

**GRE@T-
PIONEER**



Teaching advanced courses in hybrid learning environments and using active learning techniques – Experience from the GRE@T-PIONEER project

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BACKGROUND

- **Advanced courses** = often offered as intensive onsite “workshops” or “summer courses”
 - Too condensed format to lead to “efficient” learning
 - Issuance of certificates of attendance (with no real measure of engagement, progress and understanding)
- **Online and hybrid learning environments** = more accessibility and flexibility
 - Often low engagement and high drop-out rates

BACKGROUND

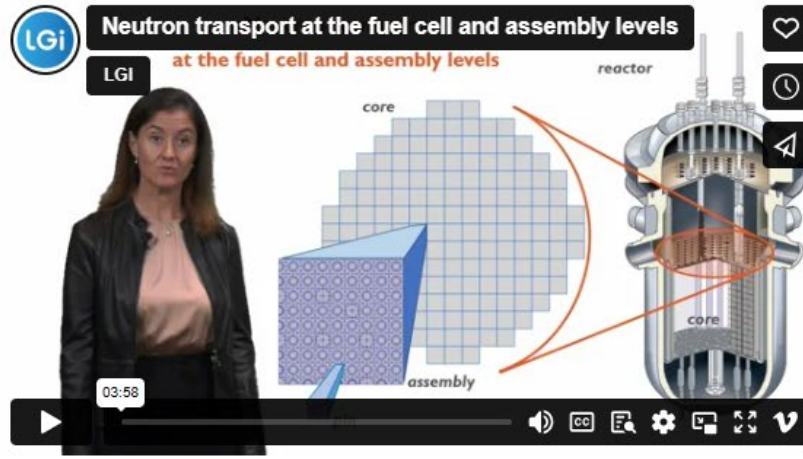
- “Innovative” learning design proposed in the GRE@T-PIONEER project, having for objectives:
 - To offer **advanced** courses
 - In a **flexible** manner
 - Having a **high engagement** of the participants in the activities
 - And making sure that the **participants successfully learn** the concepts/principles/methods

WHAT IS GRE@T-PIONEER?

- **18** university teachers from **8** different universities in **6** different countries
- Main **goals** of the project:
 - Maintain or further develop **competences in computational and experimental nuclear reactor physics and safety**
 - Deliver **top-class courses** using **state-of-the-art pedagogical methods** (active learning through flipping)
 - Create a **community of reactor physicists**

COURSE OFFERING

- **9 course modules** offered:
 - Nuclear cross-sections for neutron transport
 - Neutron transport at the fuel cell and assembly levels
 - Core modelling for core design
 - Core modelling for transients
 - Reactor transients, nuclear safety and uncertainty and sensitivity analysis
 - Radiation protection in nuclear environment
 - Hands-on exercises on the AKR-2 training reactor
 - Hands-on exercises on the CROCUS training reactor (onsite only)
 - Hands-on exercises on the BME training reactor
- **More info and registration at <https://great-pioneer.eu/register>**

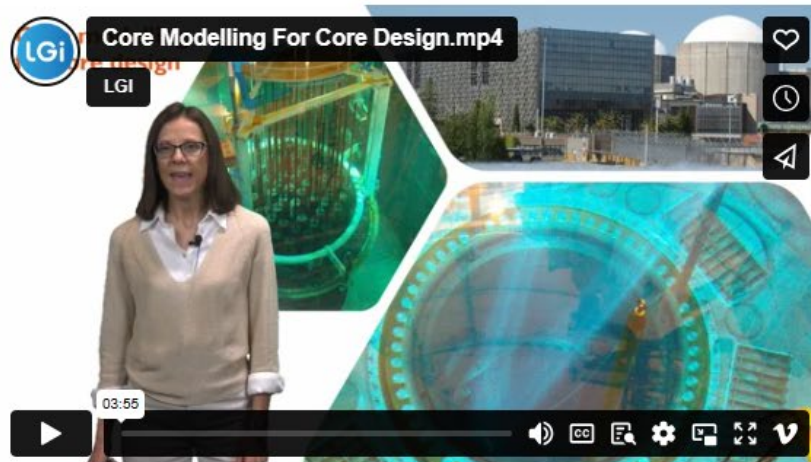


NEUTRON TRANSPORT AT THE FUEL CELL AND ASSEMBLY LEVELS

- The principles of probabilistic methods in steady-state conditions for fuel cell and assembly calculations.
- The principles of deterministic methods in steady-state conditions, their approximations, and their range of validity for fuel cell and assembly calculations.
- The use of those methods for macroscopic cross-section generation.

[DOWNLOAD COURSE LEAFLET](#)

[EXAMPLES OF COURSE VIDEOS](#)



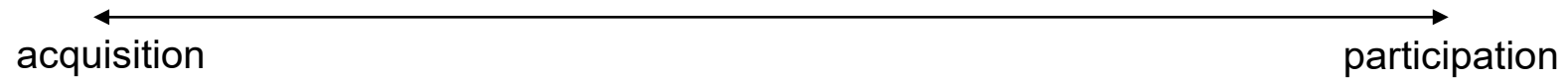
CORE MODELLING FOR CORE DESIGN

- The principles of probabilistic methods in steady-state conditions for core calculations.
- The principles of deterministic methods in steady-state conditions, their approximations, and their range of validity for core calculations.
- The use of those methods for reference calculations or for core design, operation and safety analysis.

[DOWNLOAD COURSE LEAFLET](#)

PEDAGOGICAL METHOD

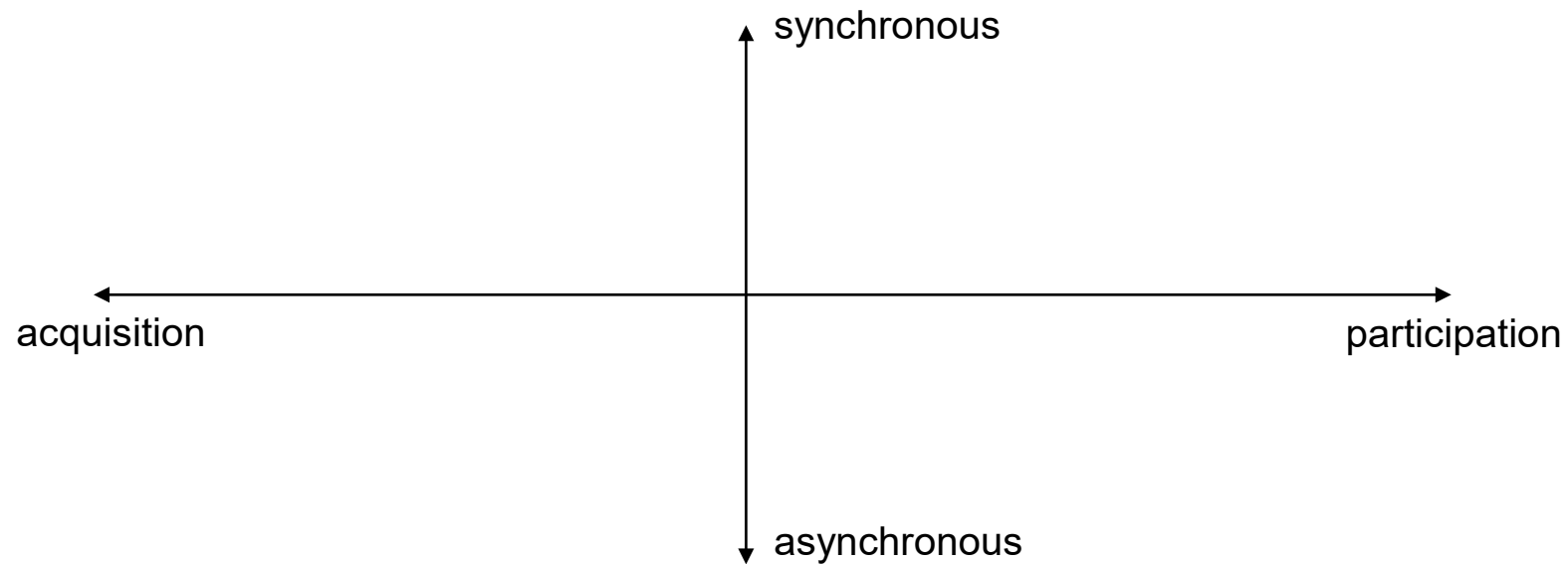
- Flipping:



Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. Educational researcher, 27(2), 4-13.

