

**GRE@T-
PIONEER**



A meta-analysis of student engagement, performance and satisfaction from the GRE@T-PIONEER hybrid flipped courses

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This project has received funding from the European Union's Euratom research and innovation programme 2014-2018 under the Grant Agreement n°890675. The content of this document reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

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

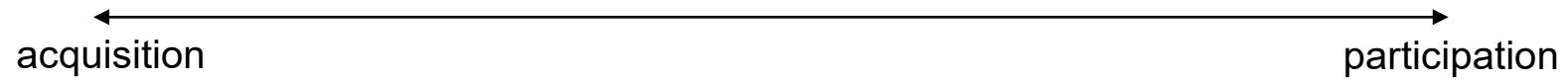
- “Innovative” learning design proposed in the GRE@T-PIONEER project, having for objectives:
 - To offer **advanced** courses
 - In a **flexible** manner
 - Having a **high engagement** of the participants in the activities
 - And making sure that the **participants successfully learn** the concepts/principles/methods

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**

PEDAGOGICAL METHOD

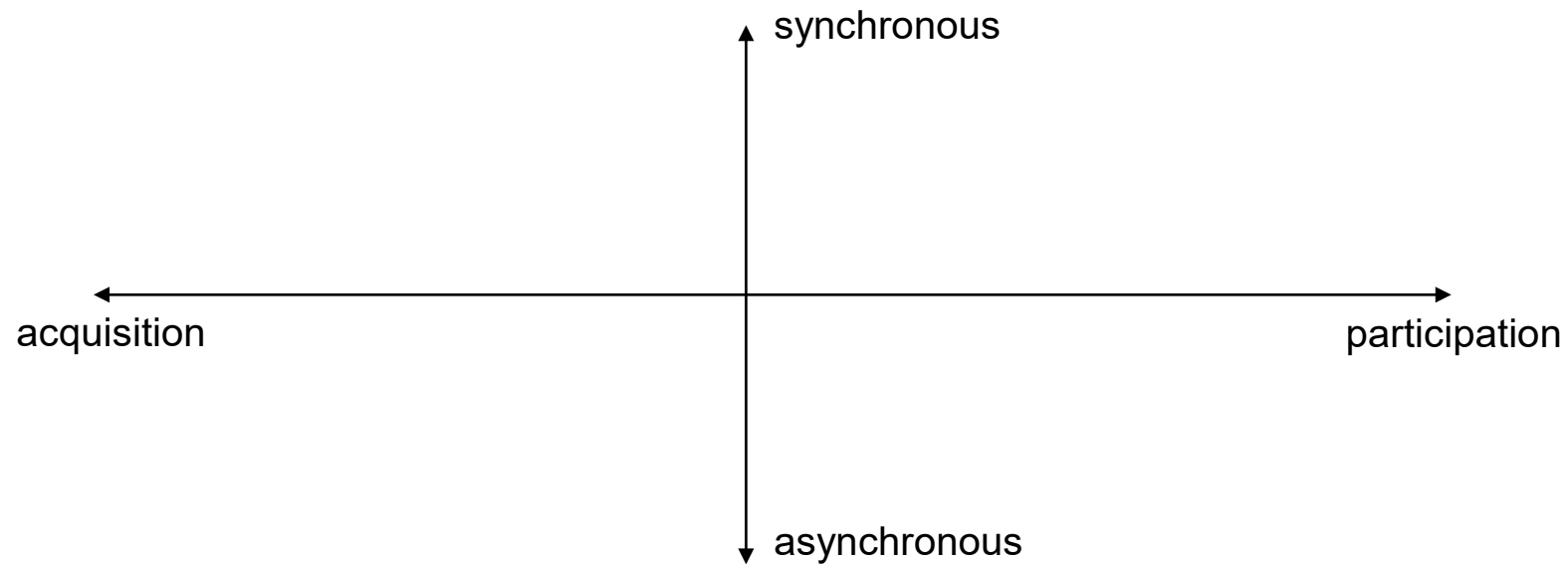
- Flipping:



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

PEDAGOGICAL METHOD

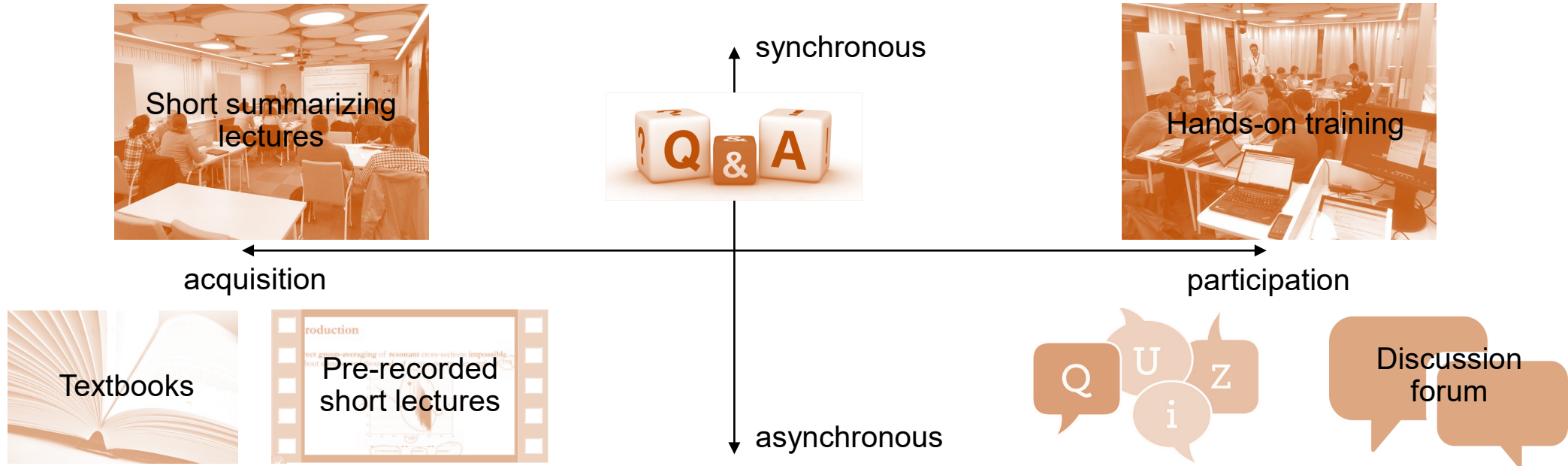
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Hrastinski, S. (2008). Asynchronous and synchronous e-learning. Educause Quarterly, 31(4), 51-55.

