the same in both environments.

The KTH Royal Institute of Technology in Stockholm started “Computerized Education in Heat and Power Technology” in the mid 1990’s (for example Leotard et al., 1998; Salomon et al., 2004) and an “online” MSc program “Sustainable Energy Engineering World” in 2004¹, with student intake until 2011. The content was, apart from some hands-on laboratory work, exactly the same as the corresponding successful international on-campus program. In 2007 The OUSL entered the program, and more than 130 students have since successfully graduated from the program in Sri Lanka (SEEWSL alumni²). Some of these graduates have become successful teachers at various educational institutes (traditional and vocational training universities) in Sri Lanka, some have successfully completed PhDs in countries around the world, and many more have successful private or governmental careers in Sri Lanka. This program clearly proved that although the teaching and contact hours, as well as the environment the learners work in, are extremely important, the “teacher/student environment” does not need to be “at one physical place” if other conditions are set up towards global, societal, and collaborative studies with motivating and inspiring education.

Over the years, KTH and The OUSL have also collaborated, to a much smaller but still highly significant extent, on smaller courses within the T.I.M.E. Association³ and the EIT⁴ InnoEnergy⁵. KTH has developed laboratory exercises in the energy sector that can be used remotely by students globally (for example Navarathna, Fedulov, Martin, Fransson, 2004; Monaco, Vogt, Bergmans, Fransson, 2014). These and many other educational online collaborations⁶, including also the KTH-coordinator role of three Erasmus-Mundus Joint Degree MSc and PhD programs, have led to the conclusion that it will today be possible to create full-level local, affordable, Master programs in emerging economies. This could be done with the use of globally available, small-scale learning modules from open educational resources, going through smaller “certificates”, “diploma courses”, etc. (depending on local regulations) and ending with, if the learners so seek, a full MSc degree. As such, the learners will have the possibility of “stacking” their learning and gradually enhancing their educational level even if the local university does not have teachers with all the skills needed for a fully valued degree in the subject area. Of course, similar to what is done in on-campus programs, to perform the proper “stacking” it is a matter of how the intended learning outcomes can be combined to move gradually from the low taxonomy levels of “remember” and “understand” to the higher levels of “analysis”, and eventually be able to use the skills and competencies to “create” values in the field of study. Along the road learners must also prove themselves to have the various “21st Century Skills” that today’s employers require employees to have to be fully effective in the energy world (including skills such as collaboration, communication, creativity, “pitching”, etc.).

1. www.kth.se/en/studies/master/sustainable-energy-engineering/description-1.8711

2. “Sustainable Energy Engineering World” Alumni. www.aseewsl.lk

3. A network of 57 worldwide universities, <https://timeassociation.org>

4. European Institute of Innovation and Technology, <https://eit.europa.eu>

5. www.innoenergy.com

6. For example: Abeyweera, Senanayake, Senaratne, Jayasuriya, Fransson, 2017; Abeyweera, Senanayake, Jayasuriya, Fransson 2018; Abeyweera, Guillerme, Senanayake, Peiris, Jayasuriya, Fransson, 2019; Kithsiri, Peiris, Wickramarathna, Amarawardhana, Abeyweera, Senanayake, Jayasuriya, Fransson, 2018.

Presently, MOOC-platforms like Coursera⁷ and FutureLearn⁸ work towards a similar concept in the sense that they aim to establish “micro-credentials” in various topics. However, although highly interesting and extremely well prepared for online learning, these are still fairly straightforward and often directed towards a large learner base. And although universities often are at the origin of the courses, these do not always carry academic credit. Furthermore, they are often general “one size fits all” courses, developed by western universities and, thus far, seldom adapted to local environments, such as in countries with emerging economies.

Methodology

With the goal of demonstrating the concept of building high-quality curriculum from different “small-scale learning units” in a “hard-core engineering” subject, a number of individual teachers in the energy area from different universities have over the last few years worked towards a “scalable and stackable” concept in which educational material from many sources can be shared and re-used among teachers. Teachers from mainly the T.I.M.E. Association, the EIT (EIT Climate, EIT Digital, EIT InnoEnergy) and other organizations participate. The keys to success in such a voluntary, global, and collaborative effort among these teachers have been identified as:

- Ensuring a broad base of teachers who (i) are willing to consider paradigm shifts in digital education, including developing student-centered and challenge-driven methods in a digital environment, who (ii) consider that affordable education is a necessity for citizens in emerging economies, who (iii) are willing to share their own material on a largely voluntarily basis and (iv) work together with other colleagues to improve it.
- Working on smaller learning modules (~0.5-5 Estimated Learning Hours [ELH]), including videos, reading material, and appropriate assignments, thus not burdening individual teachers with heavy workloads, and also realizing that teachers globally must have the possibility of putting their own “mark” on the modules they use in the extent they want (while of course always acknowledging where the material originally comes from).
- Accepting, with an open mind, individual modules from teachers, recognizing that it takes significant time to establish collaborations and that teachers will make needed adaptations and improvements when they have the time, and especially when they receive feedback from students.
- Having, for each individual small-scale learning module, clearly defined (but locally modifiable) intended learning outcomes and corresponding (for the lower taxonomy level automatically corrected) assignments, such that non-specialized teachers can re-use the complete module without having to be specialists in all sub-areas of a subject.