PEDAGOGICAL METHOD

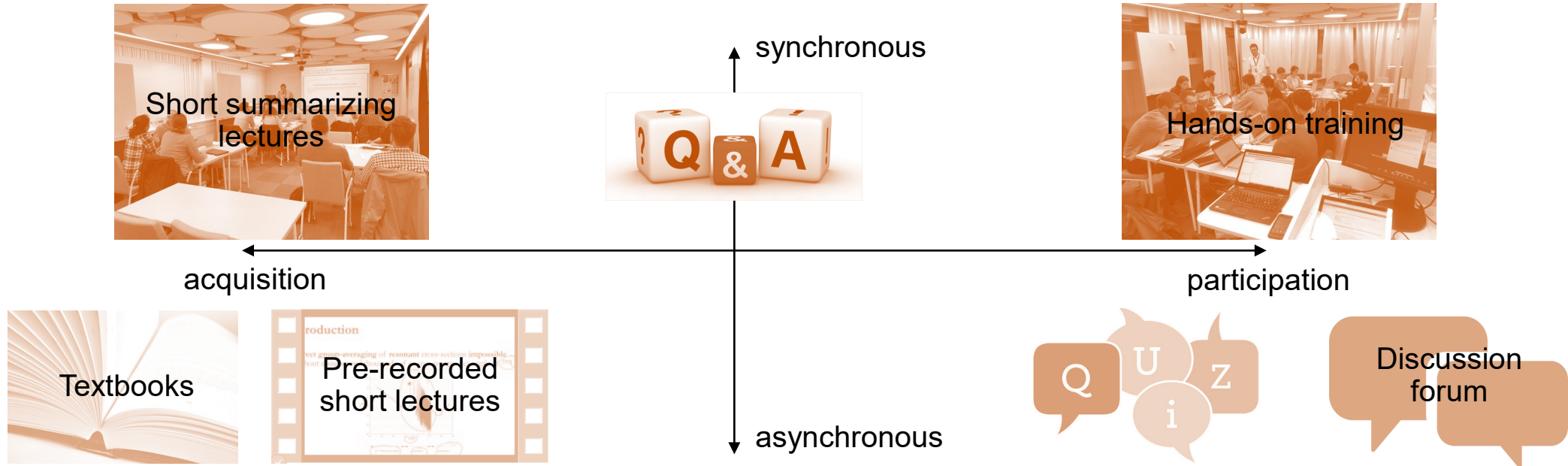
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PEDAGOGICAL METHOD

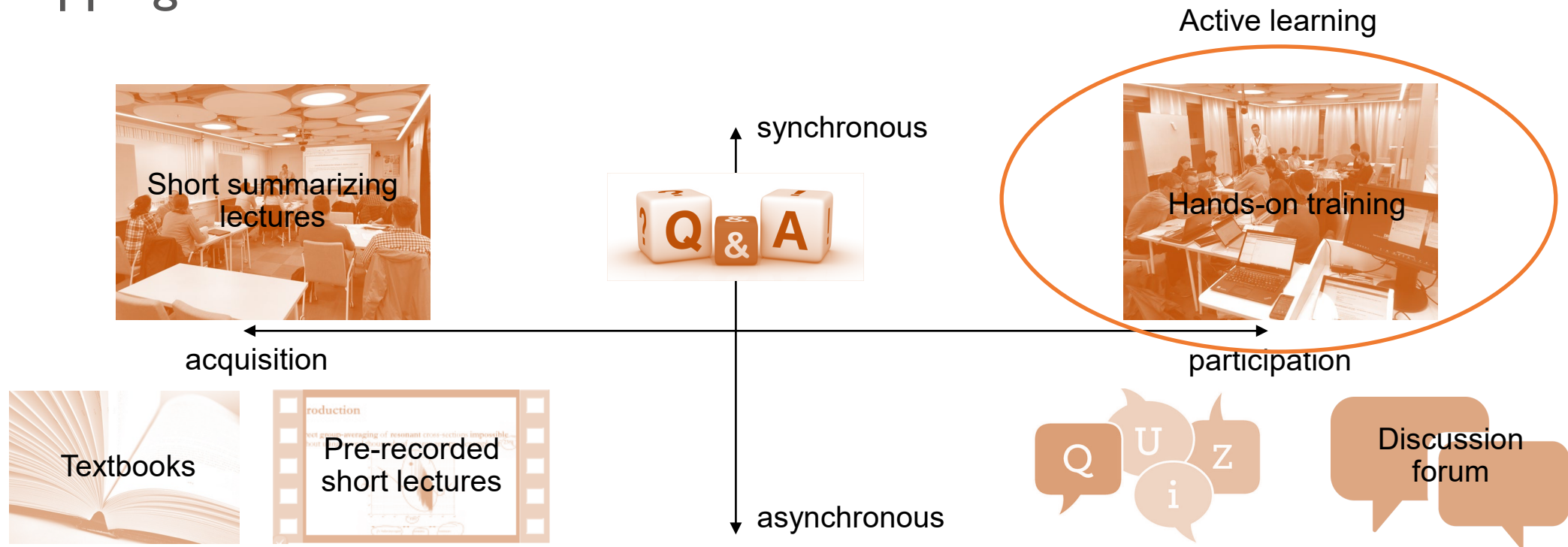
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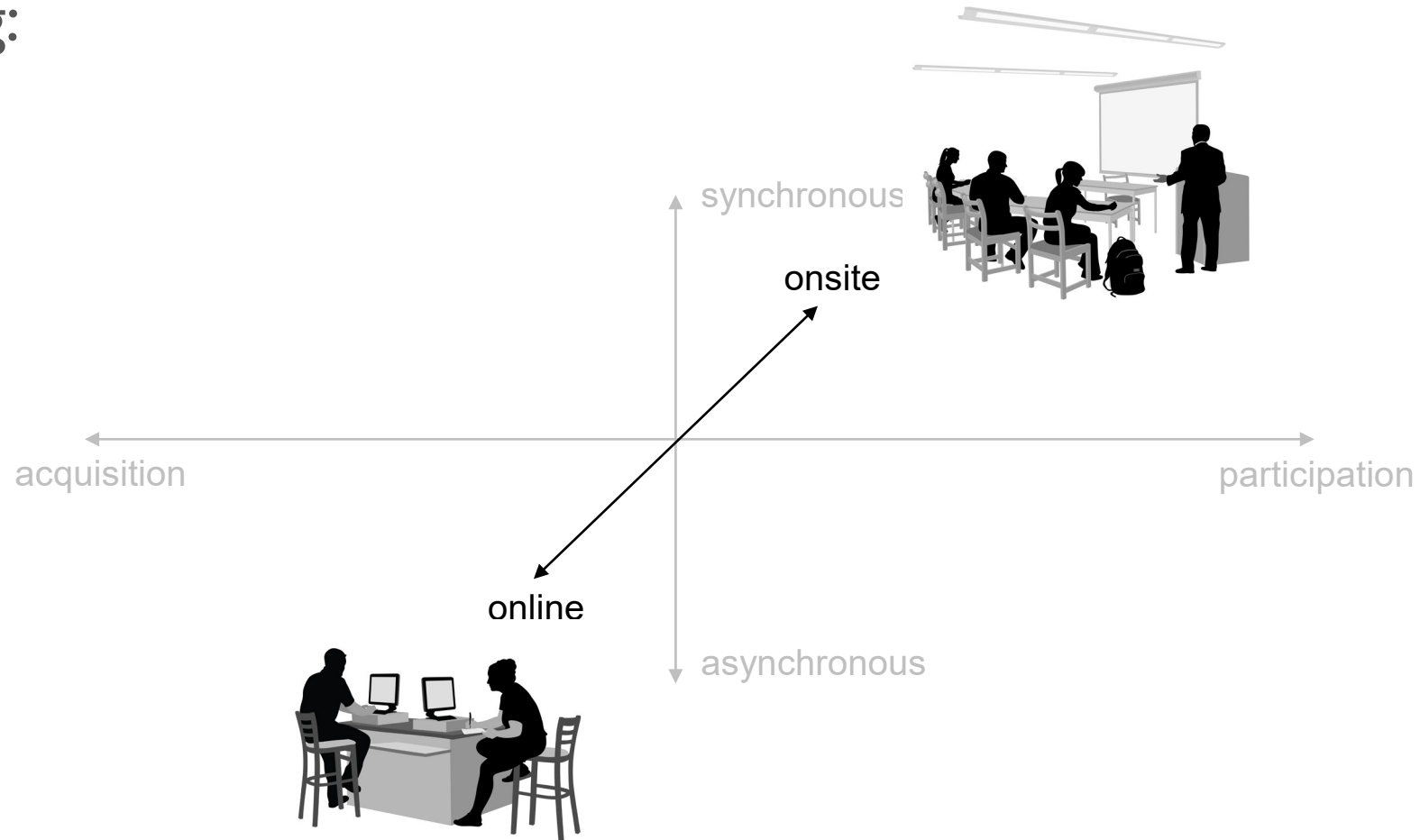
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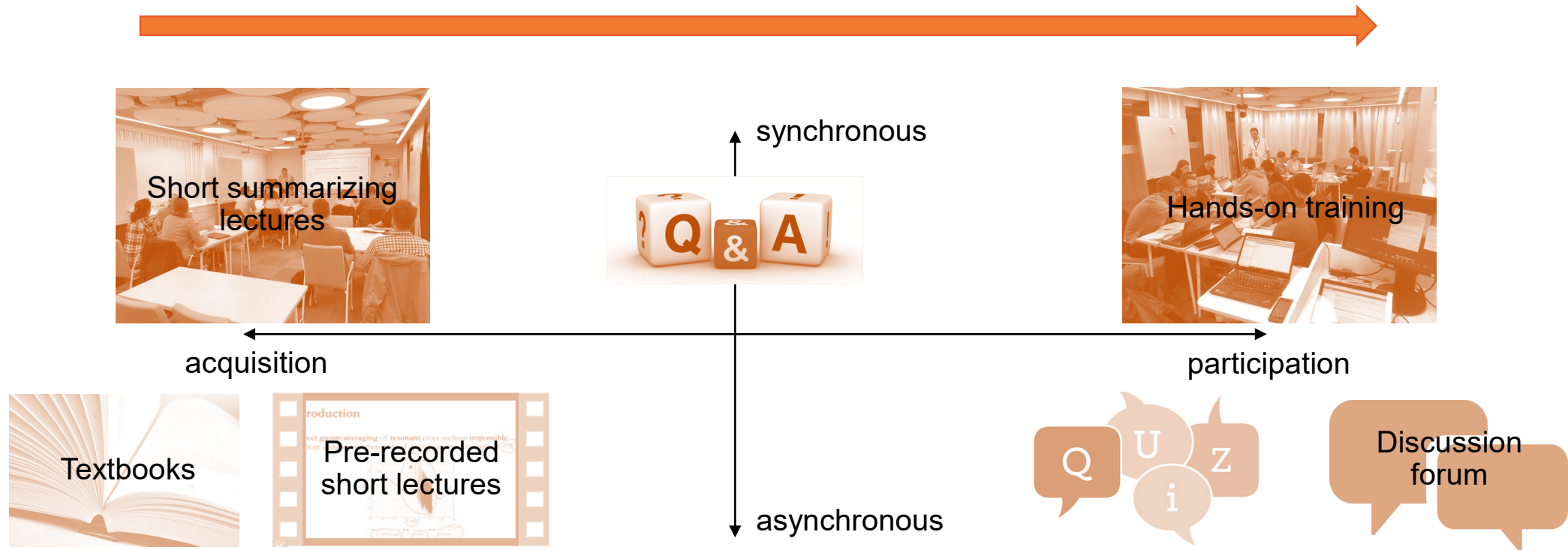
PEDAGOGICAL METHOD

- Flipping:



PEDAGOGICAL METHOD

Synchronous hybrid learning phase concentrated on 5 consecutive days



Hrastinski, S. (2008). Asynchronous and synchronous e-learning. Educause Quarterly, 31(4), 51-55.