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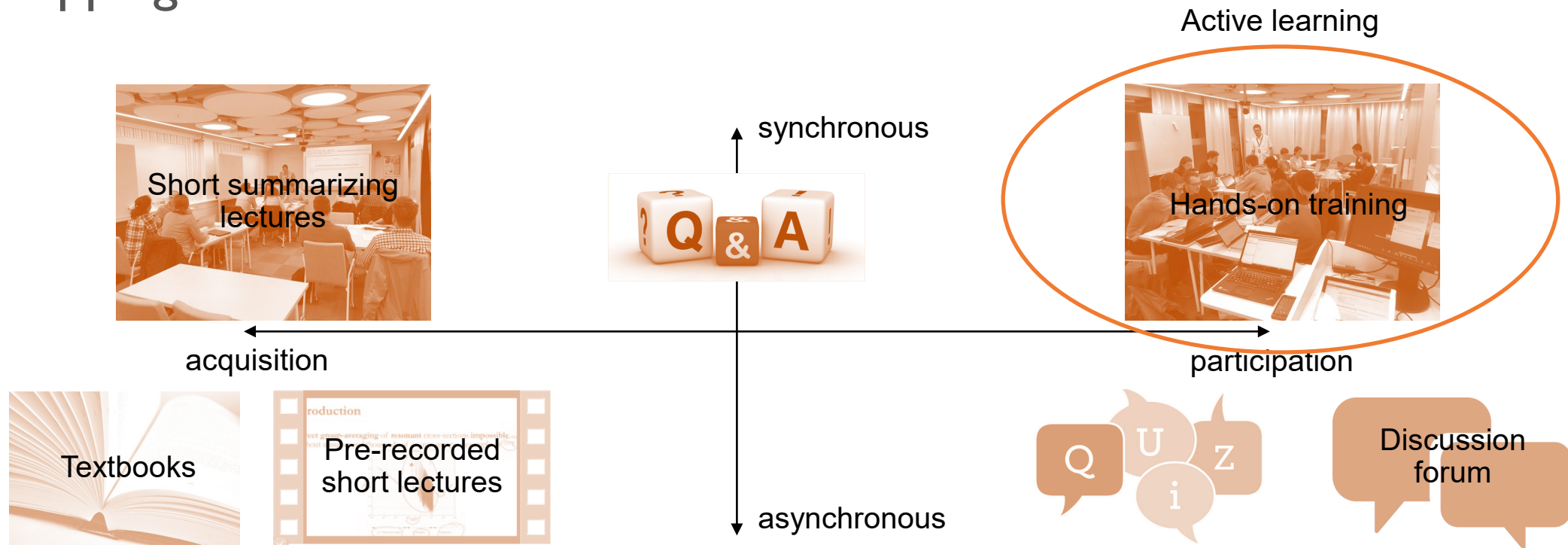
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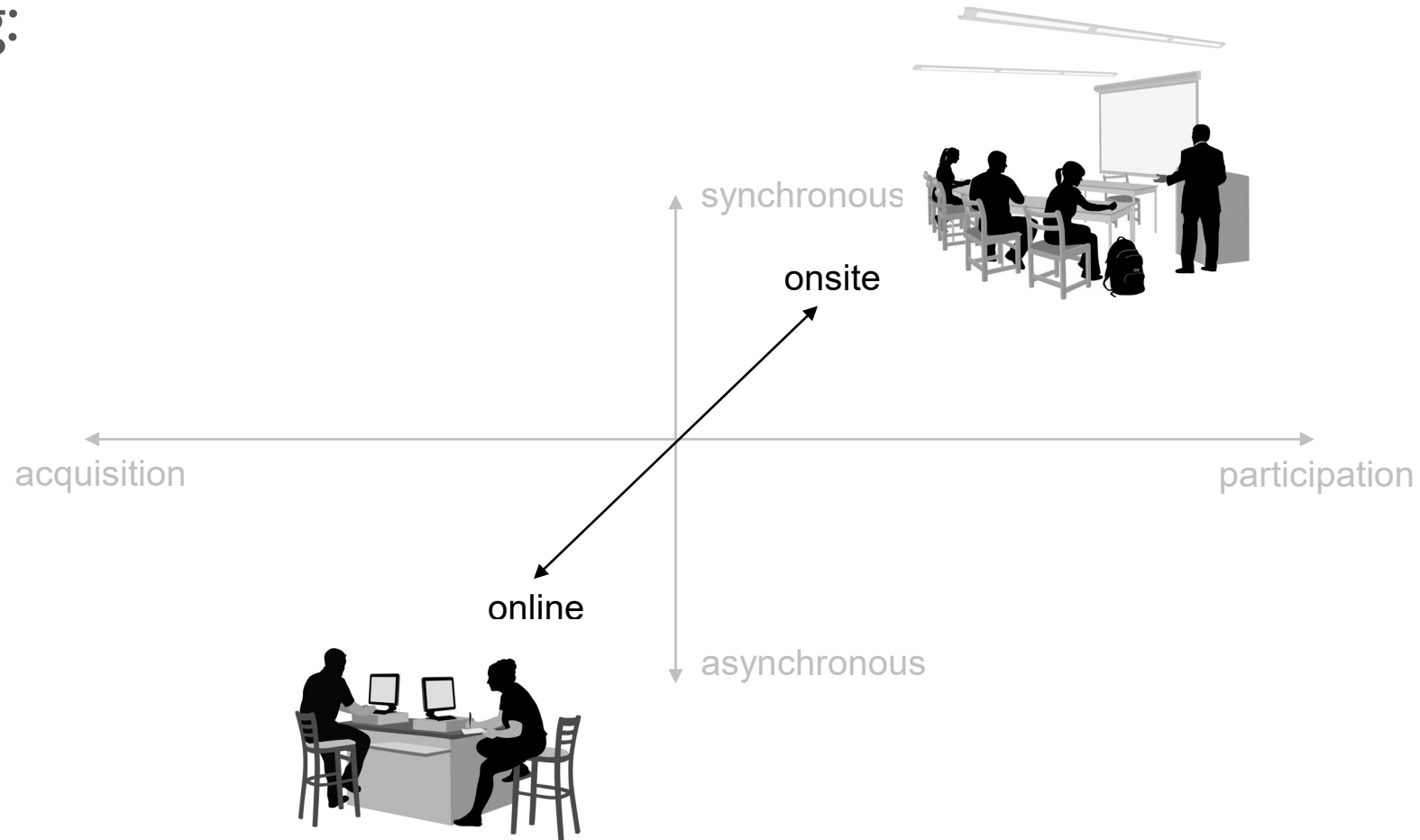
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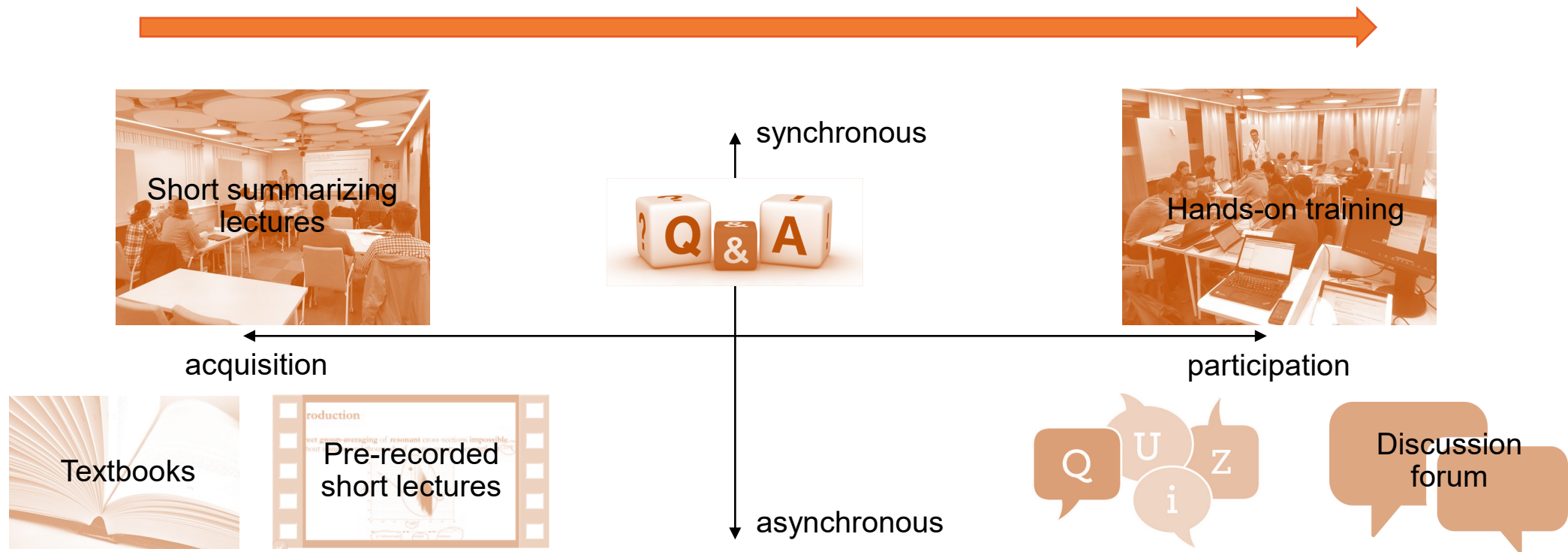
PEDAGOGICAL METHOD

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PEDAGOGICAL METHOD

Synchronous hybrid learning phase concentrated on 5 consecutive days/course



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

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

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

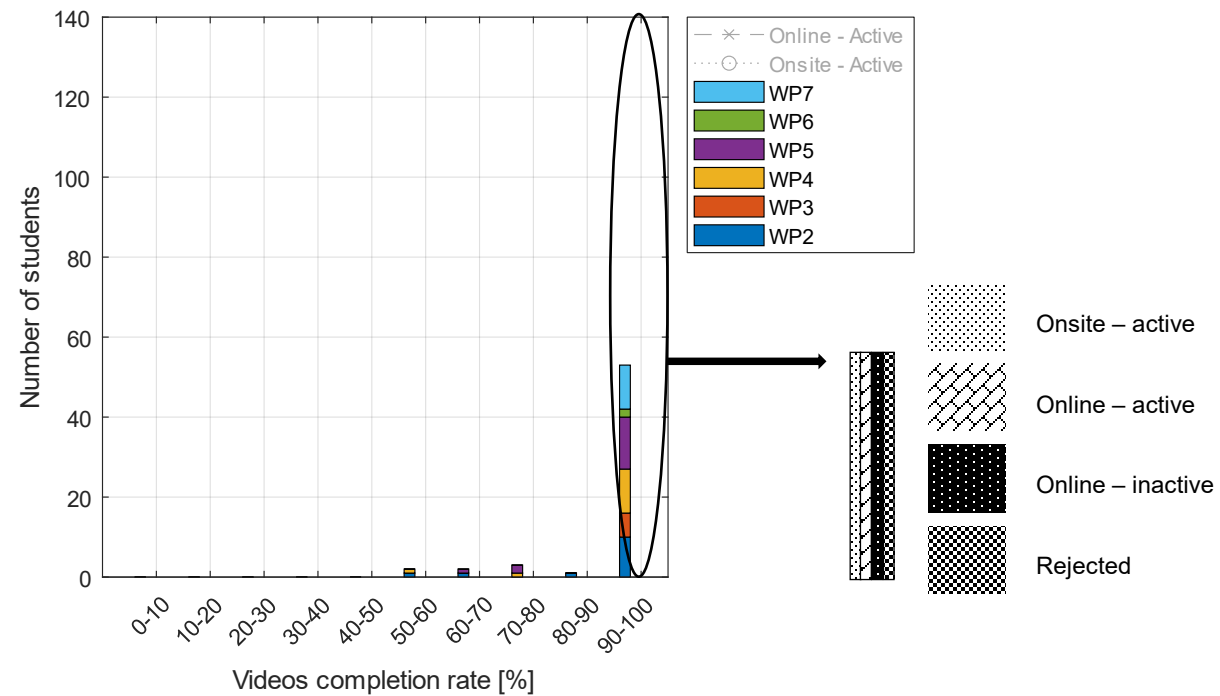
- Meta-analysis of all courses offered during the academic year 2023/2024:
 - Nuclear cross-sections for neutron transport
 - Neutron transport at the fuel cell and assembly levels
 - Core modelling for core design
 - Core modelling for transients
 - Reactor transients, nuclear safety and uncertainty 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)

