COLLABORATIVE ONLINE INTERNATIONAL LEARNING IN RADON MEASUREMENTS

S. SCHREURS
Faculty of Engineering Technology, Nuclear Technology, CMK, UHasselt
Agoralaan building D, 3590 Diepenbeek, Belgium

School of Educational Sciences, UHasselt
Agoralaan building H, 3590 Diepenbeek, Belgium

W. EERDEKENS, W. SCHROEYERS
Faculty of Engineering Technology, Nuclear Technology, CMK, UHasselt
Agoralaan building H, 3590 Diepenbeek, Belgium

C. LICOUR, I. GERARDY
Dept of Nuclear and Medical Physics, HE2B-ISIB
Rue Royale, 150, 1000 Brussels, Belgium

S. SOARES
Departamento de Física, Faculdade de Ciências, Universidade da Beira Interior
Rua Marquês d'Ávila e Bolama, 6201-001, Covilhã, Portugal

F. GROPPI
Physics Department, Accelerator and Applied Superconductivity Laboratory – LASA
Università degli Studi di Milano – UNIMI, Segrate (MI), Italy

T. SAVITSKAYA, I. KIMLENKA
Faculty of Chemistry, Belarusian State University
Leningradskaya str., 14, Minsk, Belarus

ABSTRACT

Due to COVID, academic staff are challenged to explore new educational approaches that are attractive, sustainable and transferable. This Collaborative Online International Learning (COIL) on radon aims to offer virtual mobility and internationalization@home in practical training. Eleven students from four Cherne universities participated in this COIL. Each institution has research infrastructure and expertise on radon measurements. Microsoft Teams was used to organize interactive sessions. During the final presentation, practical skills obtained during their research@home were visualised to all students. Finally, procedures and data were gathered in a portfolio on MS Teams. Students were evaluated on laboratory work, portfolio and presentation.
Student feedback will be used to optimize future COILs. In the framework of the RADIUM Erasmus+ Capacity Building project, Belarus State University professors evaluated the activities for further development within the design of a new Master of science program in 'Radiation Protection and Nuclear Safety'.
.

1. Introduction

The organization of international training schools is a major part of international cooperation. Due to the COVID pandemic the organization of the "traditional" on-site training schools was no longer possible. An alternative online approach has been developed in this training school on radon. The overall objective of this collaborative online interactive learning (COIL) activity is to share the knowledge and knowhow that each university possesses concerning radon in general and more specific on applications and measurements. The participating students of

each university learn how to transfer the information and skills they acquired during their on-site experiments within this program to all other students from the different universities.

Due to the above mentioned constraints in mobility, and the historic evolution of the use of more online platforms, modern technology and practices became more available at all higher education institutions. Although many different platforms are used between institutions (Blackboard, Toledo, MS Teams, Google classroom/meet, Moodle, …) and other digital tools and 'classroom' set-ups are available, a joint total approach still needs to be framed. Moreover, a COIL cannot be set up without a good educational network of institutions that know each other's strengths, expertise and infrastructure. Furthermore and preferentially, it grows from a common understanding of the importance of international collaboration not only from the technical and practical point of view but also from the intercultural point of view.
A COIL is not a technology or a platform but a new educational approach. It is not an online course provided at one partner and opened to all partners but it is based upon developing team taught learning environments where teachers from different cultures work together to develop a shared syllabus, emphasising experiential and collaborative student learning activities. (1) Classes can be online but activities are blended forms of interaction between students of different partners and activities at the home institution guided by their professors face to face. It is designed in such a way that not only technical skills are transferred but also social and intercultural skills, and to encourage other employability and soft skills like teamwork, communication, … for their future career.

This training school is the first attempt to (temporarily) replace an on-site practical training on radon with a COIL within the Cherne network. Cherne is an open European academic Cooperation for Higher Education on Radiological and Nuclear Engineering (http://www.cherne.ntua.gr/). The aims of CHERNE are to share competences and facilities in organizing teaching activities, mainly at Master level, and to enhance mutual support by learning from each other, by exchanging experiences and by regular mutual reflections during annual workshops. It has a long experience in intensive programs, Erasmus projects and strategic partnerships. This initiative is a continuation of the recent 'train the future trainer in radiation protection and nuclear technology' Erasmus+ strategic partnership (2018-2021).
The outcome of this COIL on radon will be used to optimize similar online training in the future and more specifically to explore the implementation and integration of this format within the courses of the new master in Nuclear Safety and Radiation Protection of the Erasmus+ capacity building project RADIUM.