Asynchronous online learning phase spread on 4 weeks (self-paced learning)

PEDAGOGICAL METHOD

- For the 8 courses delivered in the academic year 2022/2023, number of resources developed:
 - 12 handbooks
 - 133 video lectures
 - 611 asynchronous quizzes
 - 298 synchronous quizzes
 - 115 assignments

PEDAGOGICAL METHOD

- **Delivery of all teaching resources** (asynchronous and synchronous) via a **Learning Management System (LMS)**:

PREPARATORY WORK ON STEADY-STATE NEUTRON TRANSPORT AT THE CORE LEVEL - CHAPTER 1 - INTRODUCTION

Please read the corresponding chapter/section of the handbook. Thereafter, watch the short summarizing videos and answer the online quizzes.

You can provide feedback on the above teaching resources using the "Feedback" functionality associated to each of the teaching resources.

In case of questions, use primarily the forum (contact the course lecturers only when the forum is not appropriate). In case other course participants and/or teachers are online chat to chat with each other.

HANDBOOK 01 - Steady-state neutron transport at the core level
To do: View
Please read Chapter 1 titled "Introduction", before watching the videos.

Feedback on the chapter/section

VIDEOS

VIDEO 01 - Introduction
Restricted Not available unless: The activity **HANDBOOK 01 - Steady-state neutron transport at the core level** is marked complete

Feedback on the videos

QUIZZES
There is no quiz on this chapter.

Course completion status

Status: *Not yet started*

All criteria below are required:

Required criteria	Status
Course grade	No grade (50.00 required)

[More details](#)

COMPULSORY WORK

NOW
Mouse over or touch bar for info.

PART 1 - CHAPTER 1

NOW
Mouse over or touch bar for info.

PEDAGOGICAL METHOD

- **Delivery of all teaching resources** (asynchronous and synchronous) via a **Learning Management System (LMS)**:
 - **Compulsory learning sequence** to be followed (parts of the resources are locked until selected activities are completed)
 - Students can see their **progress** (completion) and **grades** (performance) at all times
 - **Access to synchronous elements** only possible if **sufficient asynchronous work completed** (50% of the preparatory work)
 - **Course certificate only delivered** if the participants get at least **50 points** (out of 100)

PEDAGOGICAL METHOD

- **Active learning** techniques used during the **synchronous sessions**:
 - **Short summarizing lectures** followed by “**quizzes**”, with or without prior group discussions
 - Heavy use of **computer simulation tools** with different objectives:
 - **Implementing** nuclear reactor **modelling techniques** introduced in the other course elements
 - **Checking** the proper **understanding** of key concepts via small assignments
 - **Checking** the proper **use** of third-party nuclear simulation software against some reference solutions
- **Highly-structured sessions**

ANALYSIS

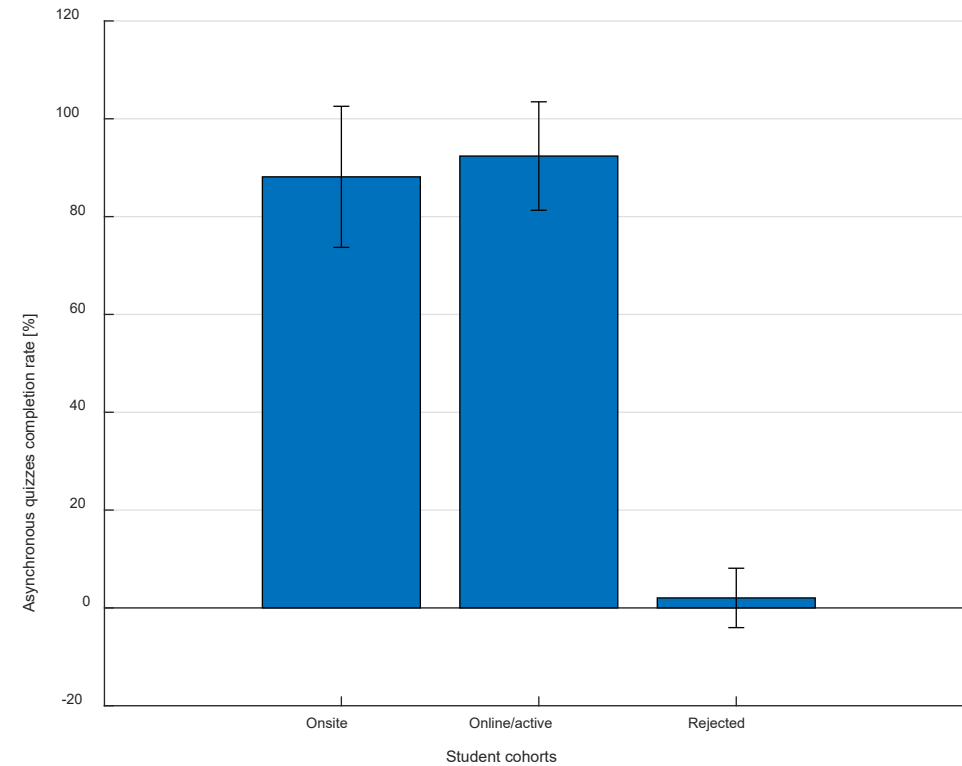
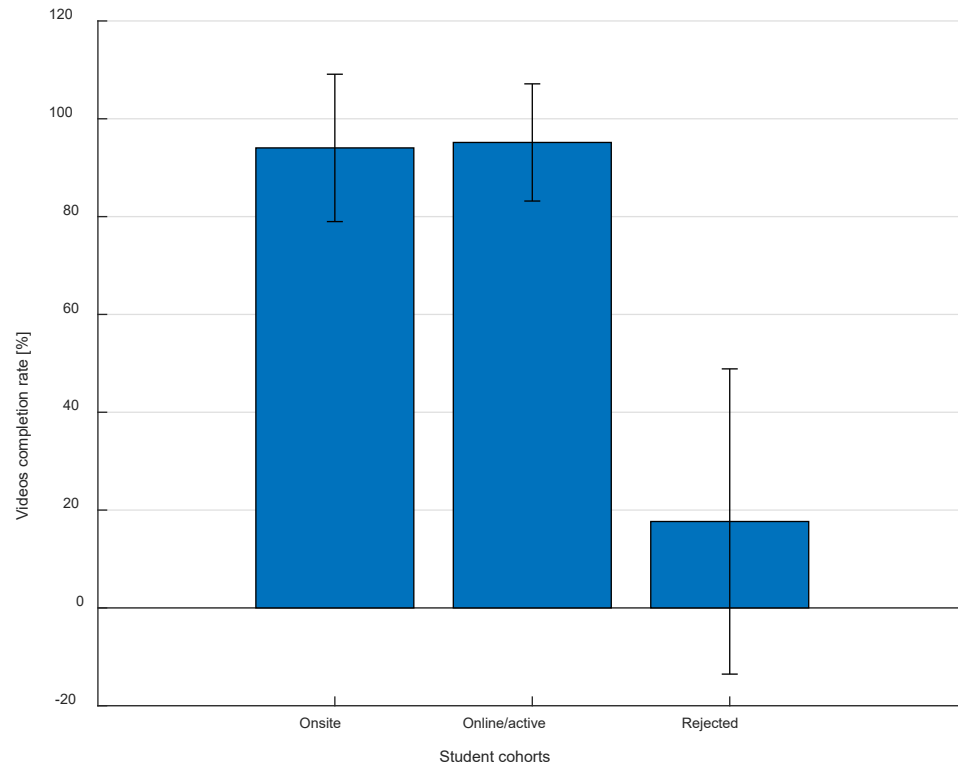
- Analysis of one of the courses: “Core modelling for core design”
- Timing:
 - **Asynchronous** learning phase: November 25, 2022 – January 8, 2023
 - **Synchronous** learning phase: January 9-13, 2023
 - **Extra time** to complete the synchronous activities: January 14-February 13, 2023

ANALYSIS

- Analysis of one of the courses “Core modelling for core design”
- Student statistics:
 - **56 applicants**
 - 6 rejected applications (upper limit for each course set to 50 participants)
 - **50 accepted applications** (23 onsite and 27 online)
 - **52 persons** granted access to the LMS (late registrations)
 - **31 participants qualified for the synchronous sessions** (with 13 onsite and 18 online)
 - **29 participants received a course certificate** (13 onsite and 16 online)
- NB: All participants to the synchronous sessions were active during those

