

EFFECT OF COVID ON THE AUSTRIAN UNIVERSITY COURSES IN NUCLEAR

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ABSTRACT

Nuclear Education in Austria is limited to three universities. The main education institute in nuclear is the Technical University Vienna with the 250 kW TRIGA research reactor. Some courses are also taught at the TU Graz and the Montanuniversity Leoben.

The Covid Crises effected all university education. Courses were shifted towards online formats and made practical courses impossible for over a year. This paper will discuss the changes in the education format. Lectures with many students were easily shifted towards an online format, while smaller lectures were cancelled. This paper will present the challenge of the change to an online format and the benefits that appeared. It will describe different online solutions and discuss its pros and cons for nuclear education with special focus on the Austrian situation. An increased interest in nuclear topics was obvious, including high interest in all nuclear subjects and a higher number of bachelor- and seminar theses.

The paper will also describe how the Atominstitut managed to restart courses in person after 12 months.

1. Introduction

1.1 Nuclear Education in Austria

Austria is per constitutional-law a strong anti – nuclear country. Nevertheless, it is necessary to maintain a body of knowledge about nuclear topics. Hence a basic nuclear education is guaranteed at Austrian Universities. Three universities offer courses within their curricula that reach beyond radiation protection or risk perception of nuclear.

Courses at the three mentioned universities are held by the authors. The main point of focus is at the Atominstitut in Vienna. The institute offers a variety of nuclear education:

1. Nuclear Engineering I (introductory course to nuclear subjects and reactor technology)
 2. Nuclear Engineering II (research reactor technology)
 3. Reactor Physics
 4. Physics of Severe Reactor Accidents
 5. Practical Course on Reactor Physics at the reactor
 6. Practical Course on Reactor Instrumentation at the reactor
 7. Alternative Nuclear Energy Systems
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8. Practical Courses at the Reactor for Safeguards Inspectors of the IAEA
 9. Practical Courses at the Reactor for foreign students (UK, Belarus, EERRI (Eastern European Research Reactor Initiative), ENEEP (European Nuclear Experimental Education Program)
- Possibility for Bachelor-, Master- and PhD Theses
 - At the Technical University of Graz, the author teaches Nuclear Energy and Environment, and at the Monantuniversity Leoben a basic introduction course to Nuclear Energy.

This paper will present the challenges authors (and lecturer) phased during the Covid Crises and how the authors tackled the problems.

1.2 Situation before March 2020

The Atominstitut offered the above described lectures at every year. The lectures were held once a week, with a written exam at the end of the term. For the courses Nr. 1, 3 and 4 usually 20 students attended in person, and throughout the year we took about 30 exams.

Course Nr. 1 and 3 are semi – compulsory or elective (students need to choose from a catalogue a certain amount of ECTS), the others are voluntary but still count for the end of studies.

The Atominstitut offered the practical courses once a year (course Nr. 5 in winter term, course Nr. 6 in summer term). Throughout the months January and June, the institute can host six students per week and course. The practical courses are completely booked with waiting lists.

The situation at the TU Graz is slightly different, the lecture offered is also semi-compulsory, but not included in the Physics studies. The lecture is offered once a year. Usually, 40 students were present in the lectures and up to 70 took the exam each year.

Regarding the Bachelor-, Diploma- and PhD thesis: Till 2020 one to two bachelor theses were written each year, as well as diploma theses. Every two years one PhD thesis is defended.

2. Education during the COVID Crises (March 2020 – October 2021)

2.1 Lectures during Lockdown

The crises hit all lecturers in the middle of the term start. The author had just given its first lecture at the TU Graz, when the first lockdown was announced. The head of the institute at TU Graz thought to postpone the lecture first or cancel it. Mail discussions with the students were initiated to get an idea about their interest. The interest in the lecture was high, and a technical solution to shift the lecture to an online format was proposed by the students. At the time (March and April 2020) technical solutions for online lectures were not available for small lectures, however the universities accepted and appreciated creative solutions.

