GRE@T-PIONEeR

Coordination and Support Action (CSA)

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Overview of promoting strategies and evaluation of the course packages

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Summary

The GRE@T-PIONEeR project has been running since November 1st, 2020, for a duration of four years. This document presents an overview of the strategies followed by the consortium to promote the various courses. Beyond advertising the course offering, some targeted networking activities were undertaken and are summarized in this report. Since the courses were offered on two occasions during two consecutive academic years, feedback from the students was continuously and systematically gathered. The report presents an analysis of this feedback. Measures to further improve the courses are also detailed. Finally, the consortium has been very active since the early start of the project in establishing the conditions required for making the course offering available on the long run. A summary of the actions undertaken in this respect and of their effect is also presented.

Approval

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October 24th, 2024	1.2	C. Stöhr (CHALMERS), L. Benes (LGI), C. Demazière (CHALMERS)	C. Demazière (CHALMERS)	Finalization of the paper

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Abbreviations and Acronyms

Acronym	Description
AB	Advisory Board
A-CINCH	Augmented Cooperation in Education and Training in Nuclear and Radiochemistry
BME	Budapest University of Technology and Economics
CoI	Community of Inquiry
ENEEP	European Nuclear Experimental Educational Platform
ENEN	European Nuclear Education Network
ENEN2+	Building European Nuclear Competence through continuous Advanced and Structured Education and Training Actions
ENS	European Nuclear Society
EUG	End-User's Group
ExCom	Executive Committee
GRE@T-PIONEeR	GRaduate Education Alliance for Teaching the PhysIcs and safety Of NuclEar Reactors
GRS	Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH
IAEA	International Atomic Energy Agency
IMMS	Instructional Materials Motivation Survey
LMS	Learning Management System
OECD/NEA	Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
SNETP	Sustainable Nuclear Energy Platform
SRL	Self-Regulated Learning
SSM	The Swedish Radiation Safety Authority
VR	Virtual Reality

Executive Summary

The GRE@T-PIONEeR project has been running since November 1st, 2020, for a duration of four years. This document presents an overview of the strategies followed by the consortium to promote the various courses. Beyond advertising the course offering, some targeted networking activities were undertaken and are summarized in this report. Since the courses were offered on two occasions during two consecutive academic years, feedback from the students was continuously and systematically gathered. The report presents an analysis of this feedback. Measures to further improve the courses are also detailed. Finally, the consortium has been very active since the early start of the project in establishing the conditions required for making the course offering available on the long run. A summary of the actions undertaken in this respect and of their effect is also presented.

Keywords

Flipped classroom, active learning, hybrid teaching

1. Introduction

The EU-funded GRE@T-PIONEeR project aims at developing a specialized education in reactor physics and nuclear reactor safety for PhD and postdoc students, for nuclear engineers, and taken as advanced courses for MSc students. The education encompasses both theory and hands-on training exercises, the latter heavily relying on the use of research/training reactors and of computer-based modelling environments. The aim is for the students to be able to perform nuclear reactor safety simulations understanding all the approximations on which such simulations rely. This is considered essential knowledge in the education of highly skilled nuclear safety analysts. The use of pre-recorded lectures and electronic teaching resources allows students to learn at their own pace and get prepared for the hands-on training sessions, following a flipped classroom approach. Those sessions are offered in a hybrid set-up (i.e., they could be attended both on-site and remotely). They use active learning methods under the close supervision and support of the teachers, thus promoting student learning.

The project has been running since November 1st, 2020, for a duration of four years. This document presents an overview of the strategies followed by the consortium to promote the various courses. Beyond advertising the course offering, some targeted networking activities were undertaken and are summarized in this report. Since the courses were offered on two occasions during two consecutive academic years, feedback from the students was continuously and systematically gathered. The report presents an analysis of this feedback. Measures to further improve the courses are also detailed. Finally, the consortium has been very active since the early start of the project in establishing the conditions required for making the course offering available on the long run. A summary of the actions undertaken in this respect and of their effect is also presented.

2. Promoting strategies and networking

2.1. Promoting strategies

To enhance networking and to disseminate the project, multiple promoting strategies were implemented, using all the following tools and communication channels:

- **Website**: A public website https://great-pioneer.eu was designed and released at the beginning of the project. It was widely promoted and updated monthly. It presents general information about the project, the course modules and hands-on training exercises which were developed throughout the project, as well as all the communication tools and support materials. The objective was to reach 5500 visits on the website by the end of the project. As of September 2024, we have reached a total of 42883 visits, with a total number of 764 website visitors, and the most viewed page being the events calendar webpage.

- **Advertising videos**: Short promotional videos of professional standard were developed for each of the courses. They were widely disseminated through social media to promote course registration. Furthermore, based upon the handbook and hands-on training exercises, the lecturers created video lectures to complement the written materials. The written materials aim at presenting the topics in detail, the short lecture videos have the ambition to give a summary of the main key points of the presented topics, thus helping the students to build a conceptual understanding. Some of those video lectures were also put on the project website to give a flavour of what the prospective course participants will have access to when they register to the courses (if accepted to the courses). All these videos (promotional and selected video lectures) are embedded on a project Vimeo account and displayed on the website to illustrate the different courses. A total of 24 videos were created, counting a total of over 2960 views, with 124 views in average per video. The video which counted the most views was Neutron transport at the fuel cell and assembly levels, with a total of 603 views.
- **Social media channels**: We created and managed social media accounts for the project on both Twitter (for the more general public) and LinkedIn (for the professional audience) in order to build an online community and engage in a two-way dialogue with the project's stakeholders. Communication campaigns and social media kits were designed, shared with partners and rolled out on both channels using appealing visuals with strong messages (infographics, short animation videos, interviews with the project partners and/or students, images...). These social media channels were also used for cross-project and cross-partner collaboration. The key performance indicators for the project's social media were to have 200 or more followers. As of September 2024, the LinkedIn account totals 1282 followers, and the Twitter account totals 176 followers, which adds to a total of 1458 followers.
- **Newsletters**: 3 e-newsletters were to be issued to the newsletter subscribers to draw attention to the project and highlighting the course offering. It also allowed to provide updates on the ongoings of the project. We also created 4 dedicated "Save-the-Date" and "Workshop reminder" newsletters to promote specific workshops. The first project newsletter was issued in December 2021, the second newsletter was issued in February 2023, and the final newsletter is to be released in the final month of the project, in October 2024. They are all available on the project website. The aim was to reach 200 subscribers. As of September 2024, the project totals 136 subscribers. At this stage, it will be difficult to envision reaching this KPI for multiple reasons. Newsletters are less and less popular with digital audiences, who prefer to access information via other communication channels. People don't subscribe as much to newsletters as they are afraid of getting spammed or overloaded with emails. They don't bother reading them or do not want to have to wait to have access to information and updates and will prefer staying updated through social media. This is the trend we can identify in this project as we have less newsletter followers than aimed for but have exceeded our social media followers.

Participation to events/meetings: The Coordinator and consortium partners have actively promoted the project, its objectives and course offering at relevant external events through oral and poster presentations, distribution of project leaflets, exhibition stands. The project was represented in 1 event in 2020, 6 events in 2021, 7 events in 2022, 5 events in 2023, and 1 event in 2024 – the ENEN2 Brussels Conference in February 2024, as summarized in Table 1.

Table 1: Summary of the communication and dissemination activities.

Activity	Description	Initial Targets	Reached Targets September 2024
Public website	Online, user-friendly hub for wide scale dissemination of project objectives, course offering and detailed information about the course modules and hands-on training sessions. Links with websites of other related projects and initiatives (multiplier effect).	Total: 5500 visits	Total: 42 883
Advertising Videos	Develop short introductory videos will be developed for each of the topics covered.		24 Videos 2960 Total Views
Social Media Channels	Two social media channels (Twitter and LinkedIn) were created and managed to reach the target audiences as widely as possible. They also served as the main channels for the communication campaigns rolled out by the project.	Launched at the start of the project. 200+ followers by the end of the project.	Twitter Followers: **176** Linkedin Followers: **1282** TOTAL Followers: **1458**
E-Newsletters	3 e-newsletters were issued to a project distribution list drawing attention to the project and highlighting the course offering.	200+ subscribers by the end of the project.	Newsletter 01 – DEC 2021 Newsletter 02 – FEB 2023 Newsletter 03 – OCT 2024. Newsletters for workshops - 4 TOTAL Subscribers: 136
Participation to events / meetings	The Coordinator and/or the consortium partners actively promoted the project, its objectives and	Representation at 6 external events.	The project has been represented in over 20 events throughout the project.

	course offering at relevant external events through oral and poster presentations, distribution of project leaflets, exhibition stands.		