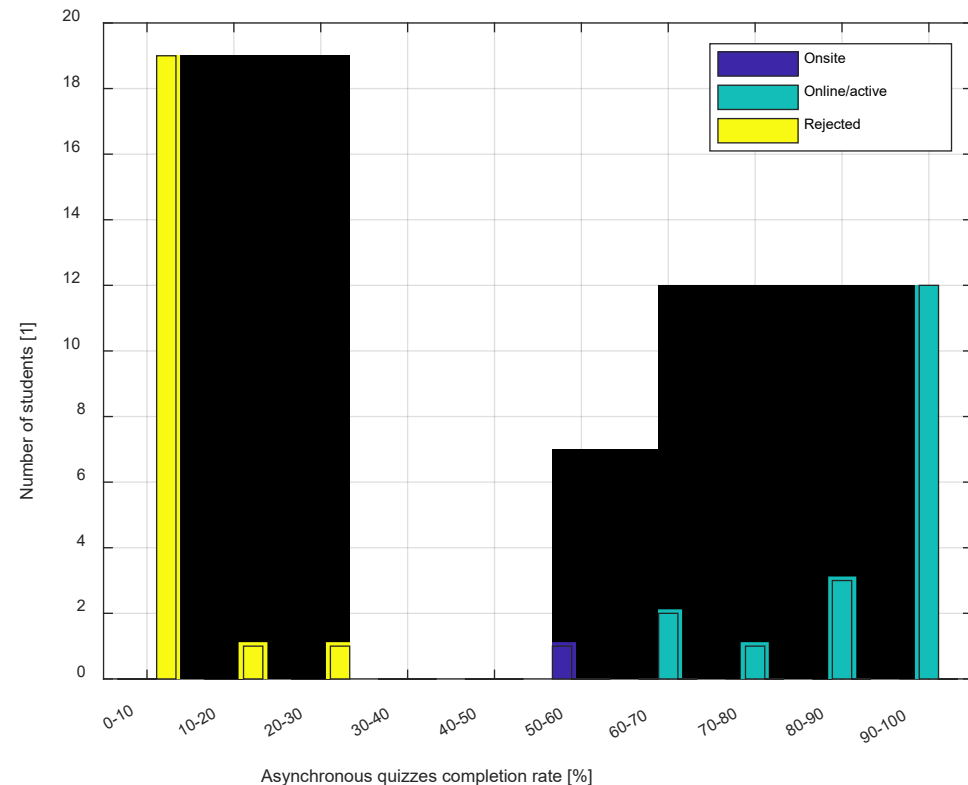
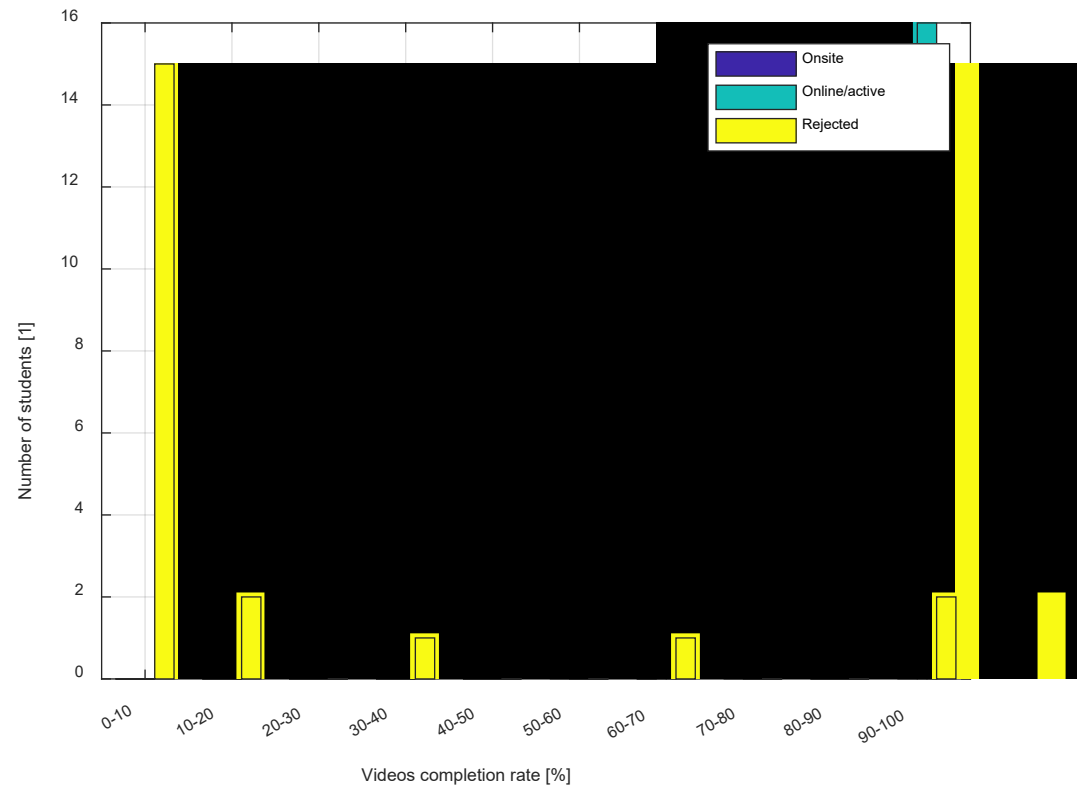
ANALYSIS

- **Use of the various teaching resources – asynchronous elements:**



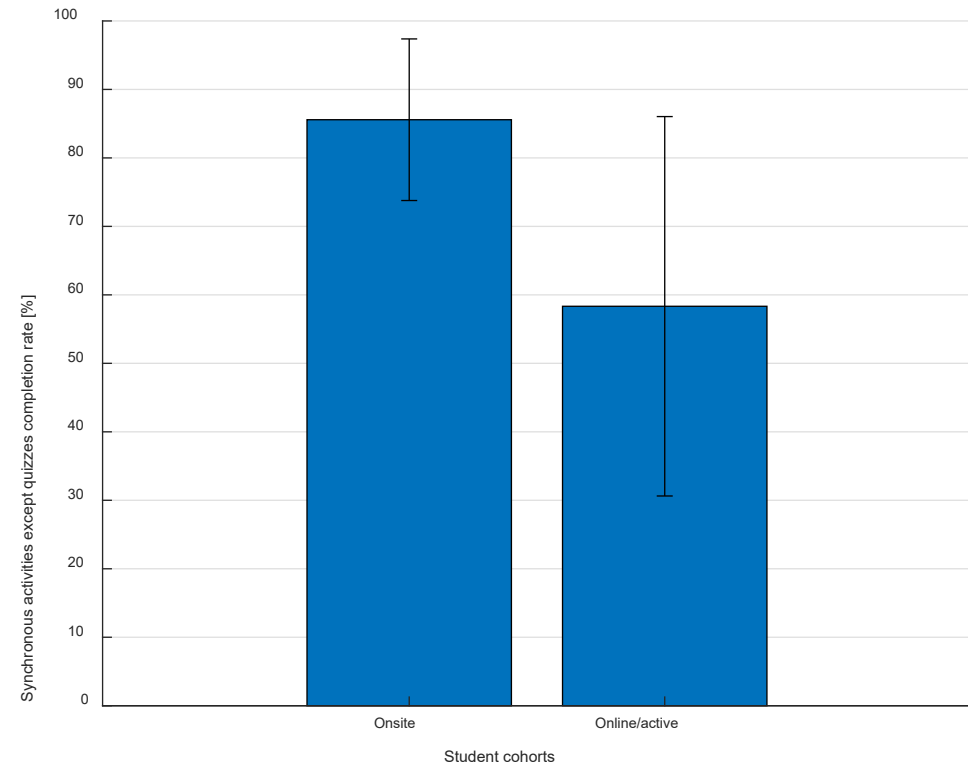
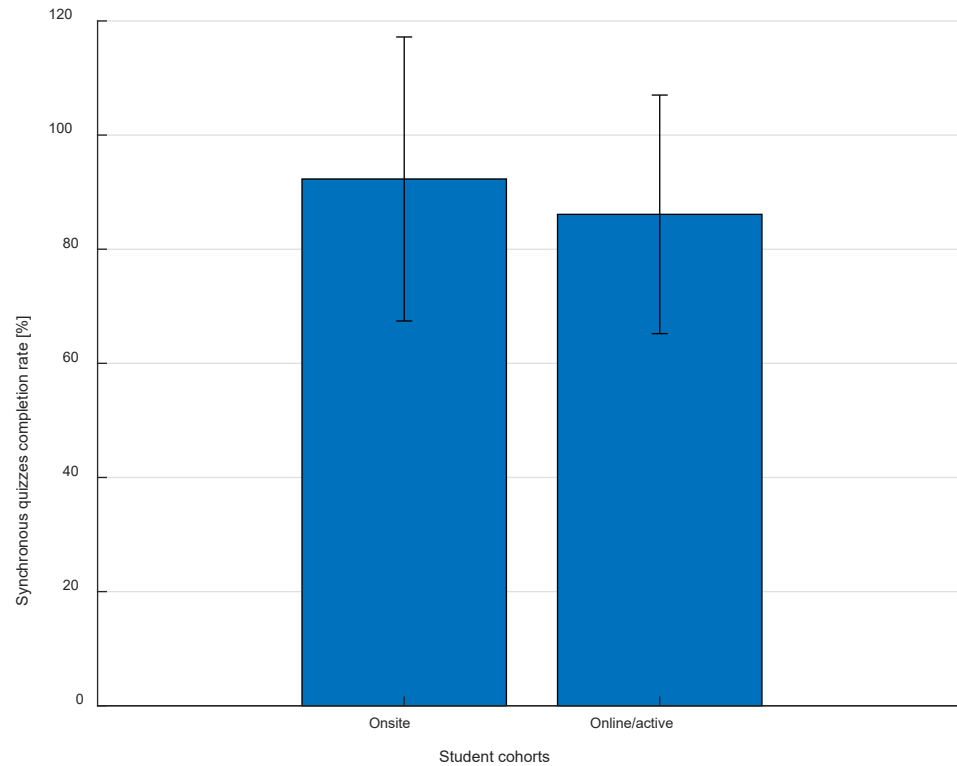
ANALYSIS