ANALYSIS

- Student statistics:
 - **389 applicants**
 - 65 rejected applications (upper limit for each course set to 50 participants)
 - **324 accepted applications** (100 onsite and 224 online)
 - **330 persons** granted access to the LMS (late registrations)
 - **232 participants qualified for the synchronous sessions** (with 70 onsite and 162 online)
 - **185 participants received a course certificate** (70 onsite and 115 online)

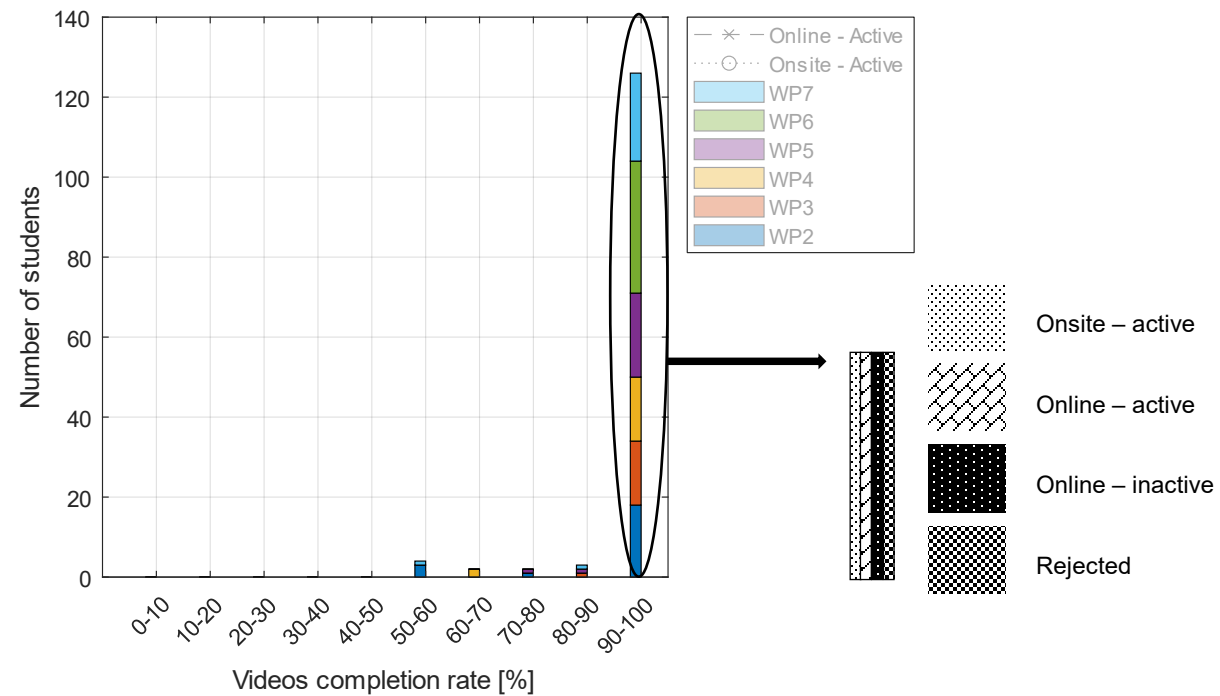
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- **Use of the various teaching resources – asynchronous videos:**