2.2. Networking

From the early start of the project, contacts were initiated with the A-CINCH (Augmented Cooperation in Education and Training in Nuclear and Radiochemistry) project and slightly later with the ENEEP (European Nuclear Experimental Educational Platform) project. With the former, the intention was to gather some feedback in terms of electronic documentation system, Learning Management Systems (LMS), laboratory exercises offered remotely and using Virtual Reality (VR), and course offering on a commercial basis. With the latter, some synergy effects were quickly identified as some of the laboratory exercises proposed by ENEEP are in experimental reactor physics, an area tackled by GRE@T-PIONEeR. A joint GRE@T-PIONEeR/ENEEP booth was held at the International Conference on Physics of Reactors (PHYSOR 2022), May 15-20, 2022, in Pittsburgh, PA, USA, to advertise both projects and attract potential participants to the courses. Discussions on joint course offerings were also initiated but abandoned when the only GRE@T-PIONEeR partner formally involved in ENEEP withdrew from ENEEP.

With the formal inclusion of ENEN as a GRE@T-PIONEeR partner, the project had access to a large network of contacts through ENEN. GRE@T-PIONEeR could regularly present the advancement of the project at the annual meetings of ENEN organized in Brussels, further gaining visibility. Also, the advertising campaigns launched by GRE@T-PIONEeR when the registration to the various courses opened were relayed by ENEN. Through ENEN and the ENEN2+ project, the possibility of financing the onsite participation of students to the GRE@T-PIONEeR courses was utilized to some extent for the first edition of the courses (via ENEN2+ individual applications) and to a large extent for the second edition of the courses (via ENEN2+ group applications prepared by GRE@T-PIONEeR). The ENEN2+ mobility grants had a major impact on onsite versus remote attendance of the GRE@T-PIONEeR courses, with the group applications resulting in a significant increase in the number of people choosing the onsite option.

Beyond the above connections, the project also had an Advisory Board (AB) and an End-User's Group (EUG). The organizations represented at the AB were Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH (GRS), the Swedish Radiation Safety Authority (SSM), the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), and the Hungarian Atomic Energy Authority. The organizations represented at the EUG were Studsvik Scandpower AB, Vattenfall, Westinghouse Electric Sweden AB and MVM Paks Nuclear Power Plant Ltd. Some of these organizations were present at some of the annual meetings of the consortium and actively contributed to the discussions, especially during the 22nd Executive Committee (ExCom) meeting of GRE@T-PIONEeR held in Stenungsund, Sweden, on June 26, 2024. During this

meeting, the long-term sustainability of GRE@T-PIONEeR was discussed in the form of a workshop, with instrumental contributions from some members of the AB. Also, discussions with the OECD/NEA have been ongoing since the beginning of 2024 to possibly offer some of the GRE@T-PIONEeR courses as OECD/NEA courses. It is worth noting that GRE@T-PIONEeR received on June 28, 2024, a grant from SSM for covering some of the running costs of GRE@T-PIONEeR, when the funding from the European Union formally ends at the end of October 2024. The SSM financing will be instrumental for lowering the course fees planned to be charged to the course participants in the future editions of the GRE@T-PIONEeR courses.

Finally, GRE@T-PIONEeR also utilized some other communication channels to advertise its courses, such as the European Nuclear Society (ENS) and the Sustainable Nuclear Energy Technology Platform (SNETP).

3. Feedback on the delivery of the courses

3.1. Overview of the offered courses

The courses were all delivered during two consecutive academic years: in the academic year 2022/2023 and in the academic year 2023/2024. All courses were given during each of the two academic years, except the hands-on course on the BME Training Reactor (only delivered during the academic year 2023/2024) and the hands-on course on the CROCUS reactor (only delivered during the academic year 2022/2023). All courses followed the same format: an asynchronous self-paced online learning phase, followed by a synchronous learning phase offered in a hybrid set-up (possibility to attend onsite and online simultaneously). The synchronous phase was typically organized on five consecutive working days (or ten working days in a few cases), whereas the asynchronous phase started typically 4 weeks before the start of the synchronous phase. The offering of the various courses is summarised below:

- Course “Nuclear cross-sections for neutron transport”, labelled hereafter WP2. The synchronous learning phase took place at the Polytechnic University of Valencia, Valencia, Spain, between November 14th and November 18th, 2022, for the first course occurrence, and between September 4th and September 8th, 2023, for the second course occurrence. This was a 3 ECTS (European Credit and Transfer System) course.
- Course “Neutron transport at the fuel cell and assembly levels”, labelled hereafter WP3. The synchronous learning phase took place at Chalmers University of Technology, Gothenburg, Sweden, between December 16th and December 20th, 2022, for the first course occurrence, and between October 16th and October 20th, 2023, for the second course occurrence. This was a 3 ECTS course.
- Course “Core modelling for core design”, labelled hereafter WP4. The synchronous learning phase took place at the Polytechnic University of Valencia, Valencia, Spain, between January 9th and January 13th, 2023, for the first course occurrence, and between November 27th and December 1st, 2023, for the second course occurrence. This was a 3 ECTS course.

- Course “Core modelling for transients”, labelled hereafter WP5. The synchronous learning phase took place at the Polytechnic University of Valencia, Valencia, Spain, between February 6th and February 10th, 2023, for the first course occurrence, and between January 8th and January 12th, 2024, for the second course occurrence. This was a 3 ECTS course.
- Course “Reactor transients, nuclear safety and uncertainty and sensitivity analysis”, labelled hereafter WP6. The synchronous learning phase took place at the Polytechnic University of Valencia, Valencia, Spain, between March 6th and March 10th, 2023, for the first course occurrence, and between February 19th and February 24th, 2024, for the second course occurrence. This was a 3 ECTS course.
- Course “Radiation protection in nuclear environment”, labelled hereafter WP7. The synchronous learning phase took place at the Budapest University of Technology and Economics, Budapest, Hungary, between March 27th and March 31st, 2023, for the first course occurrence, and between April 8th and April 12th, 2024, for the second course occurrence. This was a 3 ECTS course.
- Hands-on exercises on the AKR-2 training reactor, labelled hereafter AKR-2. The synchronous learning phase took place at the Technical University of Dresden, Dresden, Germany, between April 17th and April 28th, 2023, for the first course occurrence, and between September 2nd and September 13th, 2024, for the second course occurrence. This was a 4.5 ECTS course.
- Hands-on exercises on the CROCUS training reactor, labelled hereafter CROCUS. The synchronous learning phase took place , at the Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, between May 29th and June 2nd, 2023. The synchronous learning phase was only offered with the onsite option. This was a 2 ECTS course.
- Hands-on exercises on the BME training reactor, labelled hereafter BME. The synchronous learning phase took place at the Budapest University of Technology and Economics, Budapest, Hungary, between January 22nd and February 2nd, 2024. This was a 4 ECTS course.

3.2. Course statistics

The courses all adopted the same principles:

- Access to the synchronous elements was only possible if 50% of all asynchronous work was completed, i.e., if the students had watched at least 50% of the video lectures and had completed at least 50% of the asynchronous quizzes (irrespective of whether the quizzes were correctly answered or not).
- The asynchronous quizzes, synchronous quizzes and synchronous hands-on were all graded activities.
- The final grade of the courses was calculated using a relative weight of 25% on the asynchronous activities and correspondingly a relative weight of 75% on the synchronous activities. The number of points for the entire course was rescaled to 100 points.
- Course certificates were only delivered if a participant got at least 50 points (out of 100).

Tables 2 and 3 give for each of the GRE@T-PIONEeR courses offered during the academic year 2022/2023 and the academic year 2023/2024, respectively, the number of received applications, the number of discarded applications and the corresponding number of accepted applications. 50 students

were considered to be the upper limit for being able to efficiently support them during the courses. For the number of accepted applications, the number of candidates who opted for the onsite, online option, respectively, of the synchronous sessions is also given, together with the number of participants who got access to the LMS. This number might be different from the number of accepted participants, due to late cancellations or late registrations. The number of participants with LMS access is further subdivided in the following categories:

- A category called “Rejected” encompassing all students who did not reach the necessary level of completion rate on the asynchronous activities to qualify for the synchronous activities.
- A category called “Onsite – active” encompassing all students who qualified for the synchronous sessions, who chose the onsite attendance for the synchronous sessions and who completed at least one activity during those sessions.
- A category called “Online – active” encompassing all students who qualified for the synchronous sessions, who chose the online attendance for the synchronous sessions and who completed at least one activity during those sessions.
- A category called “Online – inactive” encompassing all students who qualified for the synchronous sessions, who chose the online attendance for the synchronous sessions but did not complete any activity during those sessions.