- Use of the various teaching resources – **asynchronous** elements:



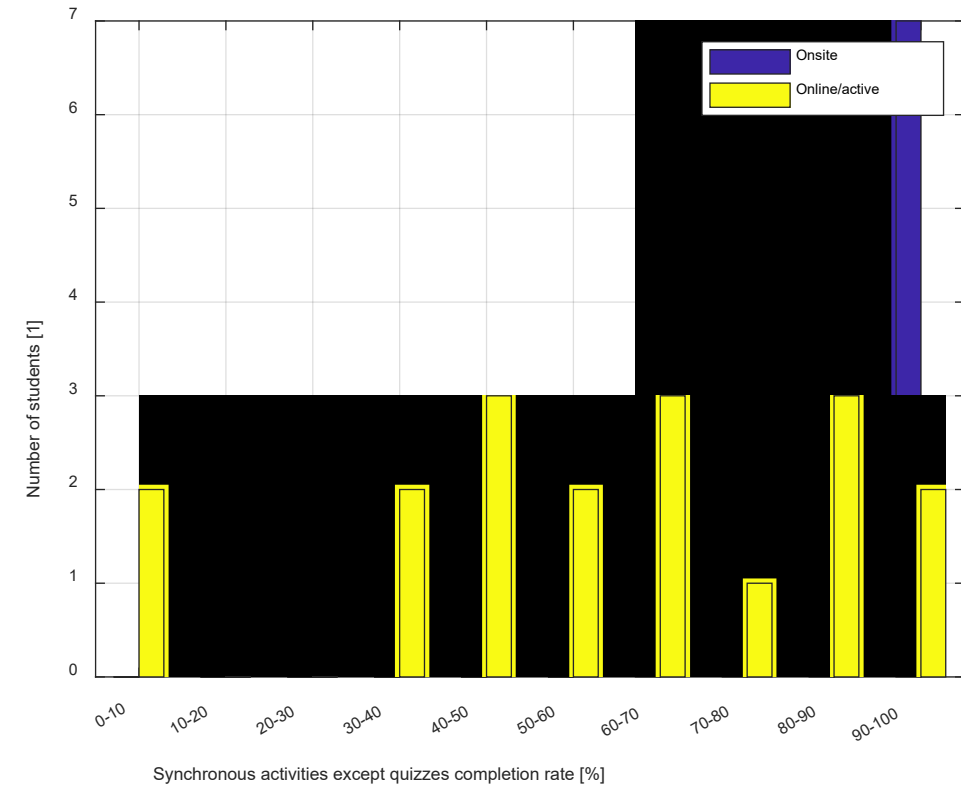
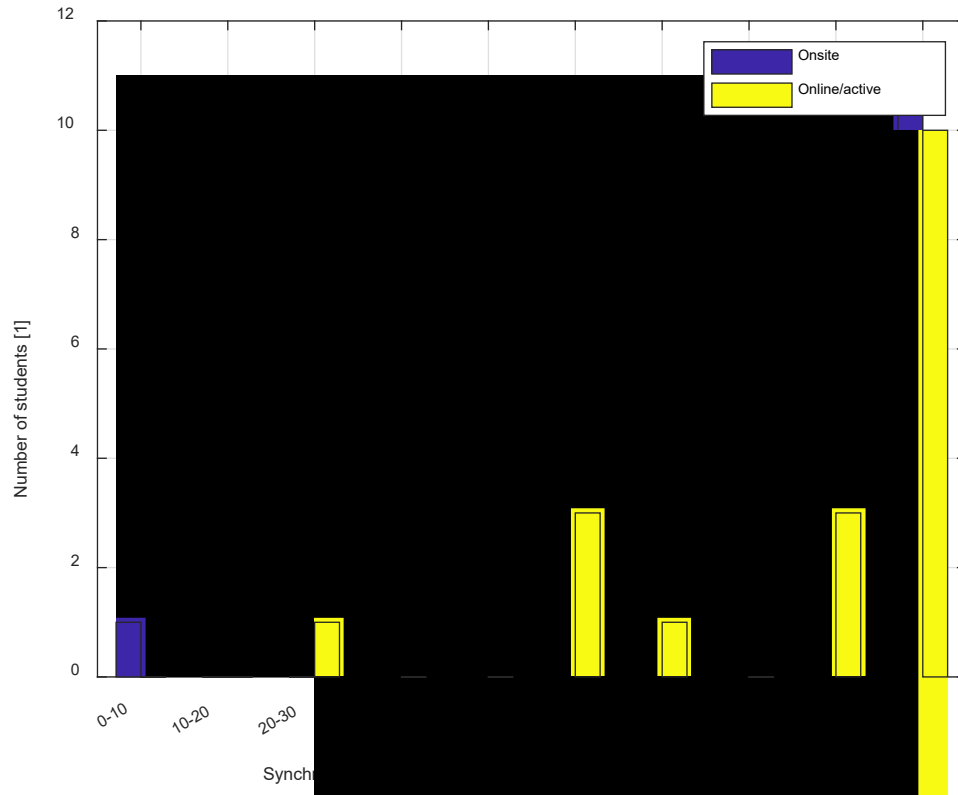
ANALYSIS

- Use of the various teaching resources – **synchronous** elements:



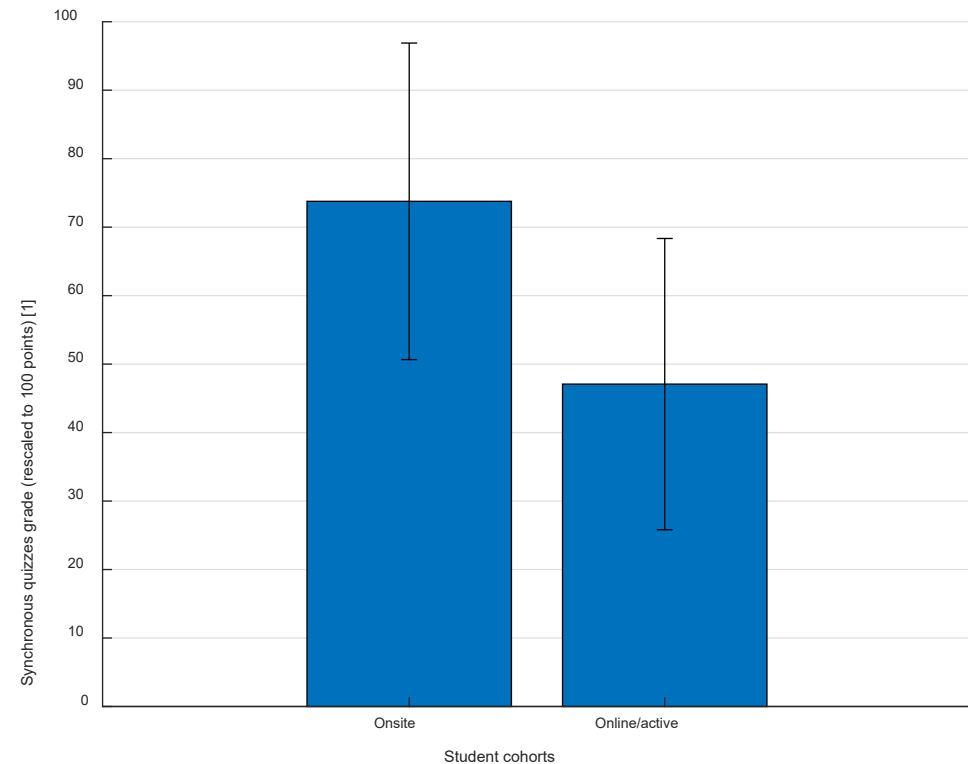
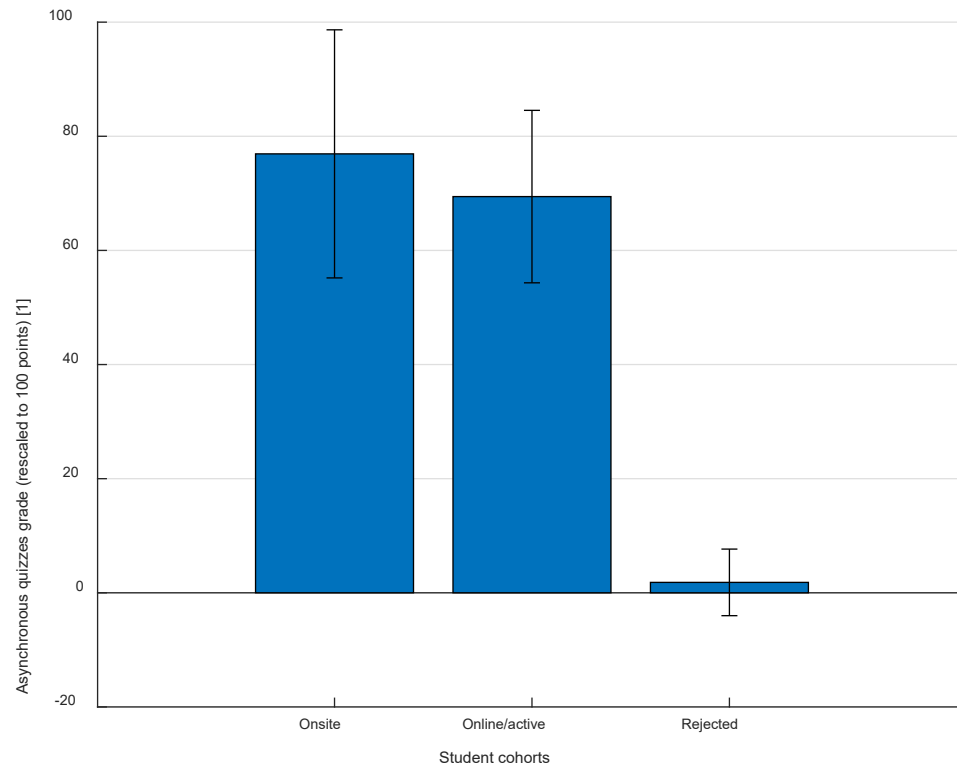
ANALYSIS