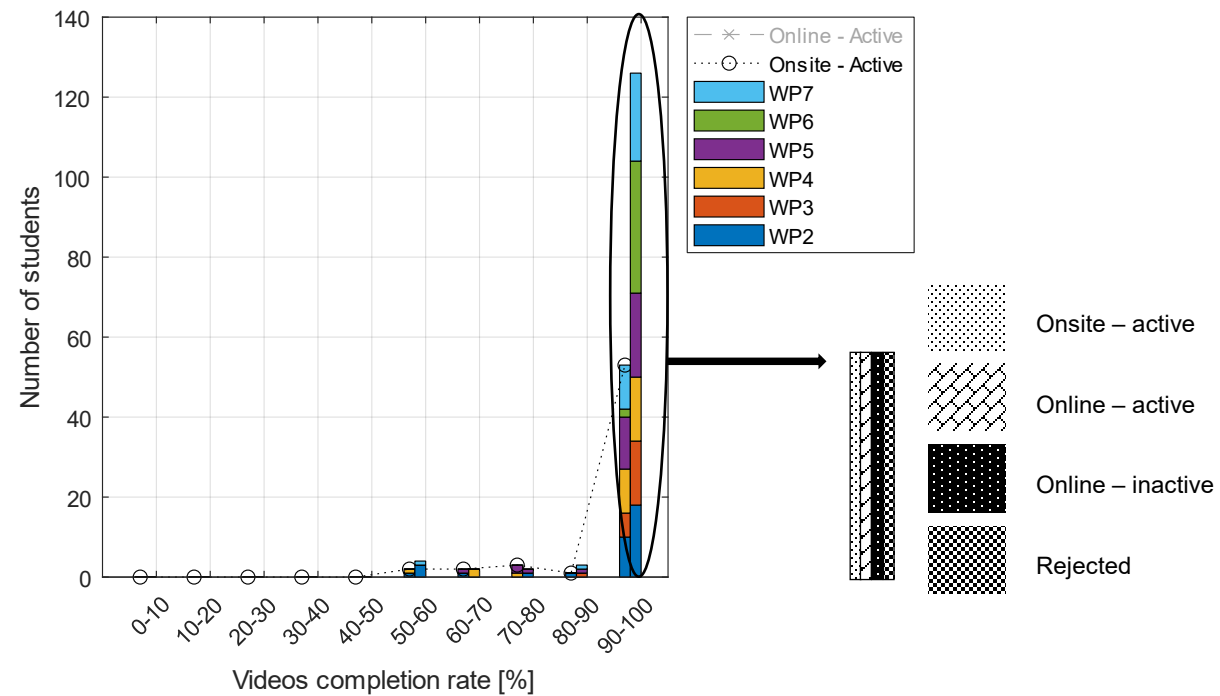
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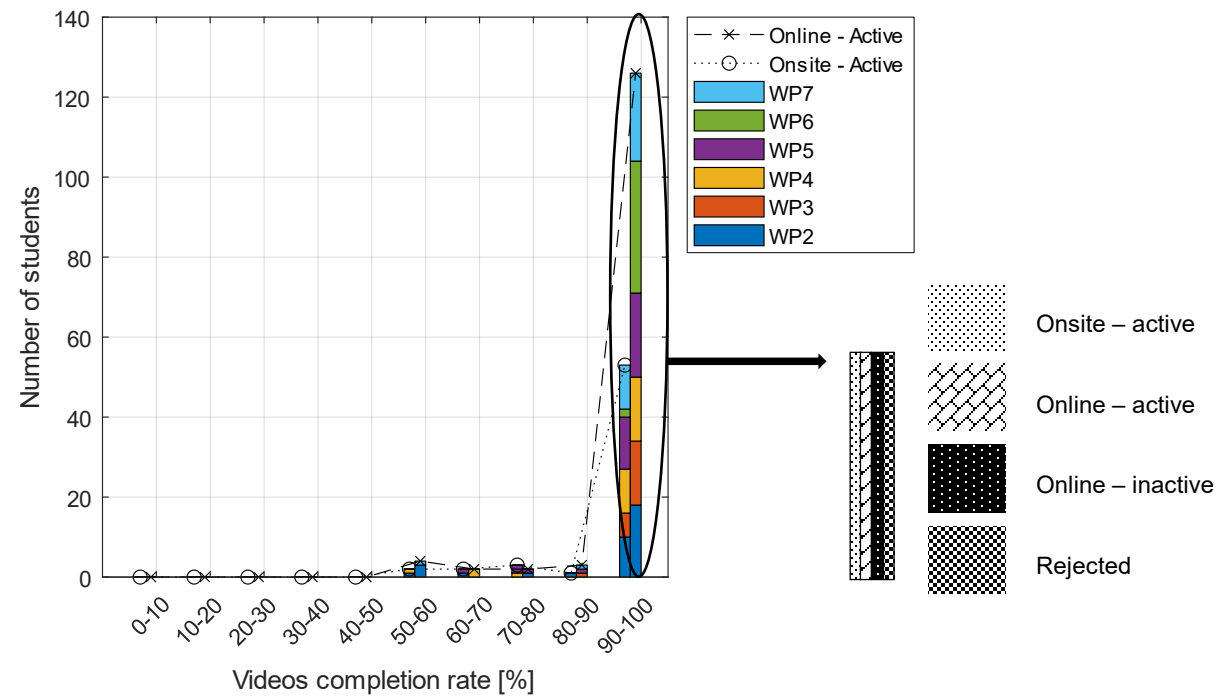
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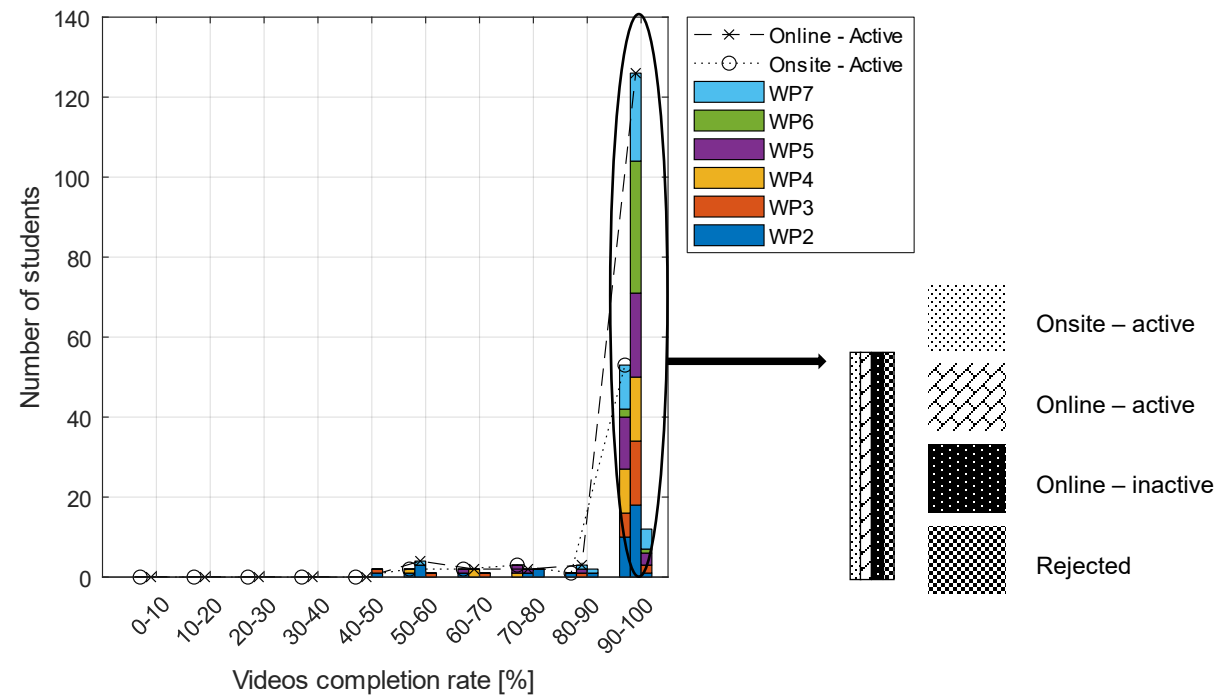
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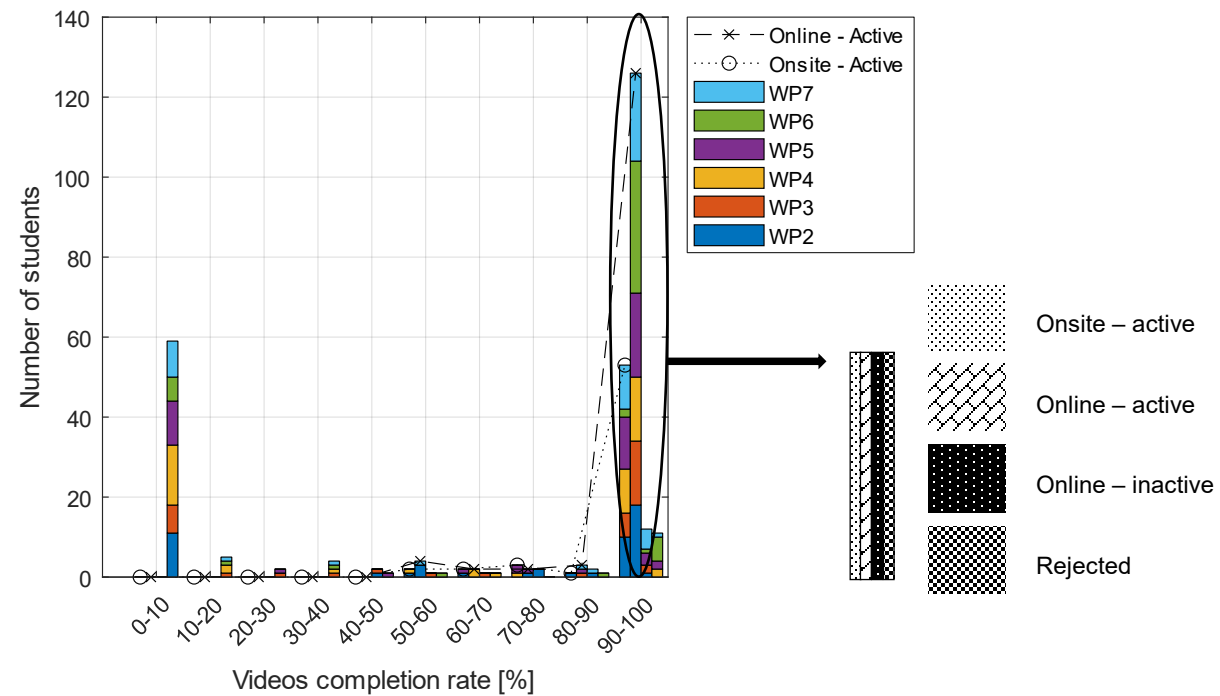
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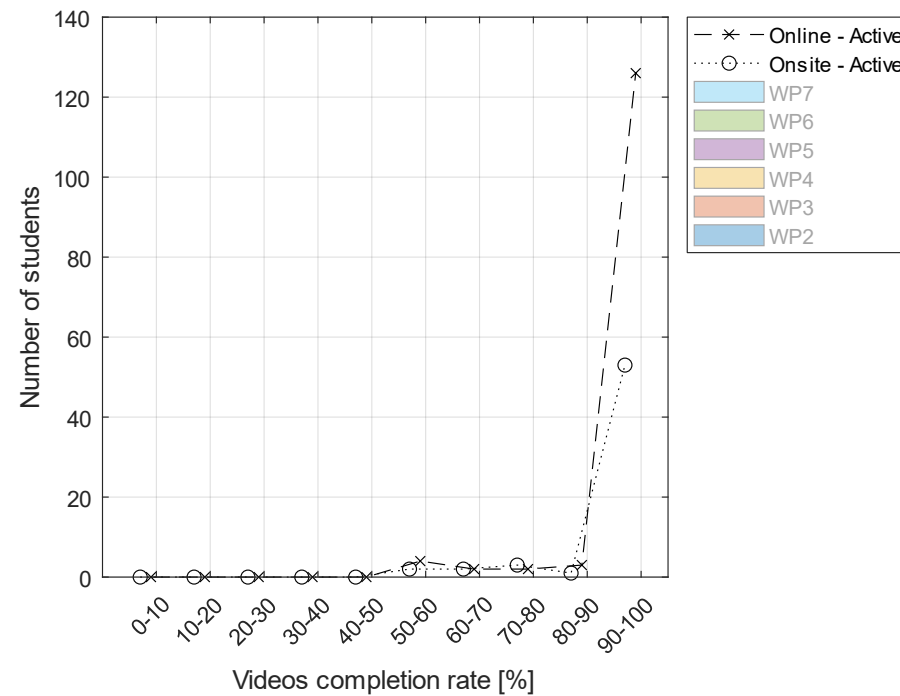
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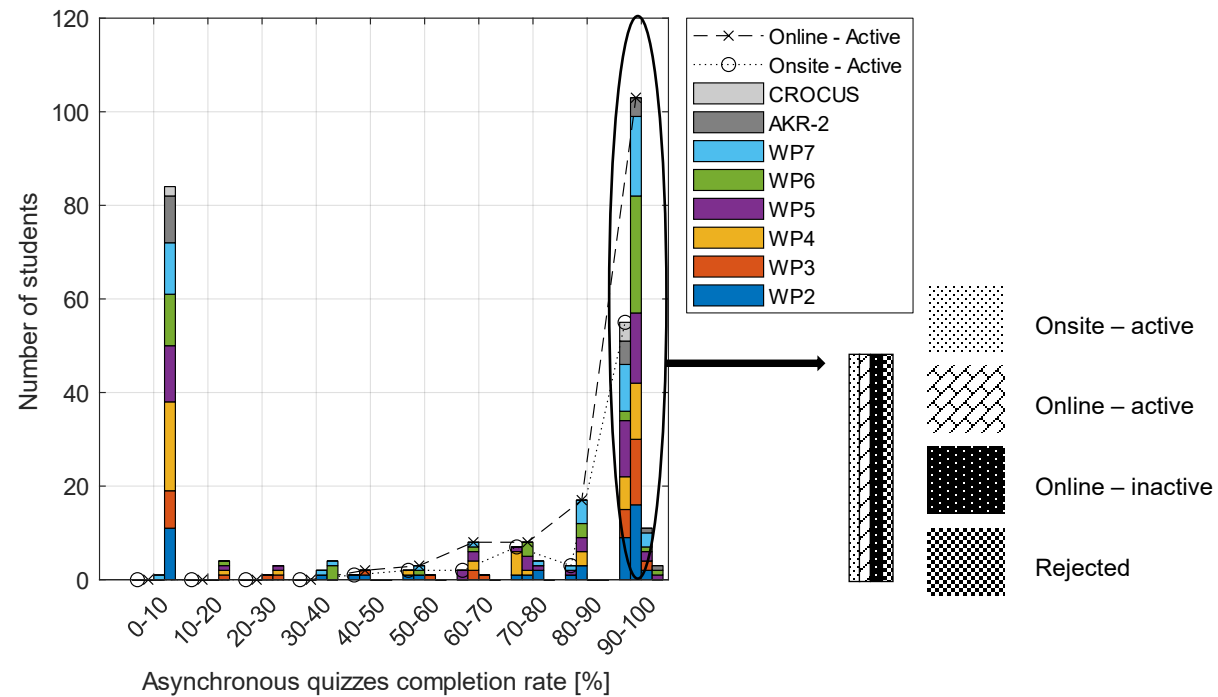
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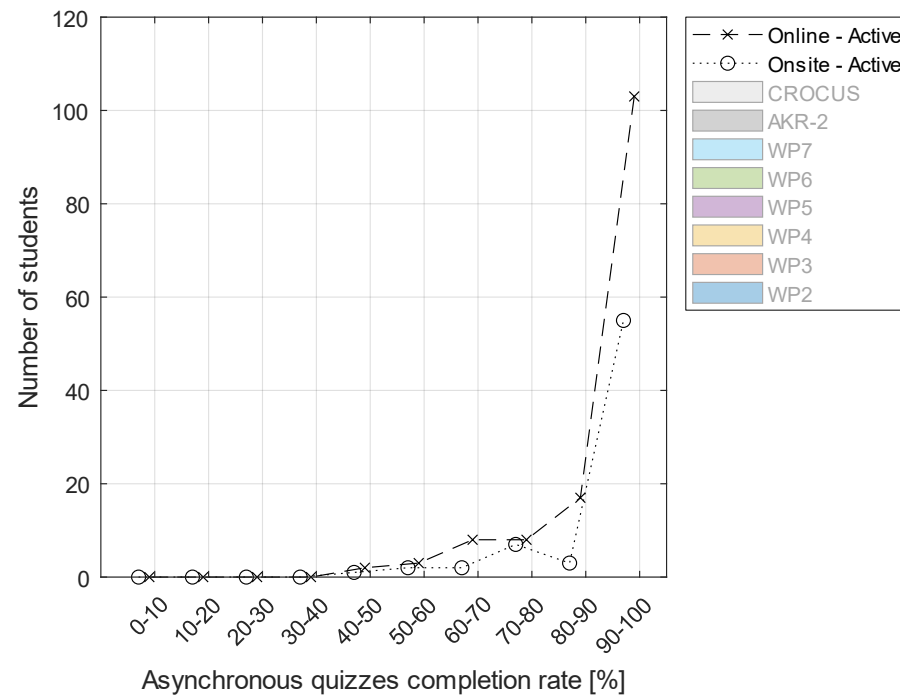
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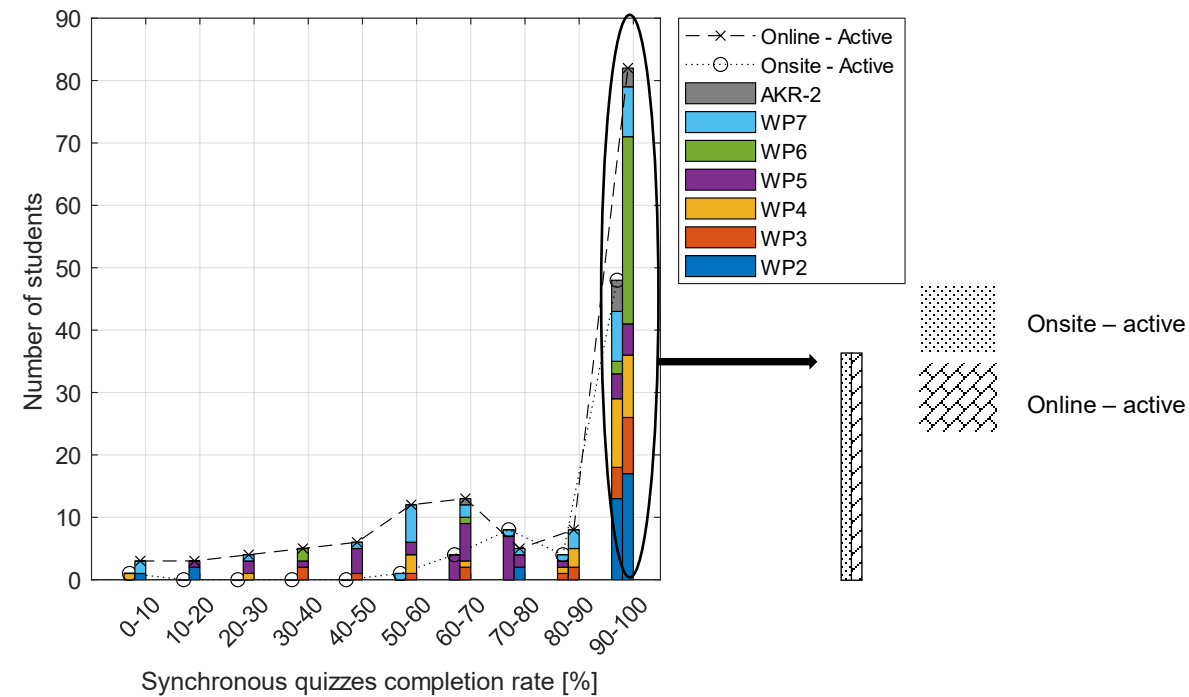
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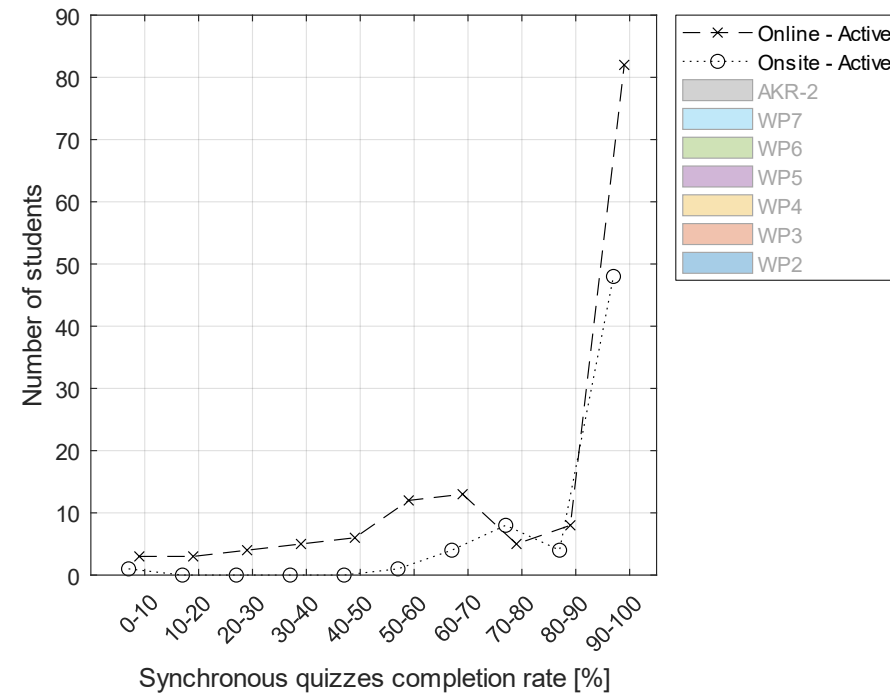
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- Use of the various teaching resources – **synchronous quizzes:**