It should be noted that all onsite attendees completed at least one activity during the interactive sessions, explaining why there is no category called “Onsite – inactive”. Furthermore, the number of “Onsite – active” students does not necessarily match the number of accepted students who chose the onsite option. Similarly, the sum of the numbers of “Online – active”, “Online – inactive” and “Rejected” students does not systematically match the number of accepted participants who chose the online option. This is due to students changing their mode of participation to the courses from onsite to online and vice versa between the time when they were accepted to the courses and the time when the synchronous sessions started.

The tables also give the number of certificates issued for each of the courses.

Table 2: Student statistics and categorization for the GRE@T-PIONEeR courses offered during the academic year 2022/2023.

Course	Received applications	Discarded applications	Accepted applications	Participants given access to the LMS	Participants labelled as " rejected"	Participants labelled as " onsite – active"	Participants labelled as " online – active"	Participants labelled as " online – inactive"	Participants issued a course certificate
WP2	87	37	50: 14 onsite 36 online	51	11	13	22	5	32
WP3	41	3	38: 6 onsite 32 online	38	10	6	17	5	23
WP4	56	6	50: 23 onsite 27 online	52	21	13	18	0	29
WP5	60	6	54: 16 onsite 38 online	57	15	16	23	3	32
WP6	54	2	52: 6 onsite 46 online	52	16	2	33	1	29
WP7	51	0	51: 17 onsite 34 online	53	12	11	24	6	28
AKR-2	24	2	22: 11 onsite 11 online	21	11	5	4	1	8
CROCUS	15	9	6: 6 onsite 0 online	6	2	4	0	0	4
Total	**389**	**65**	**324: 100 onsite 224 online**	**330**	**98**	**70**	**141**	**21**	**185**

Table 3: Student statistics and categorization for the GRE@T-PIONEeR courses offered during the academic year 2023/2024.

Course	Received applications	Discarded applications	Accepted applications	Participants given access to the LMS	Participants labelled as " rejected"	Participants labelled as " onsite – active"	Participants labelled as " online – active"	Participants labelled as " online – inactive"	Participants issued a course certificate
WP2	47	3	44: 8 onsite 36 online	44	6	5	23	10	33
WP3	41	0	41: 12 onsite 29 online	41	13	11	16	1	24
WP4	67	15	52: 18 onsite 34 online	52	14	14	22	2	35
WP5	67	10	57: 26 onsite 31 online	57	20	10	26	1	36
WP6	61	8	53: 16 onsite 37 online	53	17	11	24	1	29
WP7	85	12	73: 22 onsite 51 online	73	28	14	25	6	36
BME	56	30	26: 11 onsite 15 online	36	16	11	9	0	19
AKR-2	38	0	38: 15 onsite 23 online	30	0	13	5	12	14
Total	**462**	**78**	**384: 128 onsite 256 online**	**386**	**114**	**89**	**150**	**33**	**226**

The success rates on the courses are excellent, as demonstrated by the following measures:

- The percentage of participants who obtained a course certificate compared to the number of participants granted access to the LMS is 55.3% for the academic year 2022/2023 and 58.5% for the academic year 2023/2024.
- The percentage of participants who obtained a course certificate compared to the number of participants qualified for the synchronous sessions is 75.6% for the academic year 2022/2023 and 83.1% for the academic year 2023/2024.
- The percentage of participants who obtained a course certificate compared to the number of participants taking at least one activity during the synchronous sessions is 91.5% for the academic year 2022/2023 and 94.6% for the academic year 2023/2024.

For the last measure, 100% of the onsite participants received a course certificate, whereas for the online participants, 87.0% and 91.3% of the participants taking at least one activity during the synchronous sessions received a certificate for the academic years 2022/2023 and 2023/2024, respectively.

3.3. Student feedback

This section presents a comprehensive analysis of learner feedback from all courses (WP2-WP7) over two iterations (2022/2023 and 2023/2024) and for the two learner cohorts (onsite and online). We used various measurement instruments to evaluate different aspects of the courses. The feedback provides insights into participants' satisfaction levels, motivation, and perceptions of the learning environment, as well as their ability to self-regulate during the courses. The *Satisfaction Survey* assesses participants' overall satisfaction with the course content, instruction, and delivery methods. Further, a Thematic Analysis was conducted to capture qualitative feedback on what participants liked and disliked about the courses, highlighting specific areas for improvement. The *Instructional Materials Motivation Survey (IMMS*) measures how well the course materials captured learners' attention, their relevance, and the confidence and satisfaction derived from the learning experience. The *Community of Inquiry (CoI) framework* evaluates the educational experience across three dimensions: Teaching Presence, Social Presence, and Cognitive Presence. Additionally, *Transactional Distance* was measured to determine the perceived psychological and communicative distance between learners, instructors, and the content, particularly in online versus onsite formats. The *Self-Regulated Learning* (SRL) scale assessed how well participants managed their own learning, including their goal-setting, time management, and self-evaluation abilities. Finally, satisfaction measures for the different training labs were also collected. Together, these instruments provide a detailed and multi-faceted understanding of learner experiences and outcomes, allowing for a thorough evaluation of the course design, delivery, and overall effectiveness.

3.3.1. Satisfaction

Fig. 1 provides a comparative summary of different elements of learner satisfaction for onsite and online course participants. Ratings could range from 1 (lowest) to 5 (highest) in agreement with the statement. Overall, learners expressed very high levels of satisfaction with both formats. Learners indicated a strong interest in continuing with similar courses, suggesting that the majority would like to participate in more courses like these in the future. When asked whether the course content was *not* interesting, the response from both groups showed low agreement with only 1.4 for both groups. This indicates that participants generally found the content engaging. The vast majority of participants in both formats felt they learned new things, providing a very high rating of 4.7 for both learner cohorts. This highlights the success of the courses in providing valuable and novel content to learners. Both formats were also rated positively in terms of meeting learner expectations (4.3) and that they benefited from the courses (4.7) with no difference between course formats. In sum, the learner feedback indicates a consistent and very high level of overall satisfaction across both the onsite and online format, with particularly strong scores in terms of new learning experiences and overall benefits. These overall results demonstrate the effectiveness of both delivery formats in meeting learner needs and ensuring a positive educational experience.

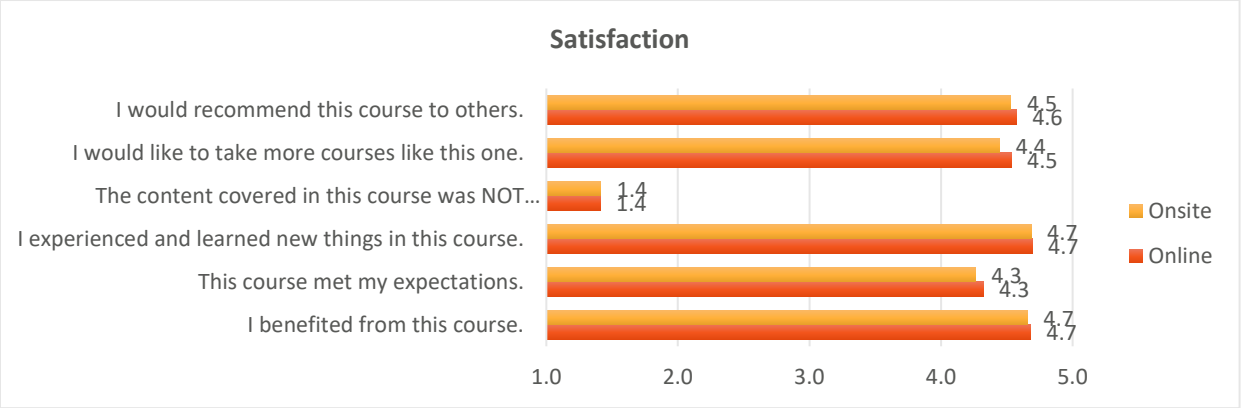


Fig. 1. Summary of the results of the course survey questionnaires.