7. www.coursera.org/browse

8. www.futurelearn.com

- Working with a framework in which “Subject area lessons” and “Subject area courses” are built-up by the local “teacher-architect” into consequently larger units from the individually small “learning modules” by the collaborating teachers. Courses can be developed with or without the involvement of the original learning unit, depending upon how the collaboration is set-up between the colleagues and partners.
- Establishing this “framework” of “assembled modules” into an easy-to-use repository with links to learning material from all other open resources needed on “learning module” level, while also fully recognizing that the “teacher-architect” will need to assemble material from many places to create the local, individual courses, course “packages”, etc., as local regulations permit.
- And ensuring that the learning modules are accessible “the year round” so that any teacher can use them in any part of the academic cycle in their curriculum.

In these ways, university teachers who might not have the full resources for creating high-level specialized content in their country’s needed subject areas can (i) create their own local programs, in which they (ii) re-use as much as needed from common resources, and (iii) develop their own local perspective, (iv) adapted to the needs of the neighbouring communities and regions, while (v) they can also develop further global collaborations. Students in universities can similarly access, in well-designed learning pathways or as individual learning pieces, high-level material from a global consortium of specialized teachers, just as universities without such courses can establish capacity building and improve the competence of their own faculty.

However, a major factor missing from such a global collaboration is that many students, and also many organizations and industrial companies, highly (and often exclusively) valorize the “degree-paper” as the ultimate proof of the actual knowledge, skills, and competencies the graduates have achieved in the learning process. In today’s environment it is still difficult for people to find appropriate employment if they cannot also show a “signed and stamped degree-paper” from a recognized university (Dimon, 2020). As such it is essential to demonstrate the concept while ensuring an academic degree is obtainable from an established university (in either “advanced” or “emerging” economy countries).

The Open University Sri Lanka (OUSL) has been very positive towards this international trend as it recognizes the need for significantly extending the number of engineering graduates in the country. As an open university, it also has more possibilities than a traditional on-campus university for offering academic credit for isolated courses, short programs, “certification programs”, etc. As such, together with several teachers in Europe, The OUSL has worked towards demonstrating the workability, and scalability, of the methodology. This collaboration resulted in an EU-sponsored “Capacity Building in Higher Education” project which will allow the possibility to “scale-up”, fully demonstrate the concept, and start to award degrees based upon such shareable material. In the project “EUSL-Energy”⁹, four

9. EUSL-Energy: “Europe Sri Lanka Capacity Building in Energy Circular Economy”, EU project 610173-EPP-1-2019-1-LK-EPPKA2-CBHE-JP, www.euslenergy.com/index.html

universities in Sri Lanka¹⁰ have teamed up with three universities in Europe¹¹ and the companies Learnify¹² and FutureLearn with the aim of establishing the “stackable” concept in the energy sector in a nation-wide, combined academic environment, and also establish a (smaller) “micro-credential” program for a broader scale of learners within FutureLearn. The T.I.M.E. Association is an Associate Partner of this project, and some of its members will be voluntary contributors to different parts of the program.

In this project all the shareable “small-scale learning modules” will be stored in a repository (figure 1) so that different universities (not only those involved in the EUSL-Energy project but also others in a global perspective) can re-use the parts they need, and then also add (into the repository) the new learning modules these universities and individual teachers develop, given their local needs.