Students proposed gaming-VoIP-software, and the lecture “Kernenergie und Umwelt” was held for three months via a Discord server¹. Students were able to communicate via a chat and saw a stream of the presentation (see Figure 1).

¹ <https://discord.com/>



Figure 1: Example of Lecture during Lockdown

The feedback was good, during the evaluation of the lecture students noticed that the format enabled easier questions, and a good possibility to discuss the topic. The author received several requests throughout the term to include students to the lecture, as it was recommended by fellow students.

Practical Courses and lectures at the Atominstitut were cancelled during the summer term (March – June 2020).

2.2 Regulations

The COVID regulations at the TU Wien and TU Graz started to get implemented in summer 2020. Non-mandatory courses had to be held remotely, practical courses were allowed to be held in person again, but with strict restrictions. The university implemented regulations that consisted of:

- restriction of 1 person per 2m²
- non mandatory lectures were cancelled
- only beginners lectures and mandatory laboratory courses were allowed in person
- 2 m distance between individuals
- mandatory FFP2 masks within buildings
- home office mandatory for staff
- 45 min break between two courses for cleaning

2.3 Changes on Lectures and exams

The regulations described in chapter 2.2 indicate that classical lectures were impossible during the winter term 2020/2021 and summer term 2021 all nuclear based lectures had to be held remotely. The universities had upgraded their video stream systems and offered professional solutions for the lecturers.

The lectures Nuclear Engineering and Reactor Physics were both held remotely. Both lectures were live sessions, recorded during the session and made available for students afterwards. The system used was ZOOM². The interest increased drastically (over 70 applications for

² <https://zoom.us/>

Nuclear Engineering). The course was offered before March 2020 only once a year - and is now offered twice a year.

The exam for nuclear engineering was a written 1,5 h test. During the pandemic situation a change was proposed - the online course system (a Moodle based tool) offers exam possibilities. The lecturer therefore changed the exam to a 1h online test (open book test) and a two-page homework about a Generation IV Reactor system. Students welcomed the system; the lecturer could not see a change in gradings.

Reactor physics exam remained oral but held via ZOOM. Nuclear Engineering II and Physics of Severe Reactor Accidents were cancelled.

In the current term we offer a hybrid format - two lectures in person (with strong access regulations - vaccinated, tested or cured and contact tracing), other lectures are held remotely. The exam format will not change. Reactor Physics uses the recorded lectures and offers a live zoom meeting every month for questions and answers.

The lecture at the TU Graz was also held remotely using WEBEX³. Lectures were also recorded. The recordings at the TU Graz needed more effort than at the TU Wien. Due to access regulations, it was not possible to use the WEBEX recording directly - bigbluebutton⁴ was offered as a solution. The exam was also changed to the above-described format (online test and a written homework).

The lecture and exam at the Montanuniversity were shifted in winter term 2020/2021 towards an online format. In the following year it was held in a hybrid format - using a ZOOM Meeting and a microphone for questions from the audience to the remote presenter.

3. Effects on Courses

3.1 Effects on Lectures

As described shortly above the authors saw an increase of the numbers of students for theoretical lectures. One reason was presumed to be the reduced offer of lectures during the pandemic situation. Nevertheless, especially for Nuclear Engineering I and the lecture at TU Graz it was also seen that the students had a higher interest in nuclear topics, compared to previous years. This might be related to the increased discussion on climate change in the media, as students indicated this as a reason to attend the lecture. The effects from the changed exam modality were minor, students reported that the format suited them. Also that they had to do a small research on a specific reactor led towards a better understanding of reactor systems.

3.2 Effects on Practical Courses in Vienna

Practical courses for students at the Atominstitut were allowed again in summer term 2021. Groups were only allowed to host five students (instead of six). Also all the above mentioned regulations regarding distancing, space and contact tracing were in place. Starting this term stronger regulations came into operation, access is only possible for vaccinated, cured or tested students.