Fig. 2 expands this evaluation of learner satisfaction by comparing overall learner satisfaction across the six different courses (WP2 to WP7) and over two iterations, 2022/2023 and 2023/2024. The results demonstrate a consistently high level of satisfaction among learners across all courses and timeframes. The ratings for each course vary slightly, with satisfaction scores for 2023/2024 either maintaining or even showing improvements compared to the previous year. In particular, courses WP2, WP3 and WP7 recorded the highest levels, with scores of 4.7 for both or the second years. WP3 and WP7 saw the largest improvements, with satisfaction increasing from 4.4 in 2022/2023 to 4.7 in 2023/2024, respectively. These results indicate that learner satisfaction is not only consistently high but also that adaptations in the second course iteration let to measurable improvements. The data highlights the success of the courses in maintaining quality and adapting to meet learner expectations over time.

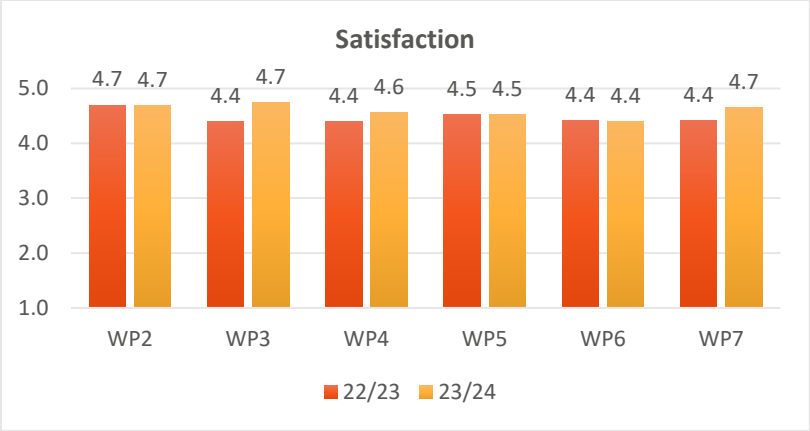


Fig. 2. Overall learner satisfaction for WP2 to WP7 over two iterations

3.3.2. Thematic analysis of learner feedback

The thematic analysis of participant feedback was conducted to identify the most liked and disliked aspects of the courses. This analysis was based on responses from 652 comments regarding what they liked, and 369 comments about what they did not like.

3.3.2.1. What Participants Liked

Among the 652 comments regarding what participants liked most, several key themes emerged. The course content, particularly the variety of topics and relevance, was the most frequently cited aspect, with 122 participants highlighting it as a positive feature. This was closely followed by teachers, where 115 participants appreciated their lecturing style, interaction, and support. The hands-on approach of the practical exercises, cited by 98 participants, was another popular aspect, particularly for its variety and the practical knowledge gained. In addition, 59 participants valued the written materials (handbooks, slides, and notes) provided during the courses. Opportunities for discussions, collaboration, and networking with other participants were appreciated by 38 respondents, emphasizing the social aspect of learning. A number of participants (36) also praised the innovative teaching methods, specifically the flipped teaching approach. Other notable aspects that participants liked included the organisation and structure of the courses (28 items), the variety of computational resources (21 items), and the inclusion of videos and quizzes (17 items). A smaller group of participants appreciated the explicit use of MATLAB Grader (14 items), the balance between theory and practice (12 items), the application of real-world scenarios (12 items), the remote learning option (11 items), and the flexibility to learn at their own pace (10 items).

3.3.2.2. What Participants Did Not Like

While the positive impressions exceeded the more critical feedback by far, the analysis of 369 comments regarding what participants did not like also revealed several key themes that might help improving the courses. The most frequently mentioned concern was time constraints, workload, and pacing of the courses, with 113 participants feeling that there was either too much content to cover in the allotted time or too little time to properly engage with the material. Technical issues were the next most common complaint, with 33 participants citing problems with hardware, software, or internet connections during the courses. Some participants (32) expressed dissatisfaction with the content and curriculum, feeling it was either too theoretical, too practical, or not relevant to their interests. Challenges related to the hybrid format, such as difficulties in hearing or less inclusion for remote participants, were mentioned by 28 respondents. A number of participants (15) found the synchronous exercises unengaging or unclear, while others pointed to issues with organization, such as unclear scheduling or chaotic course structure (15 items). Additional concerns included difficulties with the handbook materials, which 14 participants found unclear, overwhelming, or poorly written. Unclear or inadequate instructions were cited by 11 respondents, along with content repetition across different courses or between asynchronous and synchronous sessions (11 items). Issues related to difficult software installation, unprepared online participants and lack of collaboration, and unclear prerequisites, all received 11 mentions each. It is also worth mentioning that the beyond time constraints, workload and pacing of the courses (113 participants citing those aspects), all other aspects gathered much fewer comments (less than 33 participants citing those additional aspects).

3.3.2.3. Conclusion

In conclusion, the thematic analysis provides valuable insights into both the strengths and areas for improvement across the courses. Generally, as almost twice as much positive statements than critical statements were received, the analysis of comments echoes the positive evaluation as a result of the quantitative analysis of the course survey. Participants particularly valued the variety and relevance of the content, the support from teachers, and the practical, hands-on approach of the exercises. However, issues related to pacing, technical challenges, and hybrid learning formats highlight areas where adjustments could further enhance the learning experience. These findings provide a roadmap for future course design and delivery, ensuring that the strengths are built upon while addressing the concerns raised by participants.

3.3.3. Instructional Materials Motivation

Fig. 3 illustrates the results from the Instructional Materials Motivation Survey (IMMS), which measures learners' perceptions in four key motivational categories: Attention, Relevance, Confidence, and Satisfaction. Both online and onsite formats were evaluated for the 2022/2023 and 2023/2024 iterations.

As for the overall findings, the survey indicates similar results across the two groups. In terms of attention, the survey shows that learners' focus was well-captured by the instructional materials in both formats. Onsite learners rated this at 4.2, while online learners gave a slightly lower rating of 4.1, suggesting that both formats are effective at maintaining learner engagement in both iterations. Learners also felt that the instructional materials were relevant to their needs, with both online and onsite formats scoring highly in this area. This reflects consistent satisfaction with the applicability of the materials, which for onsite learners could be improved in the second iteration from 4.2 to 4.4. Confidence in the instructional materials, which measures how much learners felt the materials supported their ability to understand and apply the content, also scored high in both formats. This indicates that both online and onsite learners felt equally empowered by the materials provided. While we again see a significant improvement for onsite learners in the second iteration (from 4.2 to 4.5), online learners showed slightly less confidence in 2023/2024 (from 4.4 to 4.3). Finally, in terms of overall satisfaction with the instructional materials, onsite learners increased their experience rating from 4.1 to 4.4 in the second iteration, while online learners rated it consistently at 4.3 for both years. The ratings in this category show a high level of satisfaction across both delivery methods. Overall, the IMMS results demonstrate that learners across both online and onsite formats had positive experiences with the instructional materials, finding them engaging, relevant, confidence-building, and satisfying. For online learners in particular, the experience improved in the second iteration of the courses indicating an improvement of the materials based on the lessons learned from the prior year. The insights gathered through the IMMS suggest that the instructional materials used in the courses were effective in fostering motivation and supporting learning outcomes.

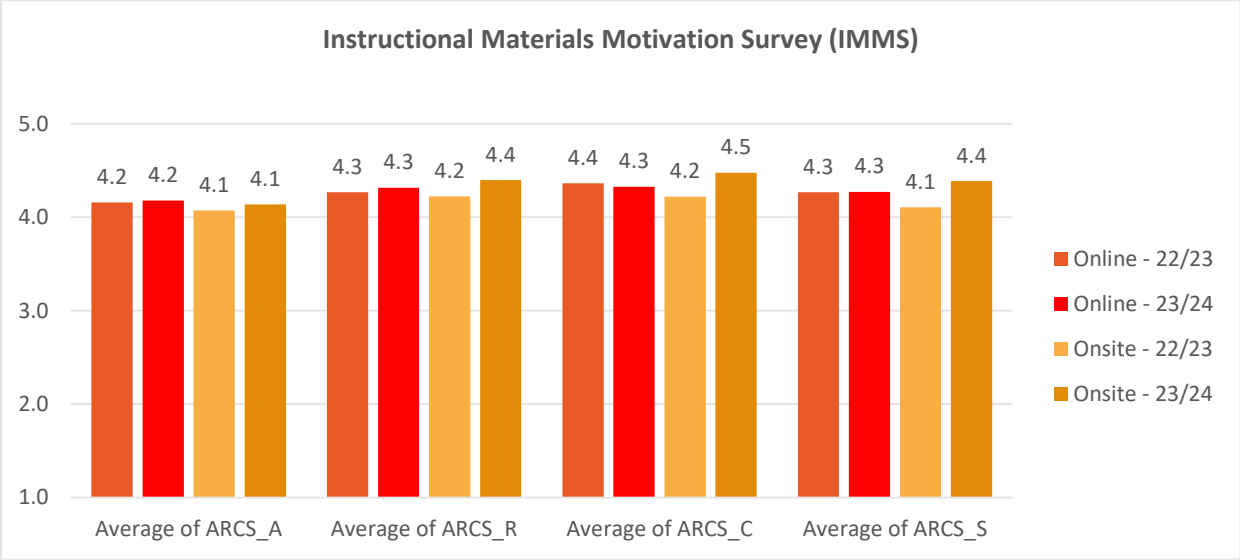


Fig. 3. Results from the Instructional Materials Motivation Survey.