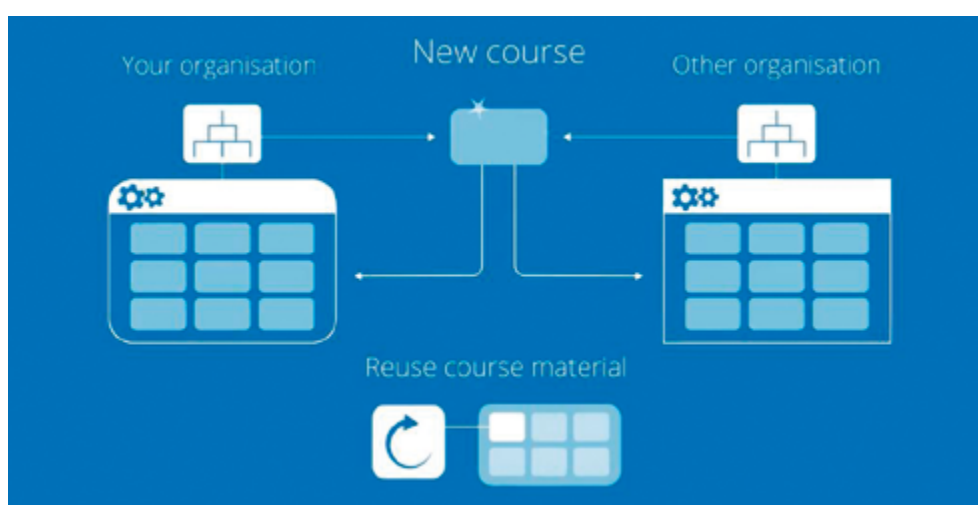


Figure 1: Concept of Learnify repository (<https://innoenergy.learnify.se>)

10. Open University Sri Lanka, University of Peradeynia, University of Moratowa, University of Ruhuna

11. CentraleSupélec, University of Twente, KTH

12. <https://learnify.se/en>

These new modules will be combined with already existing open resources from the earlier developments within the Learnify repository (see figures 2 and 3 as examples) and many other sites.

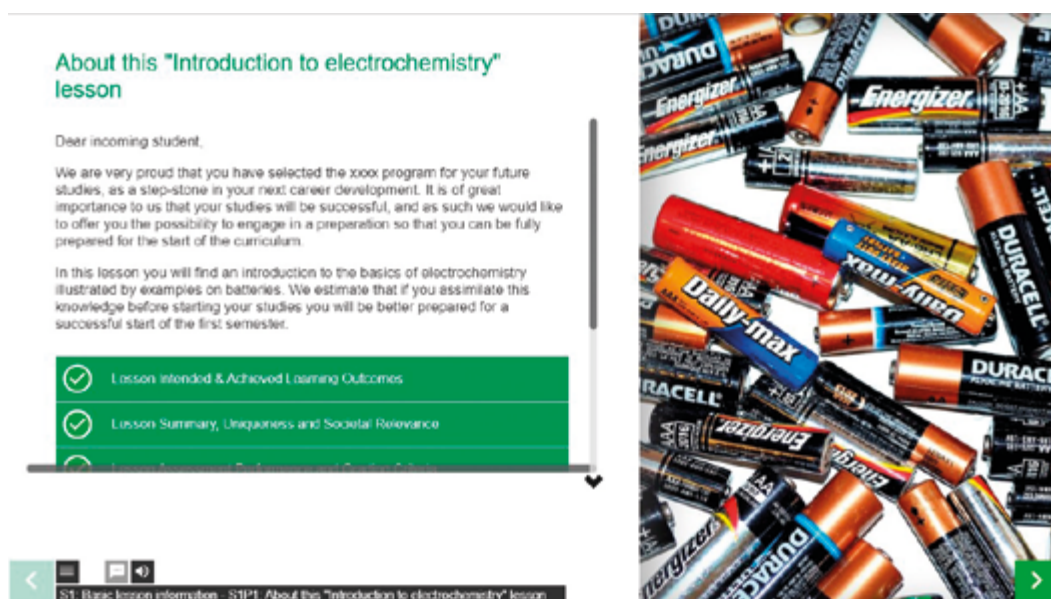


Figure 2: Construction of a "lesson"

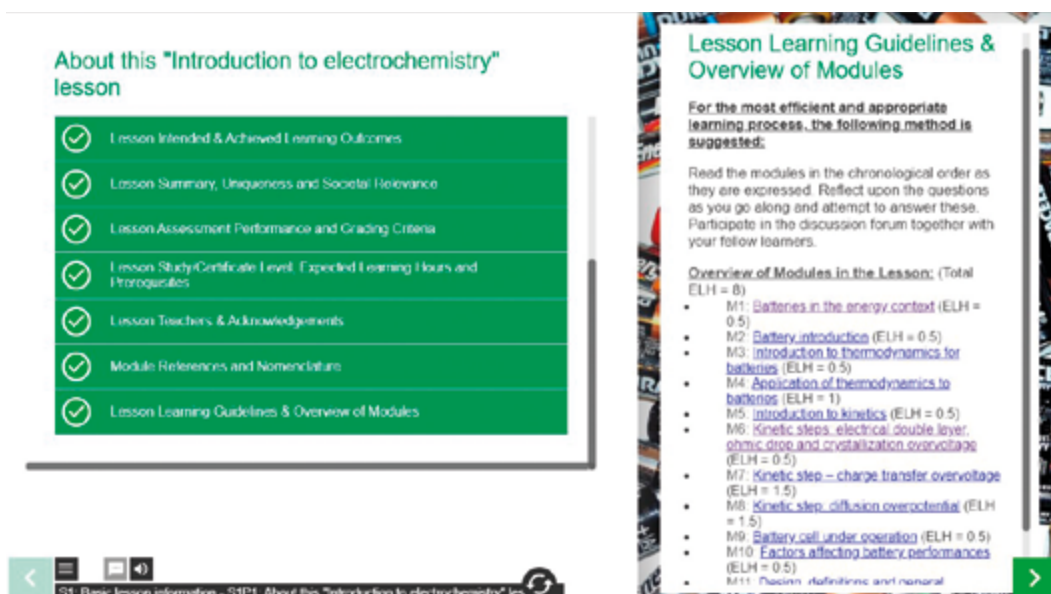


Figure 3: How to reach the individual learning "modules" from the "lesson-level"