2. Partners and participants

The COIL was organized in cooperation with several partners from the CHERNE network. CHERNE was founded in 2004 and since then many international projects were organised, mostly with European grants and more than 300 students could follow teaching activities in specific nuclear topics and at specific nuclear facilities enabled by the partnership. New activities are announced on their website http://www.cherne.ntua.gr/.
An overview of all participating institutions is shown in figure 1. Their particular expertise and contribution to the COIL is described below for each university individually.

Fig 1: Overview participating institutions and students

2.1 Hasselt University

Hasselt University was responsible for the organization of the training school. Three staff members participated to guide their two participating students. This institution focused on radon measurements in lab designs and radon exhalation chambers and HPGe measurements (2). The organization was also involved in the development of the concept, the feedback and evaluation of the students.

2.2 University College of Bruxelles-Brabant

La Haute École Bruxelles-Brabant have provided the online platform MS TEAMS where all documents are gathered and in which the online sessions are planned. Two staff members participated to guide their two participating students. This institution focused on radon indoor measurements and in the lab designed radon setup using charcoal canisters for calibration, validation and measurement (3).

2.3 University of Milano

From the university of Milano, one staff member participated to guide her three students. This institution focused on indoor radon measurements based on CR39 and environmental measurements using HPGe measurements (4).

2.4 University of Beira Interior

From the university da Beira Interior, one staff member participated to guide her four students. This institution focused on radon exhalation and environmental measurements based on CR-39 passive detectors and the RadonEye (5).

2.5 Belarussian State University

Two professors for the Belarussian state university BSU took part in introduction sessions and the final presentations to observe the concept of the COIL and evaluate the format for future implementation in the Erasmus+ Capacity building RADIUM project course development (6).

3. Organisation of the COIL

3.1 Program and activities

Over a period of two months the online and onsite activities were organised following the program shown in figure 2. The training school started with an introduction session. The first part, and maybe the most difficult one in an online setting, was to get to know the fellow participants by individual introductions. Unfortunately, this remained superficial. Next, the content of this training school was explained, along with the output that was expected of the students. The output can be divided in two parts. The first part is an online interactive teaching unit/presentation, in which each group/university explains the work they have done within this course and transfer the knowledge learned to all other participants. We specifically asked to use as many pictures and videos as possible. The second part is a portfolio that contains all documents, procedures, experiments, results etc. that was obtained or used during this training school. In this way, all acquired skills (academic, soft and trainer skills) could be evaluated. The first online session was finalized with a presentation, giving a general introduction about radon, prepared by the students of UHasselt. In advance, they organized an interview with an expert in radon from the federal agency of nuclear control (FANC) and filmed this interview. These clips were used during the presentation to make it more interesting.

After the introduction session, we scheduled three weeks to do research about radon and to figure out what specific subject each group wanted to focus on. As additional study material, 2 samples (a reference phosphogypsum and a granite sample) were send to all institutions. If possible, this could allow an intercomparison of methods between the institutions.

In the second session, each group presented the research they have done and the workplan they have developed to each other. The purpose of this session was to let the students go in interaction about the design of their experiments and workplan. They could give suggestions or remarks to each other to optimize the results obtained at the end.

Thereafter, the students got one month to execute their workplan and to obtain their results. Each group did their research at their own institution under the guidance of their own professors.

In the third online session, the students were completely free to discuss whatever they wanted about the final presentations and output. They explained to each other how they will make the presentations interactive and what kind of tools they will use. The staff members didn’t participate in this discussion. After the “formal” interaction, the students were given some time to get to know each other better. In this way we tried to have some social interaction as much as possible.

In the final session, each group presented their experiments and results. They made use of videos and online quiz platforms to make the presentation interactive and more interesting and improved the transfer of skills. It enabled to experience the practical work as if it was a real-life demo in their lab. The equipment and methodology on radon used at each university and the organisation of the experiments in group were visualised. It does not replace the on-site training but offers a good alternative. The students were enthusiastic and submitted work was of good quality. Although, the approach can be improved a lot as is explained in the critical reflection.