3.3.1. Community of Inquiry

The Community of Inquiry (CoI) model was used to evaluate the educational experience across three dimensions: Teaching Presence, Social Presence, and Cognitive Presence. Both online and onsite course formats were assessed for two iterations of the courses, and the results show a high level of consistency

between the two delivery methods, as seen in Fig. 4. In terms of *Teaching Presence*, which refers to the instructional design, organization, and facilitation of learning, both formats scored equally at ca. 4.4. This indicates that participants felt similarly supported and guided in both online and onsite environments in both iterations. For *Social Presence*, which measures the degree to which learners felt connected and engaged with their peers and instructors, the online format scored slightly lower at 4.0 compared to the onsite format, which scored 4.2 in the first iteration. While social presence could be improved for onsite learners in the 2022/2023 iteration, online participants scored slightly less with 3.8 creating a significant gap between the two cohorts. This difference suggests that the onsite version of the courses may have fostered stronger social interaction and connectedness among the participants. Finally, in the area of *Cognitive Presence*, which assesses the extent to which learners can construct and confirm meaning through reflection and dialogue, both online and onsite formats were rated with an average at 4.3 with an improvement for online learners from 4.2 to 4.4 in the second iteration of the course. These results indicate that learners in both formats felt capable of engaging with and understanding the course material. In sum, the CoI results highlight that both online and onsite courses were highly effective in fostering teaching, social, and cognitive presence, with some differences in social interaction between the two formats. Despite these differences, the findings suggest that the courses were successful in creating a supportive and interactive learning environment for all participants.

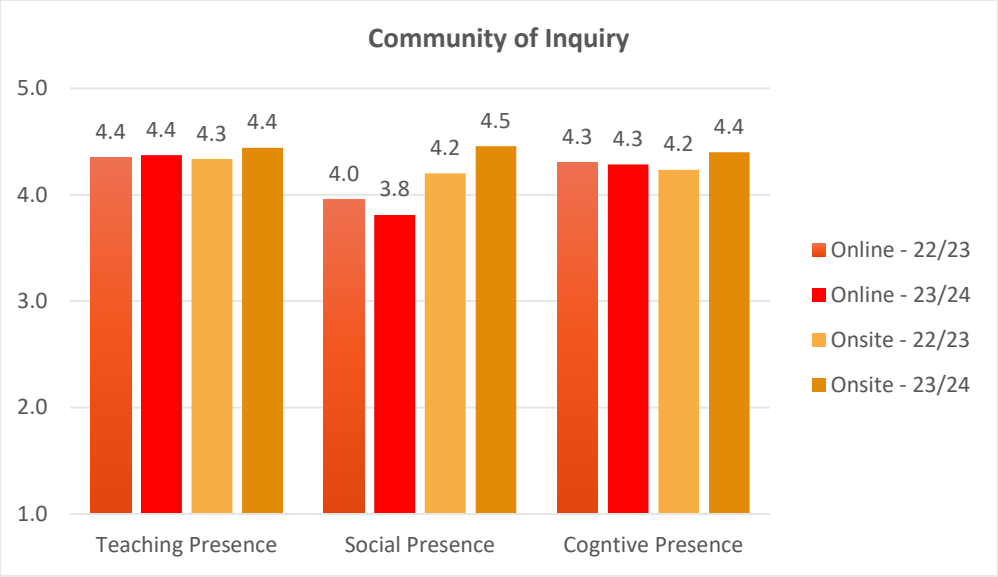


Fig. 4. Results from the Community of Inquiry analysis.

3.3.2. Transactional Distance

The concept of transactional distance was used to assess the perceived psychological and communicative distance between learners, instructors, and the content across both online and onsite formats for the two course iterations. Transactional distance is evaluated in three dimensions: Learner-

Instructor, Learner-Content, and Learner-Learner, as shown in Fig. 5. In terms of *Learner-Instructor* interaction, the perceived distance was slightly higher in the online format (0.6) compared to the onsite format (0.5 and 0.3). This suggests that learners in the online environment felt a slightly greater separation from their instructors than those in the onsite courses, likely due to the lack of physical proximity in online learning. In terms of *Learner-Content* interaction, both formats show a slightly higher but still low transactional distance, with online learners rating it at 0.8 and onsite learners at 1.0 in the first course iteration. In both course formats this could be lowered to 0.7, which is a clear improvement. This suggests that both groups felt similarly connected to the content, indicating that the course materials were equally effective in engaging learners in both formats. The *Learner-Learner* transactional distance shows a more pronounced difference between formats. Online learners rated this at 0.9 and even 1.1 in the second iteration, indicating a higher perceived distance between themselves and their peers compared to onsite learners, who rated it at 0.6 and 0.4. This difference highlights the potential challenges in fostering peer interaction and collaboration in an online setting compared to face-to-face environments. In summary, the transactional distance results indicate that while learners in the online format may experience slightly higher perceived distances from their instructors and peers, the interaction with course content remains strong in both online and onsite formats. These insights point to the importance of addressing learner-learner and learner-instructor interaction in online environments to reduce the perceived separation and enhance engagement.

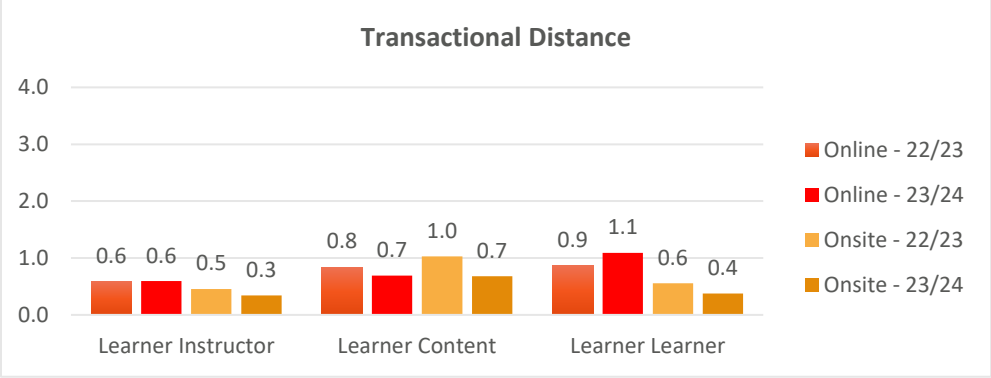


Fig. 5. Results from the Transactional Distance analysis.

3.3.3. Self-regulation of learning

Fig. 6 illustrates the results related to Self-Regulated Learning (SRL), which assesses the degree to which learners are capable of managing their own learning processes across various dimensions, including goal setting, environmental structuring, task strategies, self-evaluation, time management and help-seeking. The *overall SRL* score shows that online learners rated their overall self-regulation slightly higher (3.5) compared to onsite learners (3.3). This suggests that learners in online environments may be more accustomed to taking control of their own learning processes. In the area of *Goal Setting*, online learners also rated their abilities slightly higher at 3.8 compared to 3.7 for onsite learners. This indicates that online learners may be somewhat more proactive in setting clear goals for their learning, potentially due to the independent nature of online study. The dimension of *Environmental Structuring*, which reflects

learners' ability to manage their learning environment, saw the highest scores for both groups. Online learners rated this at 4.2, while onsite learners rated it slightly lower at 4.0, suggesting that online learners may have greater control over their learning environment. For *Task Strategies*, online learners rated themselves at 3.0 and onsite learners at 2.8. This reflects that confidence in organizing and processing tasks was somewhat higher among online learners. In the area of *Self-Evaluation*, where learners assess their own performance, online learners rated themselves at 3.4, while onsite learners rated themselves slightly lower at 3.2. This shows that both groups engage in self-reflection and assessment of their learning, with online learners displaying slightly higher tendencies. In terms of *Time Management*, online learners again rated themselves considerably higher at 3.6, compared to onsite learners at 3.0, suggesting that online learners may be more accustomed to independently managing their time effectively. Finally, regarding *Help-Seeking* behaviour, which measures how comfortable learners are with reaching out for support, both groups rated themselves relatively similarly, with online learners scoring 3.2 and onsite learners slightly lower at 3.1. This indicates that both groups are moderately comfortable seeking help when needed. In sum, the results suggest that online learners generally demonstrate a higher degree of self-regulation, particularly in areas like goal setting, environmental structuring, and time management. Onsite learners, while slightly lower in these areas, still showed solid self-regulatory behaviours across most dimensions.