- Use of the various teaching resources – **synchronous** elements:



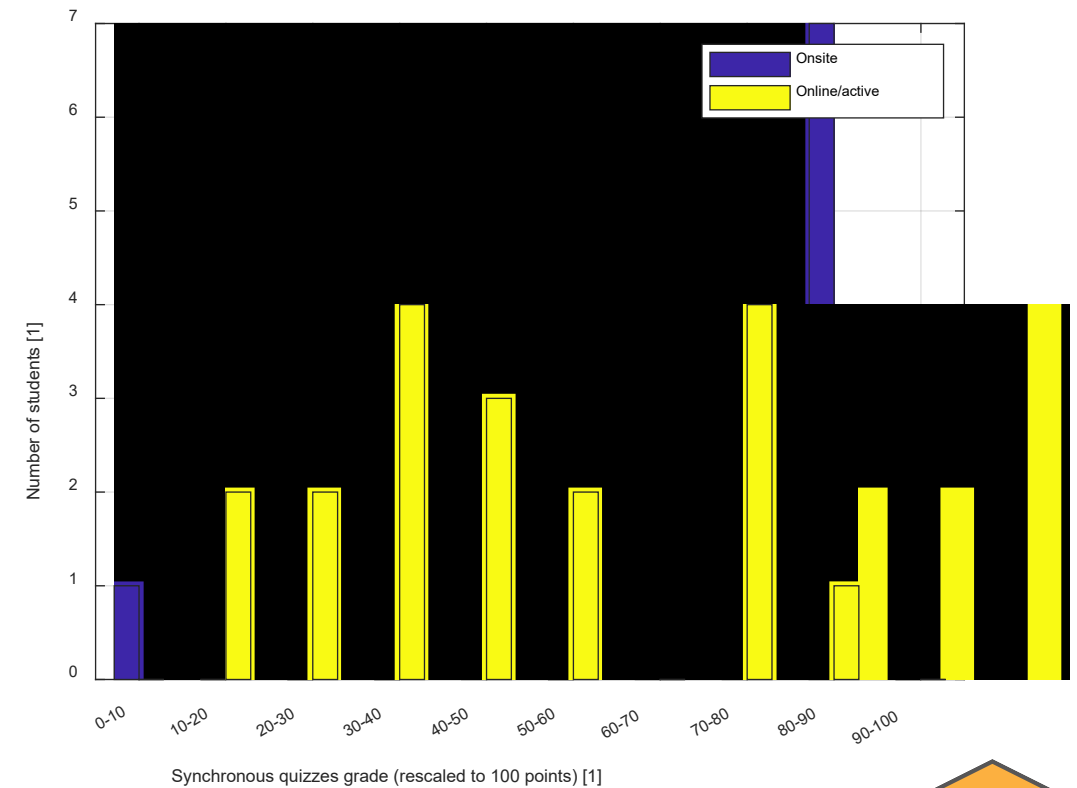
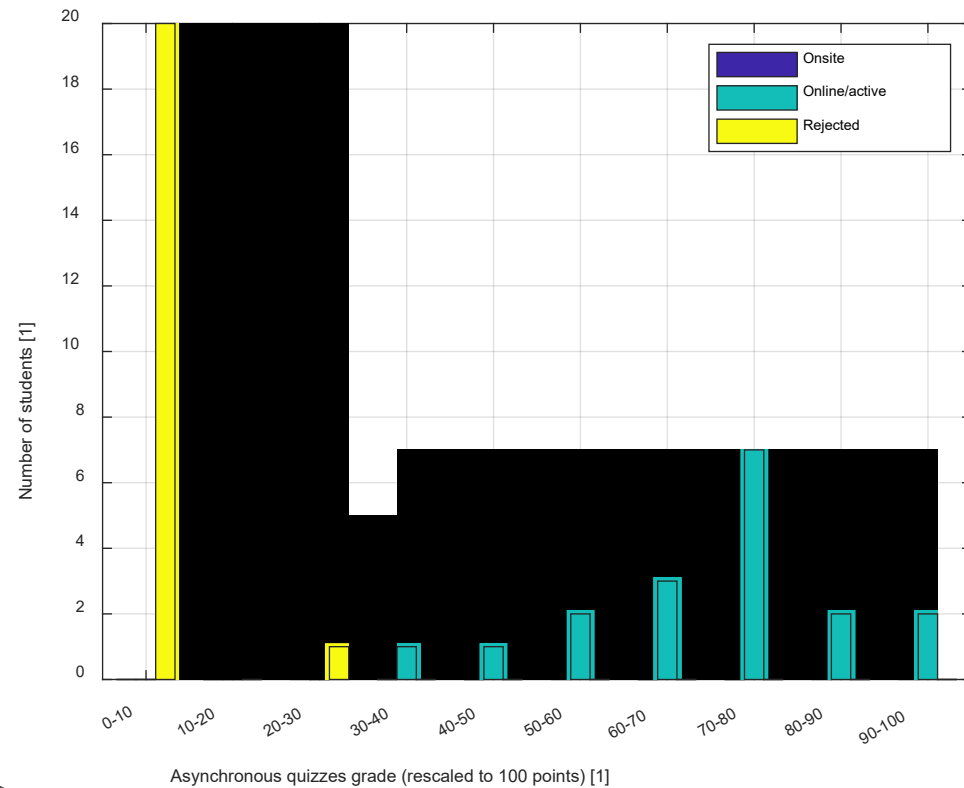
ANALYSIS