Finally, the portfolios had to be uploaded on the MS Teams site.

Date & time (CET)	Activity	Description
8 March: 4pm-6pm	Introduction session	- Content training school - Radon introduction
Research and development workplan		
29 March: 3pm-5pm	First interaction moment	- workplan - research
20h of work in lab or on site		
26 April: 4pm-6pm	Second interaction moment	- Discussion about presentation of the results
4 May: 3pm-6pm	Final presentations	- Presentation online teaching unit

Fig 2: Program of online activities and in between research/lab periods

3.2 Platform

The entire COIL was organized within the Microsoft Teams platform. Firstly, this platform allowed us to create and engage in online meetings. If needed and approved by all participants, the meetings could be recorded for further use. Secondly, all information and documents needed for participants could be placed within the platform and accessed easily by everyone involved. This way, all output produced by the students was gathered on this platform as well. The main advantage is that all learning materials and all additional documents can be accessed easily by all involved in an easy clear manner.

3.3 Evaluation

The evaluation was divided into 3 main components described below. At the end, a credit attest of 2 ECTS was obtained by all students.
The laboratory work was evaluated by the staff members of each university for their own students. Due to the long distance we could not evaluate other students. The laboratory work counts for 30% of the final mark.
The final presentations were evaluated with all staff members together. Because this interactive teaching unit was the most important output it counts for 40% of the final mark. This part was very important because with these presentations the knowledge is passed on to the other students.
The portfolio had to contain all documents made or used throughout the duration of the training. It is important that it was well structured and everything was clearly and scientifically correctly explained. The portfolio counts for 30% of the final mark.

4. Critical reflection and future perspectives

To evaluate the impact and success of this COIL, an evaluation form was distributed among the students in order to gain feedback for future optimization likewise collaborations. The most important questions and responses are shown in figure 3.
From figure 3 can be concluded that all participants were satisfied with the online training in general. The training increased their general knowledge in radon and radon measurements. As one of the main goals of the COIL was to exchange the different knowledge concerning radon between universities, it can be stated that this goal was achieved. As the training was organized in an online format, it was important to keep the duration of the session limited. Thus all participants were fully focused for the entire duration of each session. A duration of two hours in general for each session was chosen and approved by the majority of the participants. All participants indicated that they would participate in future similar trainings.

The most important working point for future optimization would be to make sure that all participants and staff involved are fully aware of all details and expectations of the training. For example, the intercomparison between the methods used by the different groups using the study materials sent to them was not clear enough stated. A solution would be to make use of general documents with all guidelines and to have extra short coaching sessions, moments of interaction in between. Also, a first social online event just to introduce all participants to each other would break the ice before the real training starts. And finally, the introduction lecture on radon could be a good activity to start not only from one institution but in collaboration between institutions. The international dimension of the subject should get more attention in the program itself.