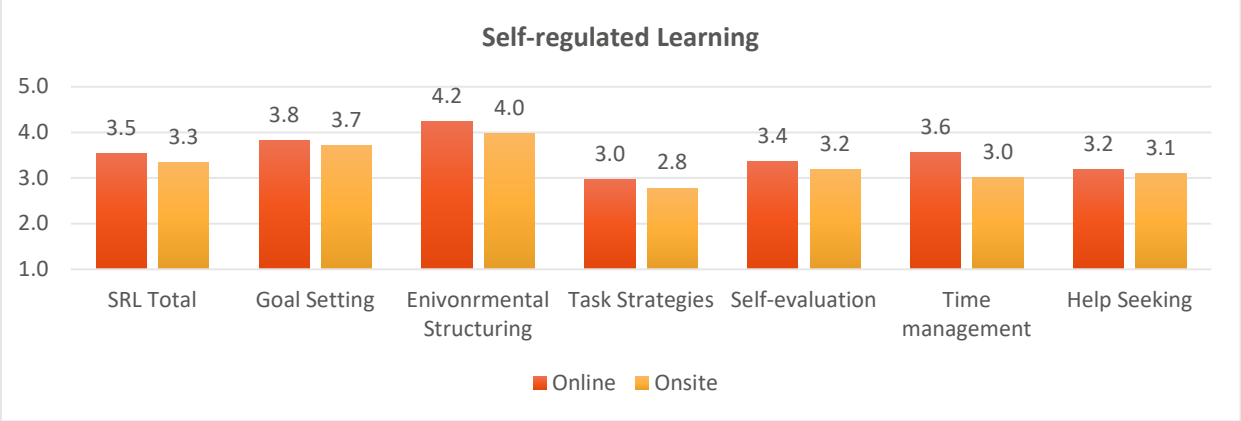


Fig.6. Results from the Self-Regulating Learning analysis.

3.3.4. Reactor training feedback

Fig. 7 presents feedback on the reactor training programs across three different facilities: BME, AKR-2, and CROCUS. The results provide insights into participants' perceptions of the teaching methods, course content, development of practical skills, and understanding of theoretical concepts. Participants rated the teaching methods used during the training highly across all facilities, with CROCUS receiving the highest score of 4.7, followed closely by AKR-2 with 4.6, and BME scoring 4.3. This suggests that the majority of participants found the instructional methods effective in facilitating their learning. In terms of the course content, participants from all facilities gave similarly high ratings, with both AKR-2 and CROCUS scoring 4.7, and BME slightly lower at 4.4. This reflects strong satisfaction with the organization and clarity of the training materials across all programs. When asked about the development of practical

skills relevant to the nuclear field, CROCUS again led with a rating of 4.7, followed by BME at 4.6, while AKR-2 participants rated this aspect 4.5. These results highlight that participants felt they gained substantial hands-on skills. Regarding the understanding of theoretical concepts, both CROCUS and AKR-2 received high scores, at 4.6 and 4.5 respectively, while BME was rated somewhat lower at 4.3. This indicates that participants in the AKR-2 and CROCUS programs felt they had gained a deeper understanding of the theoretical aspects of nuclear training, while BME participants were slightly less confident in this regard. In summary, the reactor training programs at CROCUS and AKR-2 consistently received high marks in all areas, particularly in teaching methods and course content, while BME's ratings were slightly lower in comparison. However, all programs were positively reviewed, demonstrating their overall effectiveness in providing nuclear field training.

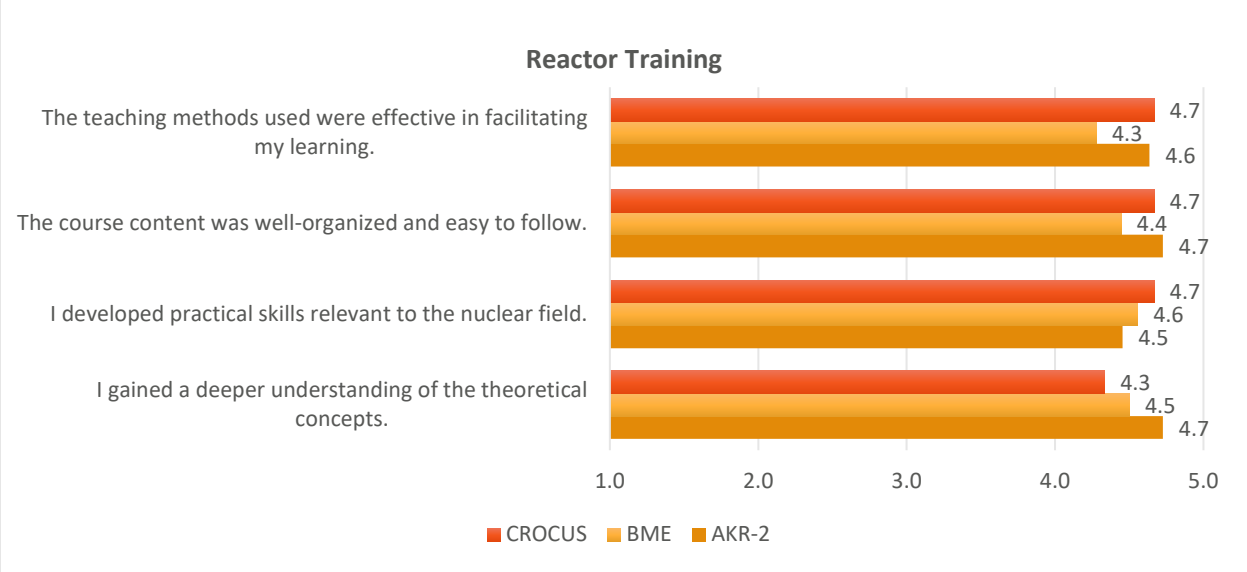


Fig. 7. Summary of the results of the course survey questionnaires for the hands-on on the training reactors.

3.4. Teacher feedback

Beyond student feedback, some feedback from the teachers involved was gathered on a voluntary basis. Some general comments and trends are summarized below.

- Adopting flipping was challenging, primarily because it was very time-consuming, with respect to the creation of videos of good quality, and to setting up the necessary equipment (laptop, screen, tablet for annotations, lighting).
- Having a well-thought strategy for the learning sequence to be followed by the students was considered essential before producing any teaching material.

- The preparation of the asynchronous teaching materials could be even more time-consuming, when, e.g., simulations or calculations need to be carried out to generate good examples of real-life conditions.
- Quizzes may require some extra efforts, if one wants to design them so that (a) they engage the students, (b) they allow to test their understanding, and (c) they are foolproof (i.e., only one solution exists).
- The actual development of the synchronous activities requires a careful planning process in terms of how they engage the students and how those activities target student high-order cognitive skills. The time necessary to develop those activities may also be very significant, depending on the complexity of those activities.
- All teachers were very pleased with the developed teaching resources, both asynchronous and synchronous. Nevertheless, a recurrent problem faced by all teachers was that time was not sufficient to cover all planned synchronous activities. This resulted in the on-the-fly cancellation of some activities and in rescheduling, which sometimes created confusion among students, especially for the remote ones. Also, facing some technical challenges with the LMS created an additional level of stress among the teachers, in addition to the need to handle two audiences (onsite and remote).
- The structure of the learning resources on the LMS should be intuitive, so that students do not lose time in looking for the resources and/or in understanding how the resources are presented/available.
- The teachers should very clearly communicate what students need to do and what is expected from them.

3.5. Measures to further improve the courses

Between the first and second iterations of the courses, some measures were introduced to further improve the courses and student experience, as summarized below.