- **Learning of the theoretical concepts – asynchronous + synchronous quizzes**



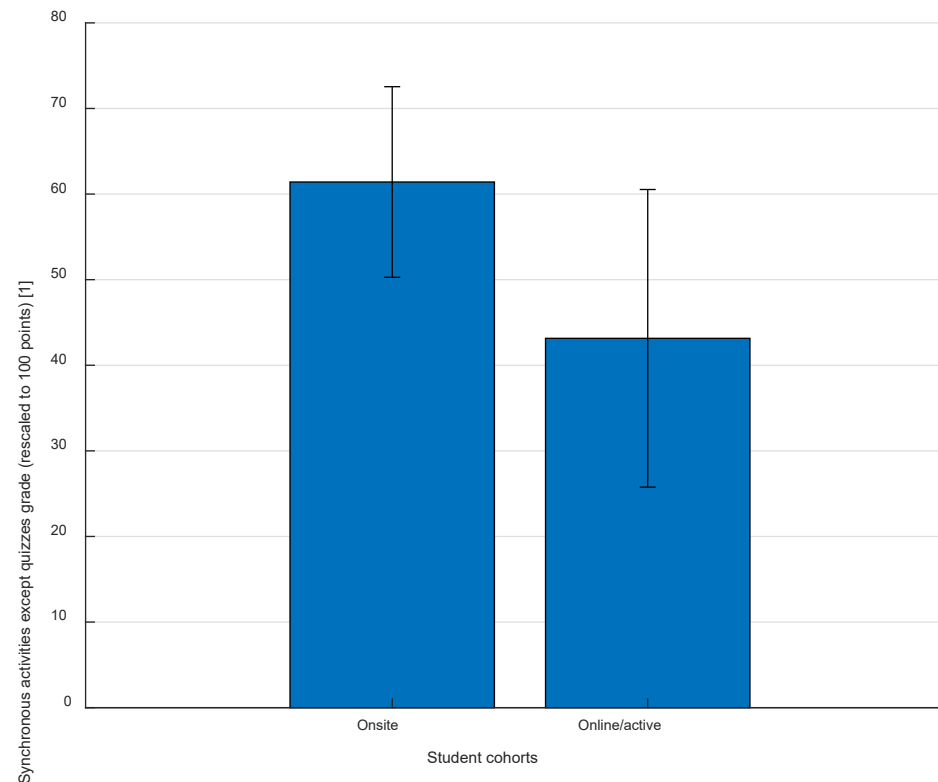
ANALYSIS

- Learning of the theoretical concepts – asynchronous + synchronous quizzes



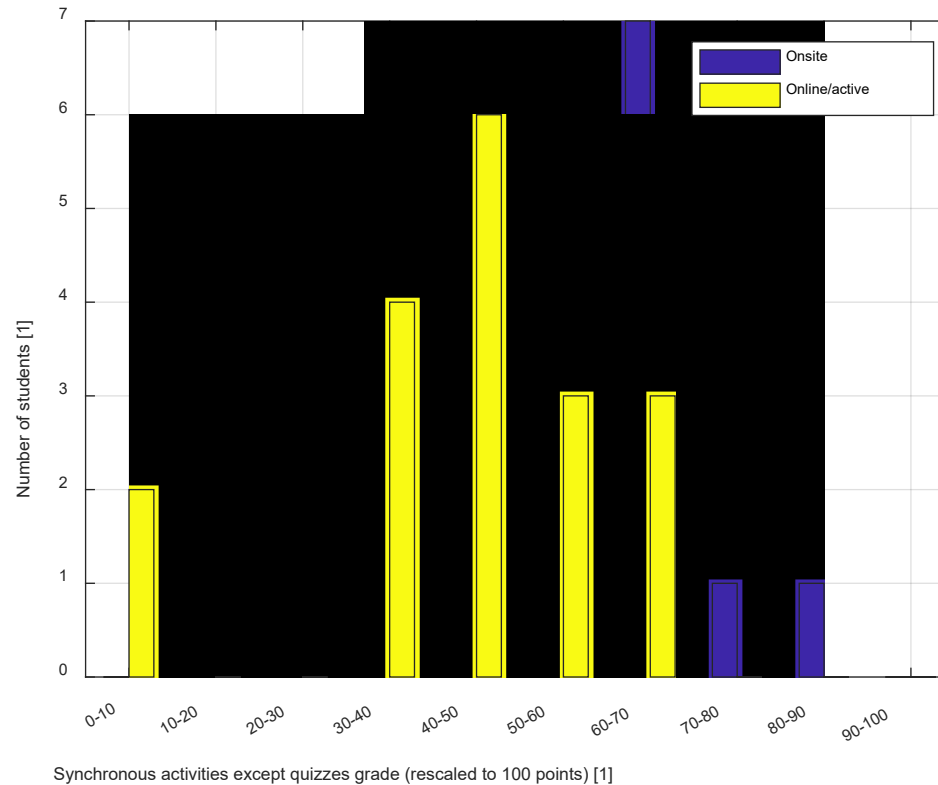
ANALYSIS

- **Ability to apply** the concepts in practical situations – **synchronous activities other than quizzes**



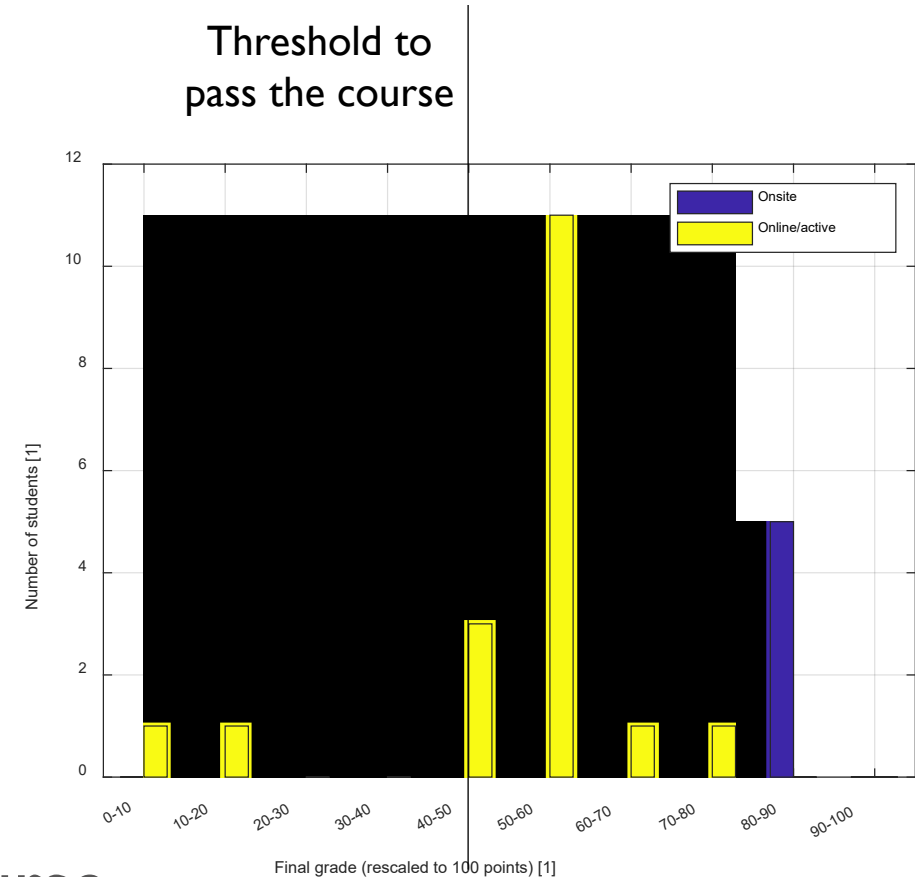
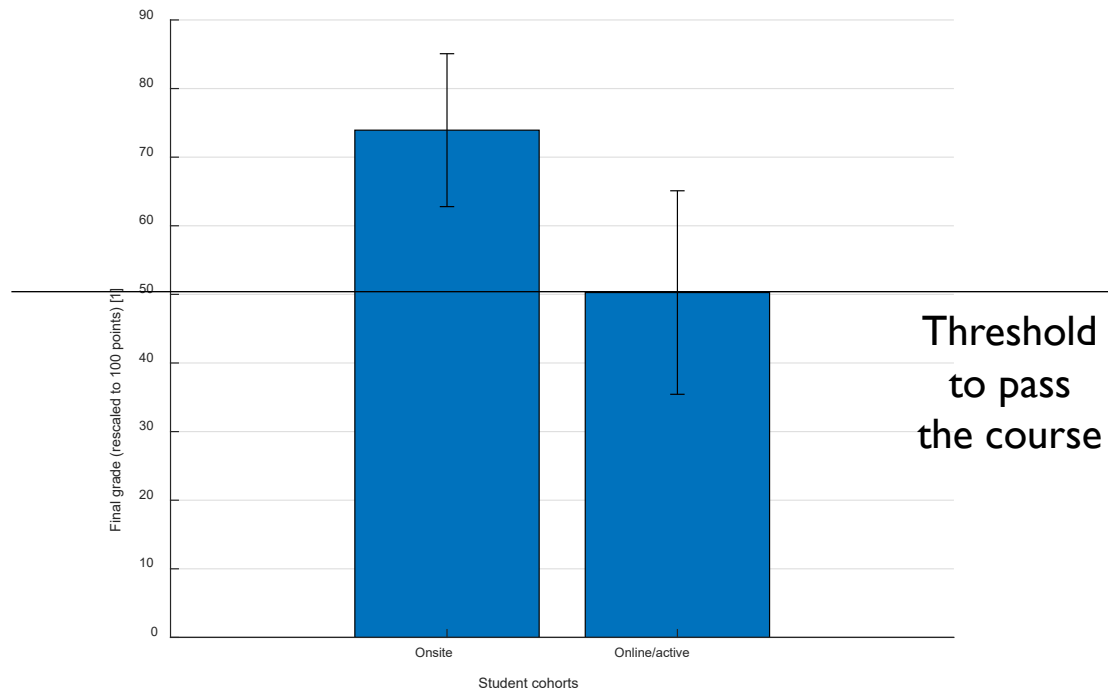
ANALYSIS

- **Ability to apply** the concepts in practical situations – **synchronous activities other than quizzes**