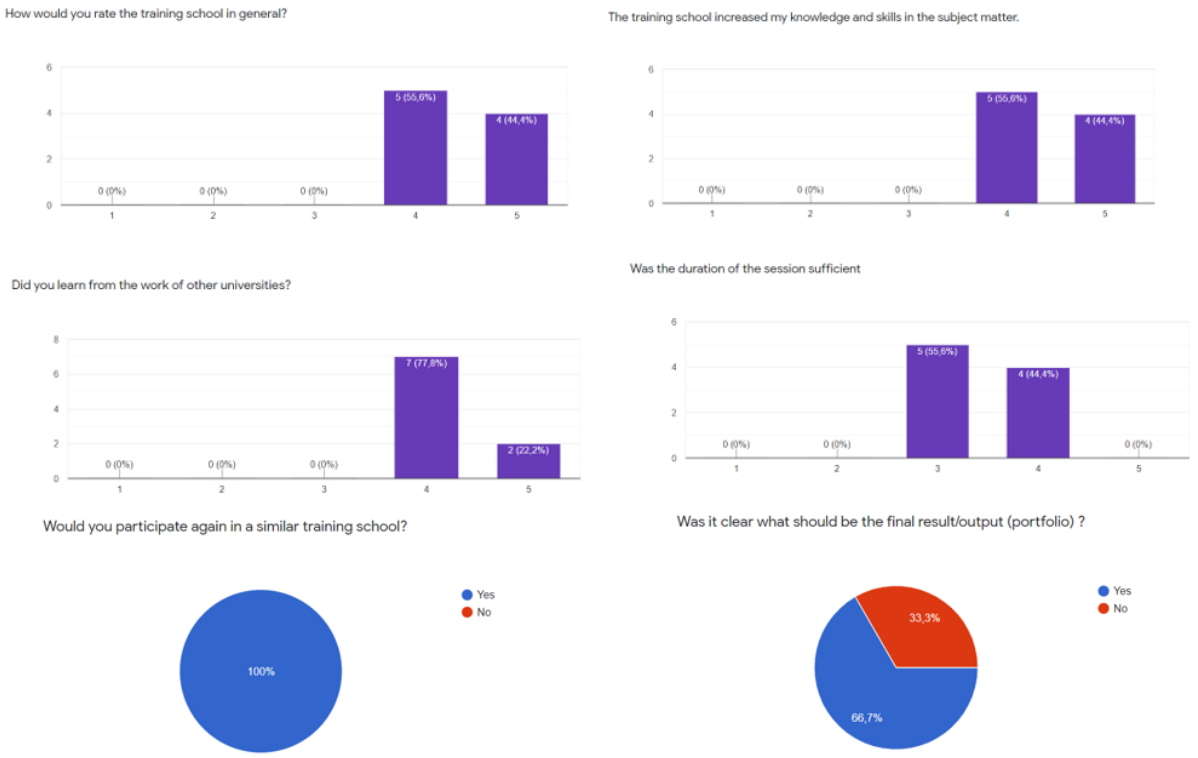

Fig 3: Main questions and responses of the evaluation

5. Acknowledgements

This project was carried out with the support of Erasmus+. 'RADIUM' is an Erasmus+ Capacity Building in Higher Education (CBHE) project, 'Train the future trainers in radiation protection and nuclear technology' is an Erasmus+ Strategic partnership, both funded by the European Commission and managed by the European Education and Culture Executive Agency (EACEA). The authors are grateful for the support of the federal agency of nuclear control (FANC) in the first online session. It is also developed by UHasselt/Dios in the framework of the internationalisation project 'lifelong learning goes international'. And last but not least, this training would not have been so successful as it was without the enthusiasm of all students and all trainers involved.

6. References

1. J. Rubin, (2017) Embedding collaborative online international learning (COIL) at higher education institutions. An evolutionary overview with examples. *Internationalization of Higher Education, 2*, 27–44.
2. K. Gijbels, P. Krivenko, O. Kovalchuk, A. Pasko, S. Schreurs, Y. Pontikes, W. Schroeyers, (2020) The influence of porosity on radon emanation in alkali-activated mortars containing high volume bauxite residue, *Construction and Building Materials, Vol 230*, *116982*, https://doi.org/10.1016/j.conbuildmat.2019.116982
3. C Licour, F Tondeur, I Gerardy, N Medaghri Alaoui, N Dubois, R Perreaux, N Gerardy, D Christiaens, (2017) 226Ra, 222Rn and permeabilty of Belgian Soils in relations with indoor radon risk, *Radiation Protection Dosimetry*, *Vol 177,1-2,*168–172, https://doi.org/10.1093/rpd/ncx163
4. F. Groppi, (2018) Radon laboratory for secondary schools*, IL NUOVO CIMENTO C. - ISSN 2037-4909, 41:3*, 127.1-127.9*. http://dx.doi.org/10.1393/ncc/i2018-18127-3*
5. S. Soares, J. Kessongo, Y. Bahu, L. Peralta, (2020) Comparison of radon mass exhalation rate measurements from building materials by two different methods, *Radiation Protection Dosimetry*, *Vol 191, 2, 255–259*, https://doi.org/10.1093/rpd/ncaa163
6. RADIUM. (2021, November 4). Retrieved from RADIUM: https://www.radium.by/