3.3 Effects on International Courses

From March 2020 till February 2021 all practical courses at the Atominstitute were cancelled. Courses started again in February 2021. Participants to international courses had to be tested every two days with a PCR test in order to be allowed to take part in the course.

³ <https://www.webex.com/de/index.html>

⁴ <https://bigbluebutton.org/>

3.3.1 European Nuclear Experimental Education Platform (ENEPP)⁵

This included also the newly founded ENEPP project. The Mission of ENEPP is to fulfill the needs of European users in order to significantly enhance their experimental education and hands-on activities in nuclear curricula, particularly in the field of nuclear safety and radiation protection. Five universities partnered up (TU Wien, STU Bratislava, BME Budapest, CTU Prague and IJS Ljubljana). The first course was held remotely at the JSI (see Figure 2), also the courses that followed till September 2021 were held remotely. Starting from January 2022, courses will be in person again.



Figure 2: Courses by JSI for Uppsala University (ENEPP)⁶

The example shows well that the force towards digital formats is working. Also practical courses can be held remotely in principle, even though the hands on part is missing.

3.3.2 Other international Courses

The first course that took place again was for Junior Safeguards Inspectors in February 2021. Seven Inspectors were trained at the reactor. Strict safety measures were in place to protect the participants and the trainers.

The EERRI (Eastern European Research Reactor Initiative) offers paid hands on training by the IAEA for researchers from all over the world. This year's course was limited to 8 participants (also due to travel restrictions), held in October and November 2021. Participants get training at the TU Wien (see Figure 3), BME Budapest and the CTU Prague. As the Czech Republic did not allow participants to enter from Hungary, they had to stay in Budapest and were trained

⁵ www.enepp.org (viewed on 10.11.2021)

⁶ <https://www.enepp.org/news/from-the-28th-september-to-the-2nd-october-the-jo%C5%BEef-stefan-institute-hosted-their-first-remote-course-in-experimental-reactor-physics/>, viewed on 10.11.2021

remotely. This measure was communicated at the last minute and shows the good improvisation possibility that is in place due to the pandemic situation.



Figure 3: EERRI Course in November 2021 at Atominstitut

3.4 Effects on scientific work by students

The last point that this paper will discuss is the effect of the COVID crisis on scientific work by students. This includes so-called project theses (theses written by master students as a training for the master thesis), bachelor thesis, master thesis and PhD thesis. As already mentioned the authors saw an increase for the interest in lectures. In Vienna and Graz more students subscribed to the courses and took the exams. If this would only be related to the lack of other possibilities, no increase in following works would be seen.

But, in the years 2015 - 2020 the authors usually supervised five project theses, one bachelor thesis and every two years a master thesis. Since June 2020 the authors supervised significantly more theses, namely 11 bachelor theses, and currently eight project theses (finished or in progress). The increase is not only linked to the lack of other possibilities, but also to the enhanced increase in nuclear topics. This can be associated to the climate crises discussion that is currently going on.

4. Conclusion

This paper has described the changes the COVID crises has had on nuclear education in Austria. All lectures had to be shifted towards online format, which still is the case at the moment in November 2021. This shift towards the online format led to a student increase, as other lectures were completely cancelled. However, the higher number in Bachelor and Project thesis cannot be explained by this shift only. During online lectures, the authors felt an increased discussion interest. As indicated by students, this could be explained by the current climate change discussion.

Practical courses were resumed after one year, with strong measures in place. New formats were implemented (ENEEP), that showed how hybrid or online practical courses are possible. The COVID crises also showed the flexibility of course organizers, as the EERRI result described chapter 3.3.1 shows.

Concluding, the authors were able to easily shift their lectures towards online formats, which was greatly appreciated by an enhanced interest by students. Also, in the future authors plan to have online courses (pre-recorded or live) ready for students.