ANALYSIS

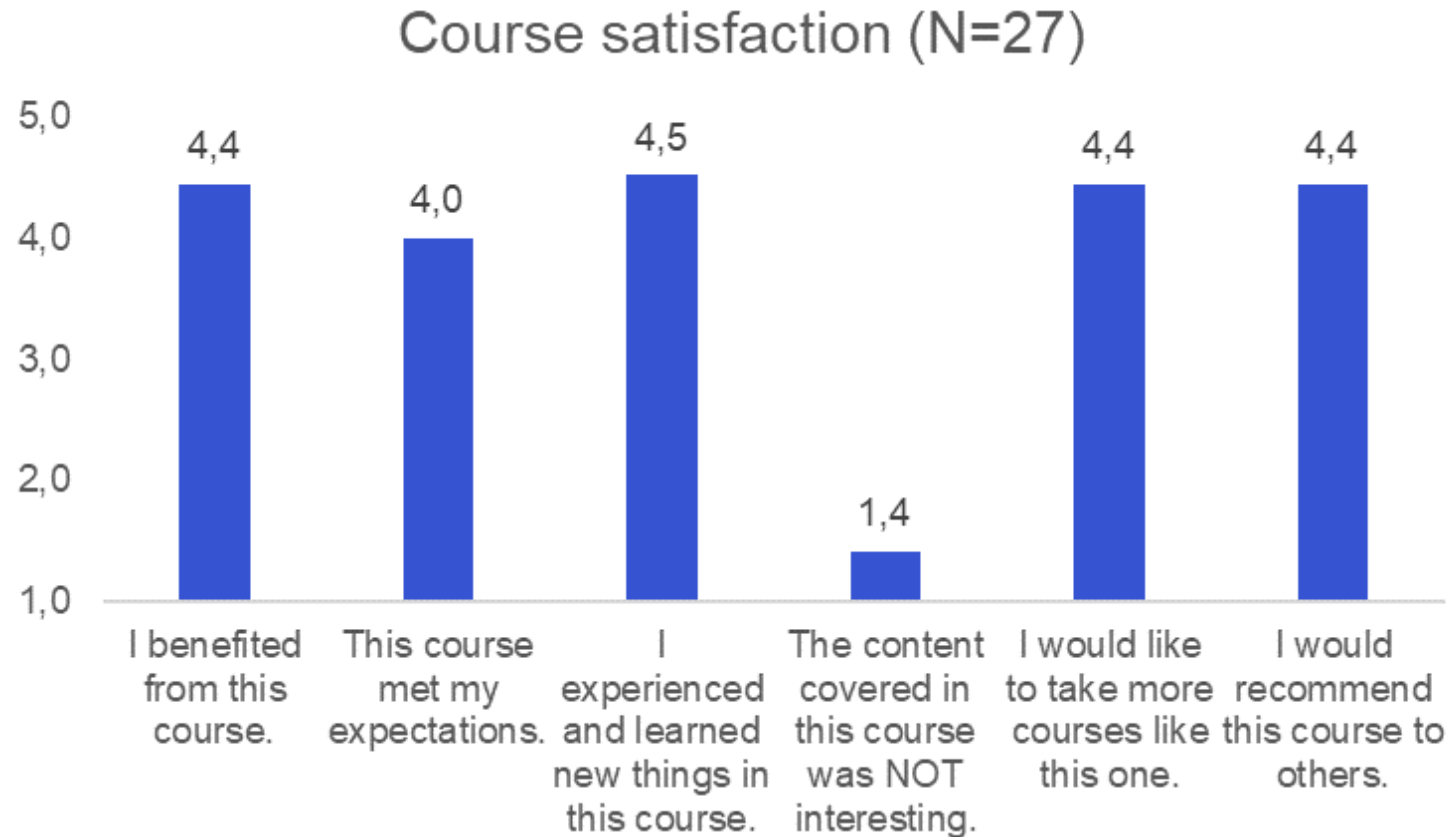
- **Final grades:**



- All 13 onsite students passed the course
- 16 of the 18 online students passed the course

STUDENT FEEDBACK

- Participants' own perception of the course:



STUDENT FEEDBACK

- Thematic analysis of “things” participants liked (N=27):
 1. Practical Exercises / Tools / Codes / Software (16)
 2. Course Materials / Handbooks / Slides / Sources (11)
 3. Well-explained Topics / Quality of Teachers (9)
 4. Organization / Course Structure / Preparation (9)
 5. Networking / Interactions with Students and Professionals (6)
 6. Inclusive Atmosphere / Support from Teachers and Students (5)
 7. Flipped Classroom / Teaching Methods (3)
 8. Flexibility / Pace / Online Learning (2)
 9. Real-world Applications / Industry Relevance (2)
 10. Multidisciplinary / Diverse Backgrounds (2)

STUDENT FEEDBACK

- Thematic analysis of “things” participants did not like (N=27):
 1. Time Constraints and Pace (17 items)
 2. Content and Instruction (13 items)
 3. Technical Issues and Software (11 items)
 4. Course Structure and Topics (6 items)
 5. Workload and Assignments (5 items)
 6. Course Format and Recommendations (4 items)
 7. Instructor-related Issues (3 items)

CONCLUSIONS

- **Very good outcomes** in terms of **participation, engagement and completion**
- **Very good feedback** from **students**
- **Significant differences** between **onsite** and **online** participants
 - **“Strategic” learning** for the **online** participants?
 - **High workload** to be combined with **other duties**?
- **Very rewarding** to reach such a high level of teachers-students interactions during the synchronous sessions, thanks to flipping
- Courses being **re-offered** during this academic year



Youssef Badr • 1st

Senior Nuclear and Radiation Engineering student at Alexandria...

1d • 🌐



I don't usually like posting course completion certificates, but this time in particular I feel like I have to. When I signed up for this course months ago I thought it's going to be a surface level introduction course, not because of the advertisement of the course, but rather because of the restrained time period of "5 days".

Not only was I proven wrong, this course ended up being one of the most challenging academic materials I had to face in quite sometime. I was absolutely blown away by the materials, and honestly a little taken aback by the resources and the exercises (Brush up on your Matlab skills, trust me). Some of them I still have to locate the time to try again later.

I am writing this to thank Prof. Demaziere, Prof. Sandra Dulla, Prof. Máté, and the amazing community of professional and graduate students I got exposed to and introduced to. It's amazing what GREAT-PIONEER is doing for Nuclear Education. I was very grateful for this opportunity, and will definitely be trying to take more Great-Pioneer courses in the future, and would recommend them to all my colleagues.



CERTIFICATE

OF COMPLETION

IS HEREBY AWARDED TO:

Youssef Badr

For successfully passing the course titled "Neutron transport at the fuel cell and assembly levels"

The course covered the following topics: analytical solutions of the neutron transport equation, deterministic modeling and Monte Carlo methods. The course was based on self-studies (preparatory work) and interactive sessions. The preparatory work, amounting to ca. 40 hours, consisted of reading a set of handbooks, watching video lectures, and answering quizzes. The interactive sessions were held between October 16 and October 20, 2023, and consisted of completing several exercises and quizzes, representing ca. 40 hours of work. The course is worth 3 ECTS credits (European Credit Transfer and Accumulation System).

Prof. Sandra Dulla
Politecnico di Torino, Turin, Italy

Sandra Dulla



Thank you!

Contact details:



Name: *Prof. Christophe Demazière*



Email: *demaz@chalmers.se*



www.great-pioneer.eu



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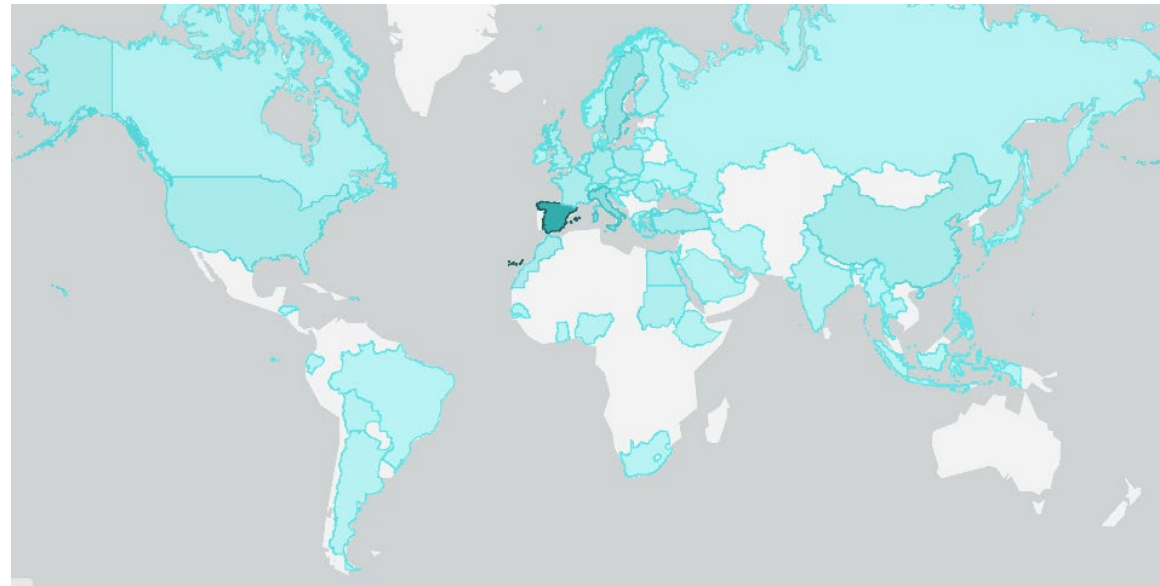
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EXTRA SLIDES ON OVERALL ANALYSIS OF ALL COMPLETED COURSES

EXTRA SLIDES ON OVERALL ANALYSIS OF ALL COMPLETED COURSES

- For the first 8 delivered courses:
 - **Origin** of the access to the LMS:



➤ Almost worldwide coverage

EXTRA SLIDES ON OVERALL ANALYSIS OF ALL COMPLETED COURSES

- For the 8 courses delivered during the academic year 2022/2023:
 - **386 applicants**
 - 64 rejected applications (upper limit for each course set to 50 participants)
 - **322 accepted applications** (92 onsite and 230 online)

- 331 participants actually granted access to the LMS
- **242 participants qualified for the synchronous sessions** (with 69 onsite and 173 online participants taking the first synchronous activity)
- **183 participants received a course certificate** (69 onsite and 114 online)

EXTRA SLIDES ON OVERALL ANALYSIS OF ALL COMPLETED COURSES

- For the 8 courses delivered during the academic year 2022/2023:
 - Completion rate of the participants granted access to the LMS: 55.3%
 - Completion rate of the participants qualified for the synchronous sessions: 75.6%
 - **Completion rate of the participants taking the first activity of the synchronous sessions: 91.5%** (100% for the onsite participants and 87.0% for the online participants)
 - Fantastic engagement and performance of the participants who take the first synchronous activity

EXTRA SLIDES ON OVERALL ANALYSIS OF ALL COMPLETED COURSES

- For the first 6 delivered courses:
 - **Participant course questionnaires:**
 - I benefited from this course (1-5): 4.6
 - This course met my expectations (1-5): 4.2
 - I experienced and learned new things in this course (1-5): 4.6
 - The content covered in this course was NOT interesting (1-5): 1.5
 - I would like to take more courses like this one (1-5): 4.5
 - I would recommend this course to others (1-5): 4.5
 - **Fantastic responses and feedback from all participants**, irrespective of whether they were onsite or online

EXTRA SLIDES ON OVERALL ANALYSIS OF ALL COMPLETED COURSES

- For the 2 hands-on at the training reactors:
 - **Participant course questionnaires:**
 - I gained a deeper understanding of the theoretical concepts (1-5): 4.3
 - I developed practical skills relevant to the nuclear field (1-5): 4.3
 - The course content was well-organized and easy to follow (1.5): 4.6
 - The teaching methods used were effective in facilitating my learning (1-5): 4.6
 - **Fantastic responses and feedback from all participants**, irrespective of whether they were onsite or online