First, common templates and course design principles were more systematically applied across all courses. As the launch of the LMS coincided with the first course being offered in the academic year 2022/2023, this first course could not fully benefit from all the LMS features that were presented by the LMS developers at that time. Most of the desired features were nevertheless implemented from the second course and all the following ones.

During the first edition of the courses in the academic year 2022/2023, the total course grades were incorrectly calculated by the LMS. More specifically, instead of adding points for each activity within the asynchronous, synchronous, respectively, groups, the activities were all rescaled to the same number of points (possibly weighted if the teachers had used such a feature) and then added. An independent *à posteriori* calculation of the correct grades executed for each courses revealed that the incorrectly calculated grades gave a relatively fair representation of the actual grades. For the academic year 2023/2024, this issue was resolved by the LMS support staff, so that all asynchronous activities were added to each other and all synchronous activities were added to each other, before calculating the final grades.

Despite clear instructions distributed to the participants about the work to be done during the asynchronous phase and the course set-up, some participants did not fully understand the course design principles. This resulted in low engagement in the asynchronous phase for some of the participants. In the academic year 2023/2024, two online meetings were arranged during the asynchronous phase. The first meeting was typically held a few days after the opening of the LMS and aimed at explaining the course set-up and the necessity to carry out the asynchronous preparatory phase to get access to the synchronous activities. A second meeting was held typically one or two weeks before the start of the synchronous sessions. The purpose of the second meeting was to further engage the participants in the course work, answer possible questions they may have and present the types of activities to be undertaken during the synchronous phase.

As the synchronous activities heavily rely on using various computer programs, compulsory exercises to be completed during the asynchronous phase were introduced in the academic year 2023/2024. The purpose of those exercises was to force the participants to install/use the programs ahead of the synchronous sessions, so that no time was lost during the synchronous sessions on installing programs or getting familiar with various computing environments.

Finally, during the academic year 2022/2023, the necessity to work on at least 50% of the asynchronous activities often resulted in the participants working on the first half of the course content. To prevent this uneven learning of the course topics, activities representing roughly 50% of the asynchronous work were selected by the teachers during the academic year 2023/2024, making sure that those activities covered the entire curriculum of each course. Thanks to the LMS activity locking and chaining features, the participants were forced to at least complete those activities to be able to progress in their asynchronous preparation studies.

4. Long-term sustainability

From the early start of the project, the consortium paid special attention to making sure that all principles, methods, tools, and procedures developed as part of the project could be replicated across courses and could be deployed on the long term and to possibly new courses to be added to the course offering.

Beyond the implementation aspects mentioned above, efforts were also pursued to define the conditions making it possible to offer the courses once the financial support from the European Union ends. Those efforts culminated in a workshop organized during the 22nd meeting of the ExCom, held on June 26th, 2024, in Stenungsund, Sweden, to which the members of the consortium, of the AB and of the EUG were invited. The workshop, having as main theme the long-term sustainability of GRE@T-PIONEeR, was animated by LGI. The objectives of this workshop were to:

- Identify business models and revenue models options for the courses provided by GRE@T-PIONEeR.
- Discuss the pricing of the courses for students and professionals.
- Identify additional external funding opportunities.
- Identify risks for the long-term sustainability of GRE@T-PIONEeR.

The workshop started with an introduction by the project Coordinator, followed by an introduction of the expectations of the workshop by LGI.

Participants first split in two groups to work on the Business Model Canvas of GRE@T-PIONEeR. The goal was to address key questions regarding the future business model including identifying the value proposition of the courses offered by GRE@T-PIONEeR, intended customer base, partners, key resources, possible sources of revenues, the nature and added value of the service provided by GRE@T-PIONEeR, etc. One group focused on students (BSc, MSc, PhD and Post-Doc students) while the second group focused on other target groups (students who cannot pay and nuclear/international organisations).

The possible pricing for students and professionals were then discussed among all participants, based on the results from a survey completed by former course participants and their recommenders (reported in Section 5) and the AB members. The pricing of the courses may depend on several factors:

- Whether the courses are fully online or on-site for the synchronous sessions.
- The type of course takers (BSc students, MSc students, PhD students, Post-Doc students, researchers/scientists, professionals).
- The geographical origin of the course takers.

As time was limited, for the final exercise, LGI presented the major risks that might be faced following the end of the GRE@T-PIONEeR project and possible interventions to minimise or address them.

The key takeaways of the workshop are summarised below.

- GRE@T-PIONEeR requires funding to continue offering the courses. A combination of external funding sources and revenue generation from students and professionals who pay for the courses is the most likely alternative.
- The business model of the courses was explored for different types of targets: paying students, non-paying students and professionals. The following emerged from the discussions:
    - GRE@T-PIONEeR is unique as it delivers top-class courses in computational and experimental nuclear reactor physis and safety using innovative pedagogical methods. It involves active learning, learning by doing and gathers a community of reactor physicists to deliver essential knowledge.
    - In terms of customer relationships/channels, to ensure that the link with students is maintained, some measures can be taken by GRE@T-PIONEeR, such as:
        - Organising webinars to announce the future courses.
        - Creating a LinkedIn alumni group with the participating students to ensure a sense of community.
        - Communicating via social media (LinkedIn).
        - Participating to conferences in the nuclear sector to advertise the course offering.
        - Maintaining contact with national networks, the nuclear industry stakeholders and international organizations (such as the IAEA, the OECD/NEA, etc.)
    - The key partners of GRE@T-PIONEeR that allow the consortium to achieve its impact are the 8 universities members of the consortium, supported by ENEN and LGI. The network of contacts those partners have (for instance with the IAEA, the OECD/NEA, national

labs, industry representatives, other universities, etc.) is instrumental in making GRE@T-PIONEeR visible.
    - In terms of key activities and resources, apart from providing courses and education activities, GRE@T-PIONEeR also provides certifications. The main resources of the consortium include the professors/teachers, the training reactors, the LMS used to deliver all courses, MATLAB Grader, and access to all modelling tools.
    - In terms of cost structure, the most important costs inherent to the resources and activities delivered by the consortium include:
        - The LMS fee.
        - Costs for the onsite presence of the teachers (travel, accommodation, daily subsistence).
        - Salary costs of the teachers corresponding to the time they spend on preparing and delivering the courses.
        - LGI communication activities.
    - In terms of future revenue streams, they could be generated through:
        - External funding obtained from national agencies, societies, sponsorships, in-kind contributions from organizations related to GRE@T-PIONEeR (such as Westinghouse for the LMS).
        - Fees paid by professionals.
        - Fees paid by students.
        - Sponsoring program for students (scholarships) that would allow to cover the course fee and potentially the onsite participation of some students.
- In terms of price recommendations, the following aspects were discussed.
    - For students:
        - A minimum price of 500€ should be required to cover the running costs of GRE@T-PIONEeR (if only the six first theoretical courses are offered). This will also ensure student commitment and avoid drop-out.
        - In-person participation possibly implies a need to cover travel fees, accommodations, and meals by some scholarship mechanism.
        - No significant price difference should nevertheless exist between online and in-person courses, as this would otherwise result in the online participants feeling that they are offered a worse learning environment.
        - A better accessibility for developing countries should be considered.
        - For professionals and researchers/scientists, a course fee in the range of 1500-2000€ was considered reasonable and corresponding to usual practice.
- In terms of additional funding possibilities that GRE@T-PIONEeR should consider, priority should be put on nuclear power utilities and national agencies of countries with big future needs (e.g., the United Kingdom, Poland, etc.).

Some actions were also identified as outcomes of the workshop:

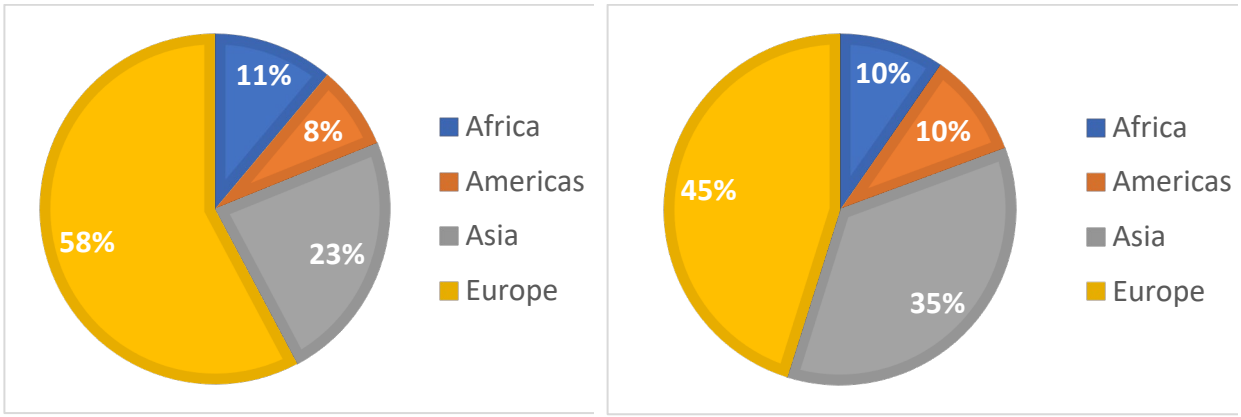
- In the short term:
    - Get in touch with the organisations identified for funding.
    - Secure partnerships/sponsorships for scholarships.