The repository identified (Figure 1) is constructed in a way that it can be used as a "storage and distribution mechanism" as well as a basic Learning Management System (LMS), but it can also easily be coupled to a more advanced LMS platform a specific organization might use. Thus, any organization can easily re-use the repository material in their usual environment, and students and teachers do not need to learn any new "tools".

All the existing, and to be developed, material in the repository is based upon Creative Commons licenses. As such it can be used towards not-for-profit education at self-cost but also towards for-profit education after agreement with the corresponding contributors¹³. It can then be used both towards local academic and professional accreditation. Individual units as well as larger blocks of a subject can be re-used. This development is entirely up to the individual teachers, and a “local program director” has significant flexibility to design individual programs and to “package” the material so that it is adapted to the local environments, while re-using the general, global content in any appropriate way. The key to re-use of material in various local environments is that all the basic learning modules used are (i) small (0.5-max 5 ELH), in order to be accepted by other teachers, (ii) self-sustained (with appropriate ILOs and assessments), (iii) allowed to be copied and modified, and (iv) inclusive of clearly Intended Learning Outcomes, which (v) can be adapted by the local teacher. Such adaption can be done by the local university alone, or, preferably, in collaboration with the different teachers who originally developed the material.

The collection of individual, high-quality learning units from a large number of teachers is, of course, the most important factor in the concept, and it has taken considerable time to establish such a trustworthy collaboration among teachers. The second most important factor in the concept is the possibility of very easily combining basic learning modules into a set of larger subject areas (presently called “Lessons”, each lesson consisting of subject-blocks of around 10-40 Estimated Learning Hours) with the appropriate “Lesson-level” intended learning outcomes. All the learning content is in the individual learning “content modules”, and the “lessons” are just the framework of how the “teacher-architect/guide” establishes the learning environment locally. These lessons are collected, and thereafter easily reached by learners, within the Learnify repository, while the learning units can be available in any other digital way.

There is presently no external review performed on the material since the material presented, including assessments, corresponds to education that the teachers do at their home university and as such the quality is equivalent to what is accepted at that university. Nonetheless, within the EUSL-Energy project framework, a set of quality frameworks, based upon the EIT-Label Handbook¹⁴, is in the process of being established¹⁵.

Next Steps

Since its creation a few years ago, the concept is under constant expansion. Presently the following steps are planned:

- In 2020 The OUSL intends to deliver accreditation for an “OUSL Energy ABC Program Certification Series”, which is largely based upon already existing learning modules, assembled into “certification programs” of around 100-200 ELH each, and offer them to both academic and industry-based professional learners.

13. This is similar to the models used by music streaming services with a payment to the originator only in the case that a profit organization is initiated, but different as the repository contributors are willing to share their material for free as long as a not-for-profit system is employed.

14. <https://eit.europa.eu/library/eit-label-handbook-2018>

15. To be implemented in the 4th quarter 2020.

- Within the Asian Association of Open Universities, the Sri Lankan universities have plans to expand the concept towards a collaboration with two universities each (one open and one on-campus) in India and Indonesia, together with seven EU universities.
- Inside Sri Lanka one private university, which does not yet have an energy program, has shown interest in taking part in the overall concept.
- Within the T.I.M.E. Association a similar concept has been discussed with eight universities in Brazil, Bolivia, and Cuba, with essentially the same base of EU-universities.

The overall concept is, of course, fully open for other partners to join in, to share their own material, and to re-use already existing material, both for individual learning modules and for creating full-scale academic/professional programs based on the material available¹⁶.

Acknowledgements

The collaboration with all the teachers who so far have offered their educational material towards the repository, allowing for re-use and sharing, is greatly appreciated. It is their hard work, coupled with the willingness to share their material globally and collaborate over university borders, that will mark the success of the initiative. With all the decision makers at different levels in the organizations mentioned (EIT, EIT InnoEnergy, EIT Climate, EIT Digital, and T.I.M.E. Association), and their moral and in some cases also financial support, and with the company Learnify behind the repository, the collaboration has been essential for the development and progress of this educational initiative.

The future funding from the European Commission within the project 610173-EPP-1-2019-1-LK-EPPKA2-CBHE-JP is also gratefully acknowledged.

16. <http://time.learnify.se>

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