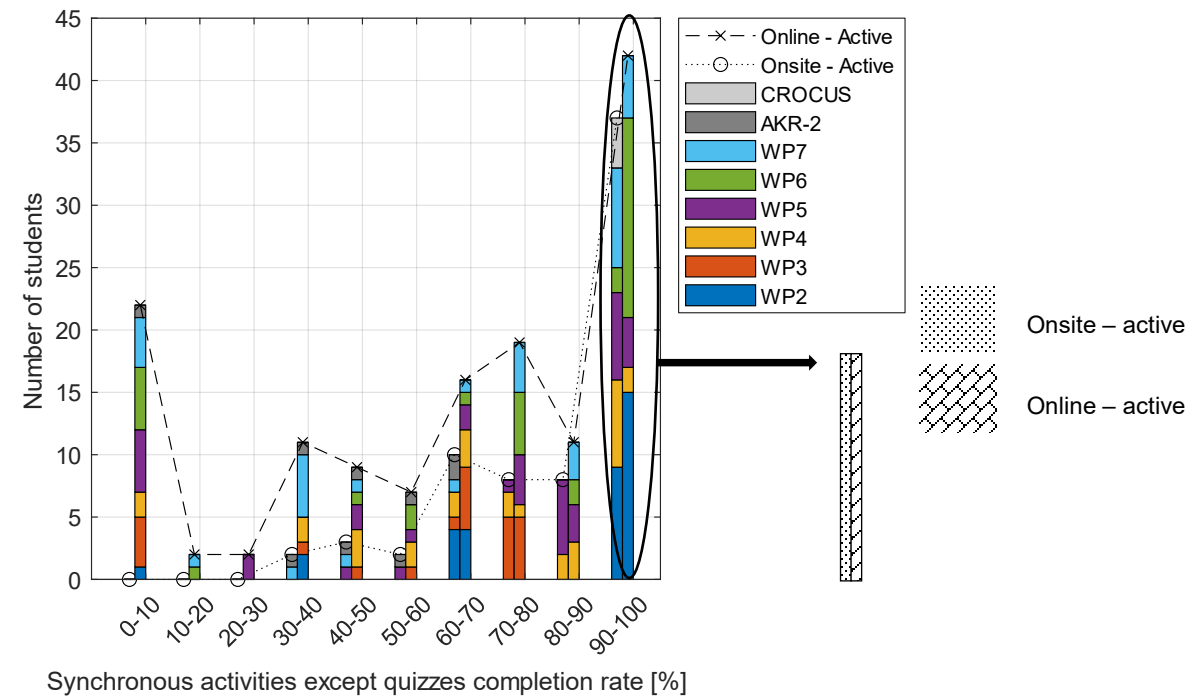
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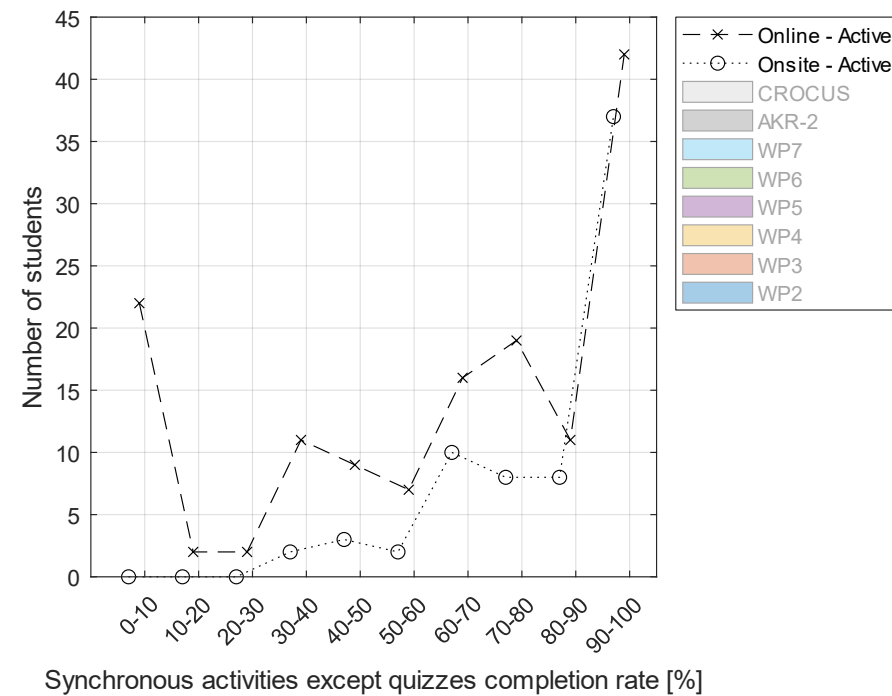
ANALYSIS

- **Use of the various teaching resources – synchronous activities other than quizzes:**



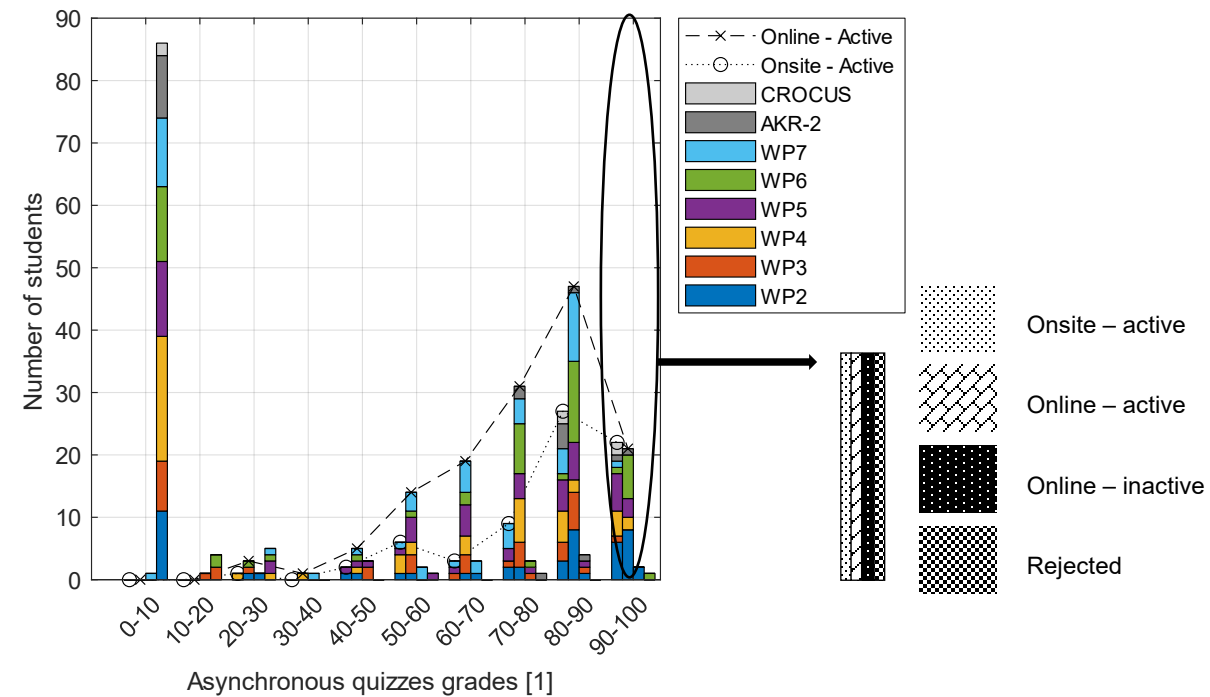
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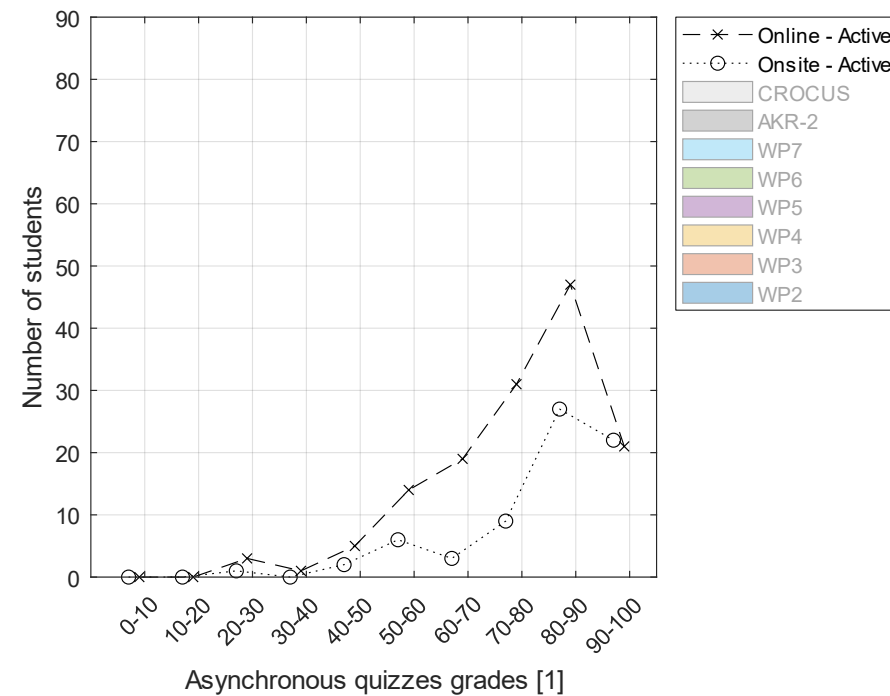
ANALYSIS

- **Learning of the theoretical concepts – asynchronous quizzes:**



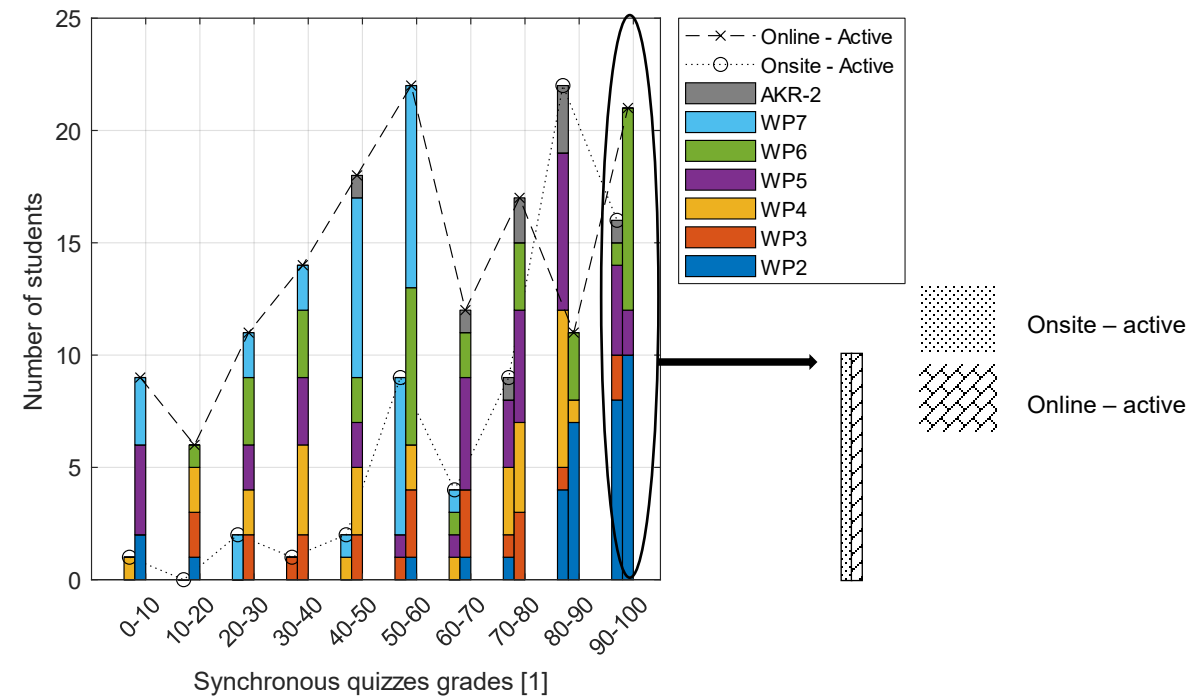
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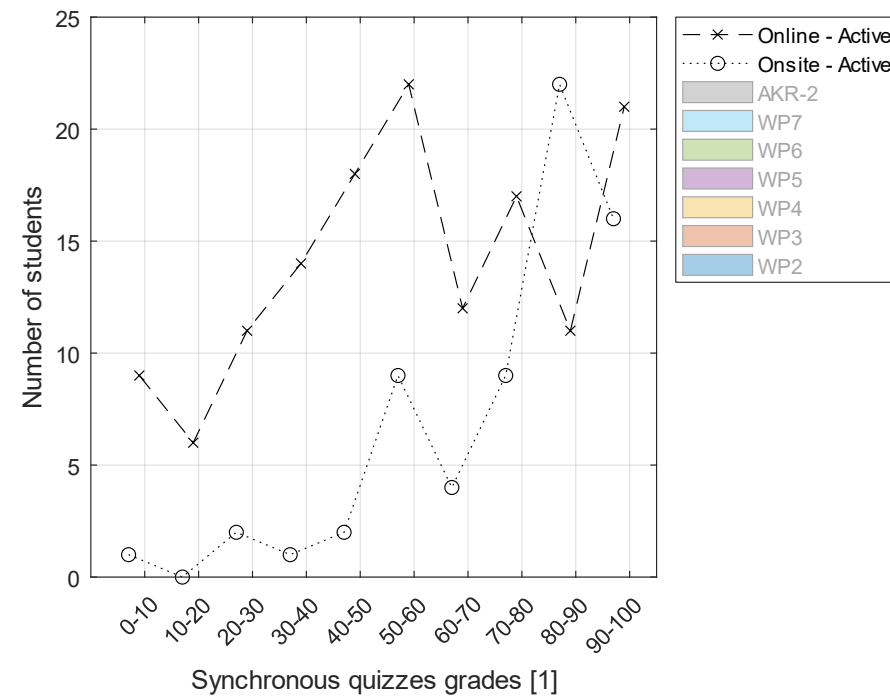
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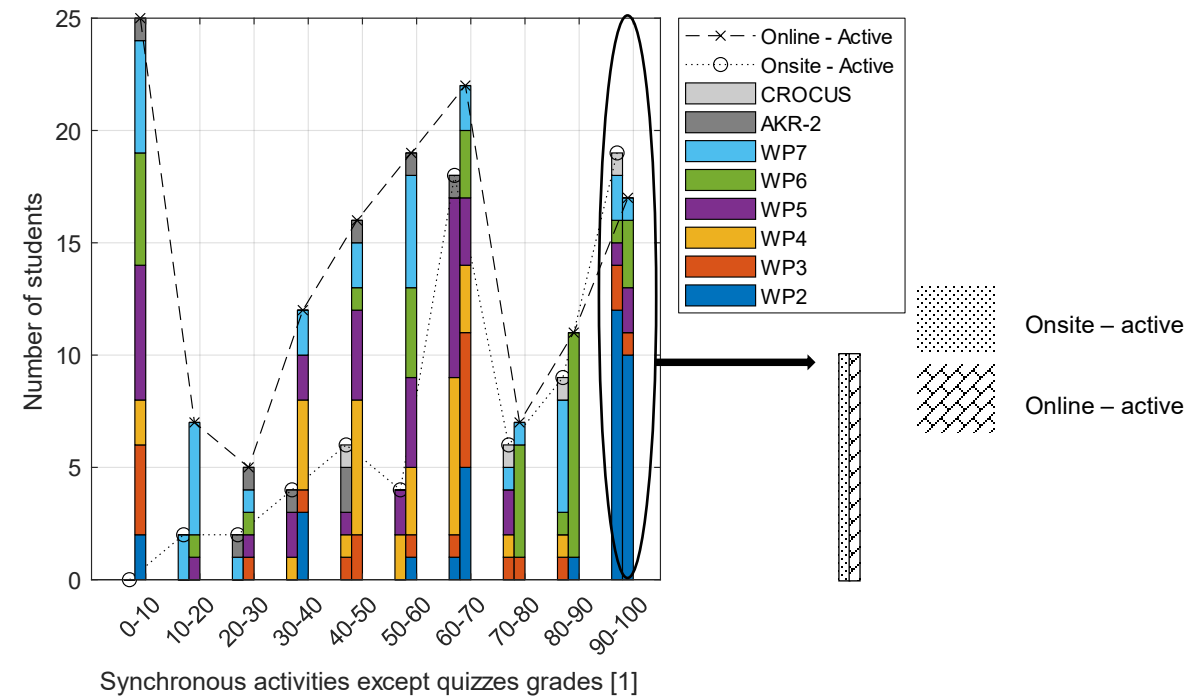
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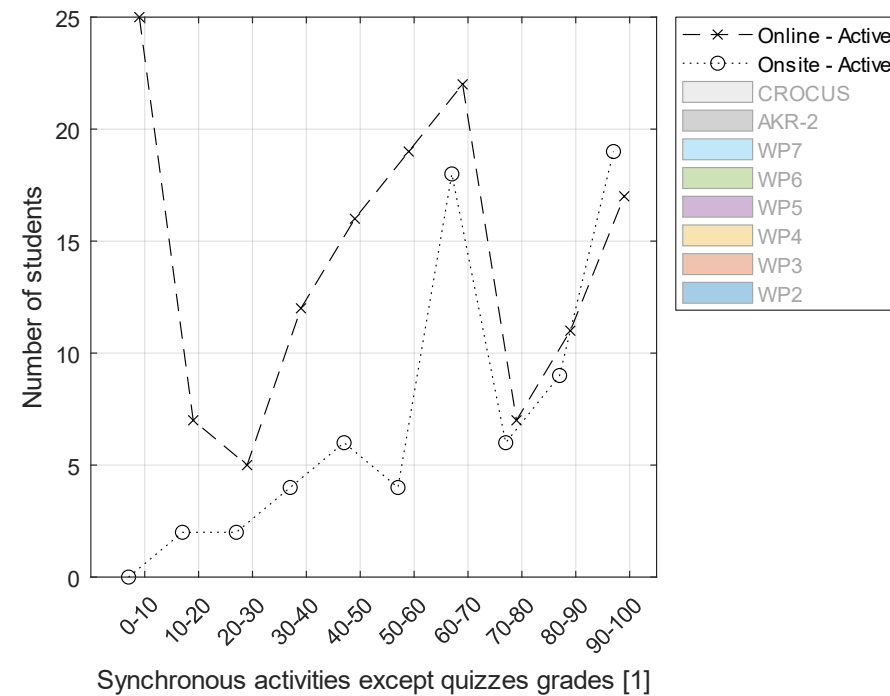
ANALYSIS

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



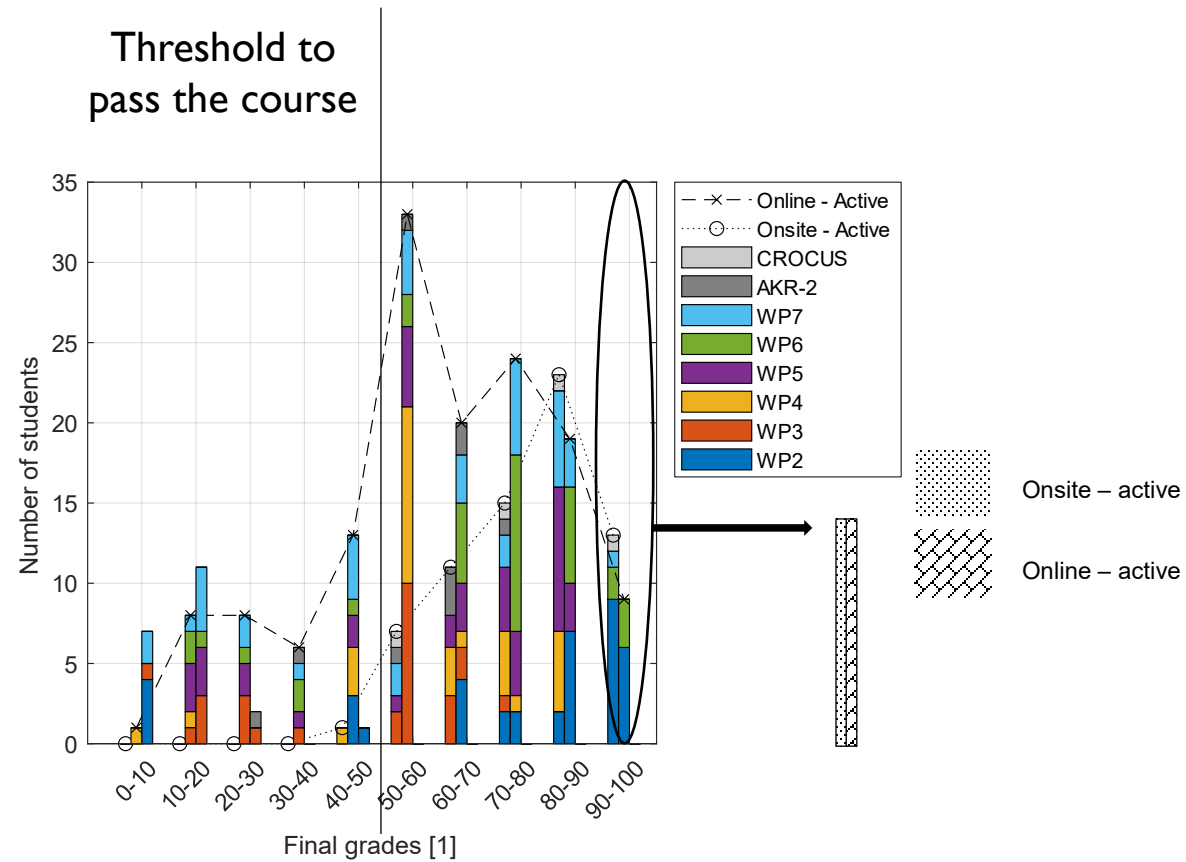
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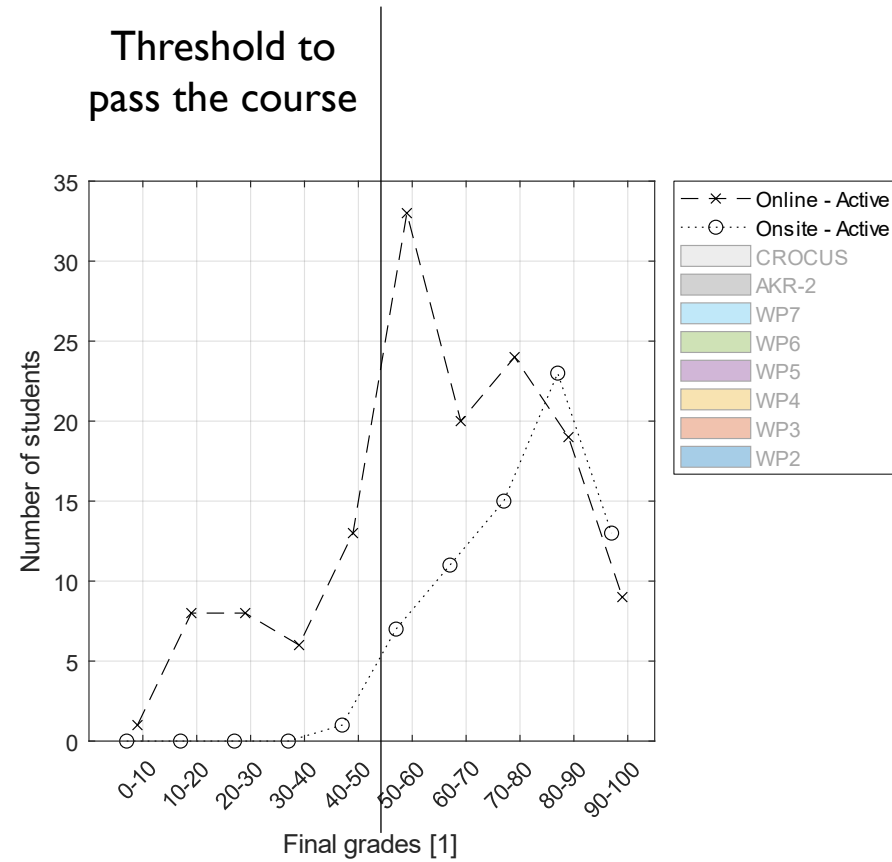
ANALYSIS

- Final grades:



ANALYSIS

- **Final grades:**

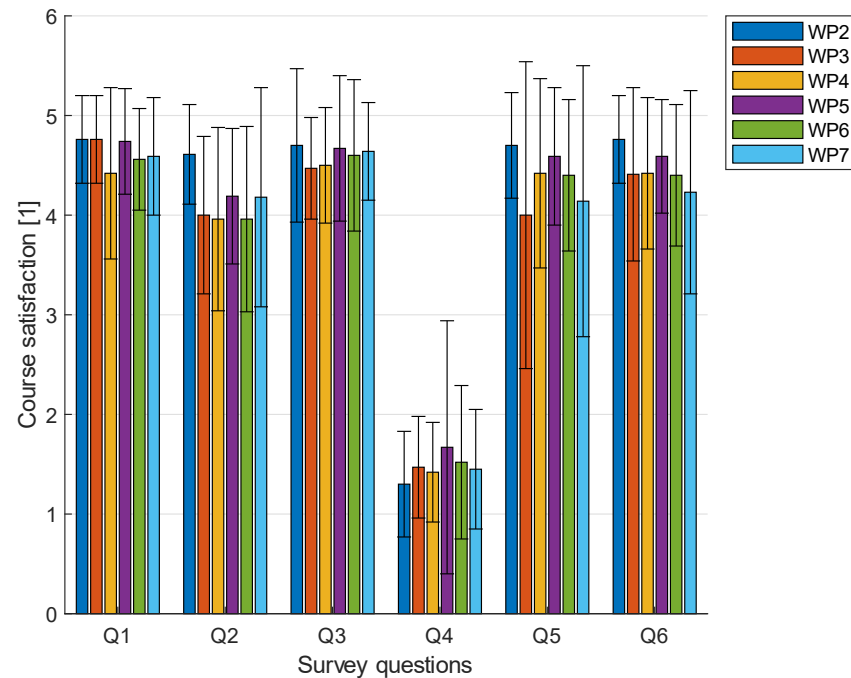


ANALYSIS

- 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)**

ANALYSIS

- **Participants' own perception of the course:**



Q1: I benefited from this course.

Q2: This course met my expectations.

Q3: I experienced and learned new things in this course.

Q4: The content covered in this course was NOT interesting.

Q5: I would like to take more courses like this one.

Q6: I would recommend this course to others.

ANALYSIS

- Thematic analysis of three “things” participants liked (over then courses, N=652):

1.	Course content (variety, relevant topics)	122 items
2.	Teachers (lecturing, interaction and support)	115 items
3.	Practical exercises (hands-on knowledge, variety of codes)	98 items
4.	Written materials (handbooks / slides /notes)	59 items
5.	Discussions, collaboration, networking with other participants	38 items
6.	Innovative teaching method (flipped teaching)	36 items
7.	Organisation and structure	28 items
8.	Variety of computational resources	21 items
9.	Videos and quizzes	17 items
10.	MATLAB grader (explicitly)	14 items
11.	Balance between theory and practice	12 items
12.	Real world applications	12 items
13.	Remote option	11 items
14.	Flexibility / own pace	10 items

ANALYSIS

- Thematic analysis of three “things” participants did not like (over 10 courses, N=369):
 1. Time Constraints, Workload and Pace (too much, too little time) 113 items
 2. Technical Issues (hardware, software, internet) 33 items
 3. Content & curriculum (too theoretical, too practical, topics) 32 items
 4. Hybrid format challenges (cannot hear, less inclusion) 28 items

 5. Unengaging, unclear synchronous exercises 15 items
 6. Organization (unclear scheduling, chaotic) 15 items
 7. Handbook (unclear, overwhelming, poor language) 14 items
 8. Bad, unclear or lack of instructions 11 items
 9. Content repetition (between courses or between asynch & synch) 11 items
 10. Difficult software installation 11 items
 11. Unprepared online participants & lack of collaboration online 11 items
 12. Unclear prerequisites (often more difficult than expected) 11 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



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-PIioneer 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



Welcome to the final workshop, June 25-26, 2024, Sweden + online!



INNOVATING PHYSICS PEDAGOGY:

Lessons from GRE@T-PIONEER's Flipped Classroom in Hybrid and Online Modes

25-26 June 2024 at Stenungsbaden. More information: great-pioneer.eu



More info and registration at:

Registration to the GRE@T-PIONEER workshop



Thank you!

Contact details:



Name: *Prof. Christophe Demazière*



Email: *demaz@chalmers.se*



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