- Pursue the search for funding opportunities and determine how much of the running costs will need be to covered by external funding.
- Determine the pricing of the courses based on the outcomes of the workshop and the amount of external funding obtained.

- In the medium term:
  - Organise online events (webinars) to announce future courses.
  - Create alumni groups on LinkedIn to ensure engagement and retainment of students in the long term.
  - Make sure timing is adequate and prepare communication on courses well in advance. As professionals need to plan their training budget up to nine months ahead of the training, it is important to advertise the courses sufficiently ahead, so that GRE@T-PIONEeR does not lose this category of participants.

5. Conclusions and outlook

As demonstrated in this report, the GRE@T-PIONEeR project has exceeded its objectives and has had a major impact on education in Europe and worldwide. A questionnaire was sent in the spring of 2024 to the course applicants and to their recommenders. 90 course applicants and 32 recommenders responded to the questionnaires. The geographical spread of the respondents is summarized in Fig. 7.

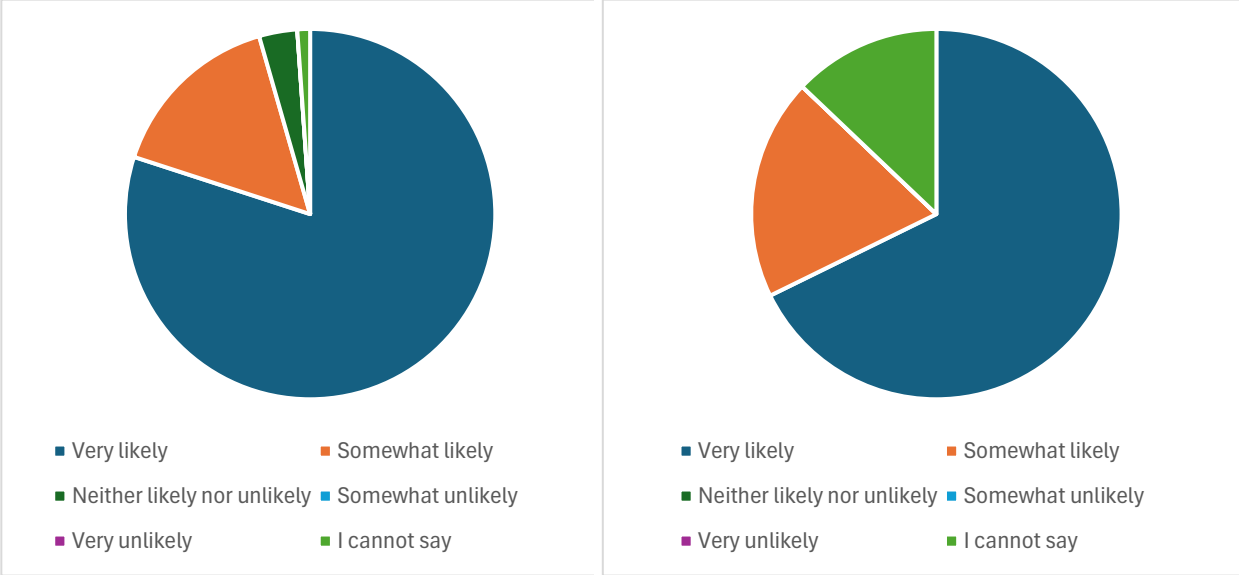


(a) Course applicants (b) Course recommenders

Fig. 2 Geographical origin of the respondents.

The overall satisfaction of the course participants, already detailed in Section 3.3, is also clearly visible in the outcome of the survey, presented in Fig. 8. This figure details the distribution of the respondents of the above survey to the question “How likely is it that you would recommend the GRE@T-PIONEeR courses in the future?”. 95.6% of the course applicants responded very likely or somewhat likely, where an overwhelming part answered very likely. For the course recommenders, 84.4% responded very likely or somewhat likely, where an overwhelming part answered very likely. The remaining 15.6% entirely correspond to people who could not answer the question. The extremely positive feedback received

from the course applicants and their recommenders is a clear demonstration of the quality of the courses, both in their contents and how they were delivered.



(a) Course applicants (b) Course recommenders

Fig. 3 Likelihood that the course applicants/recommenders would recommend the GRE@T-PIONEeR courses in the future.

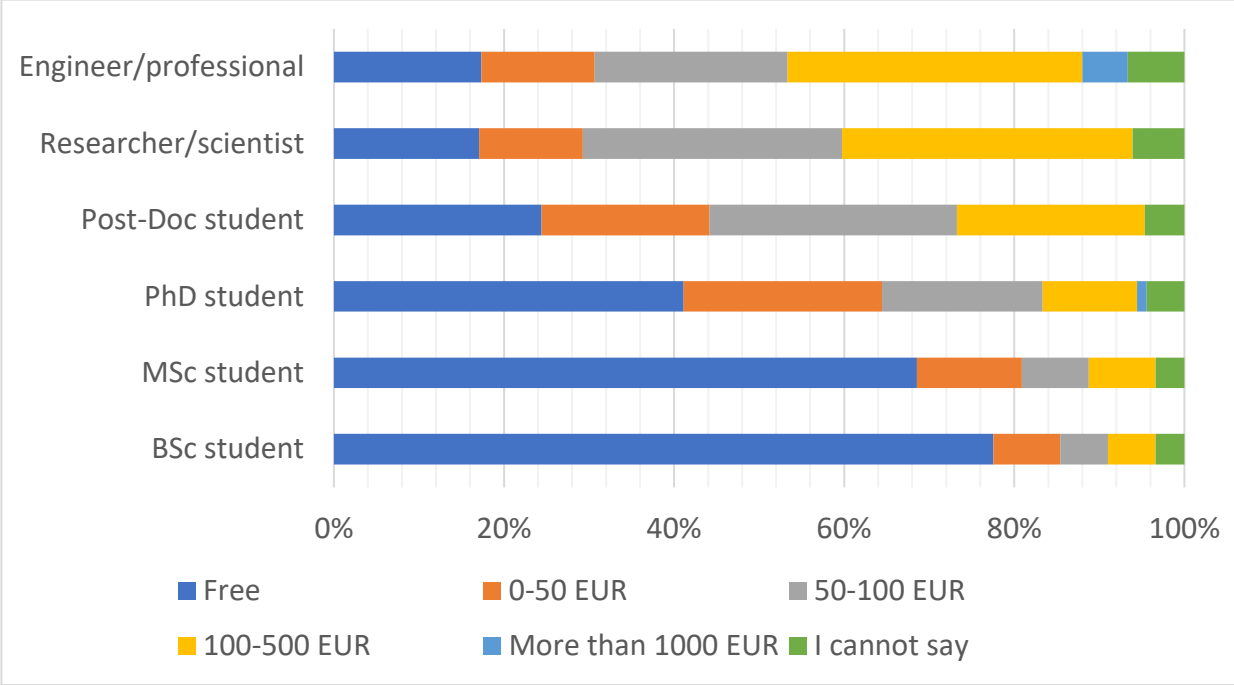
As also reported in Sections 2 and 4, GRE@T-PIONEeR has been actively working since the early start of the project to make the alliance exist on the long run, with GRE@T-PIONEeR being a key actor in the area of nuclear training and education. Beyond the formal delivery of the courses, all procedures developed and implemented in GRE@T-PIONEeR were carefully planned so that they could be replicated between the various courses and when the courses are re-offered.

When considering the long-term aspects of the project, special attention was paid to how the alliance could still offer courses when the financing of the project from the European Union formally ends in October 2024. Through many discussions held within the consortium, which also culminated with the workshop reported in Section 4, it was decided that the running costs of the alliance should be covered by two streams of revenues:

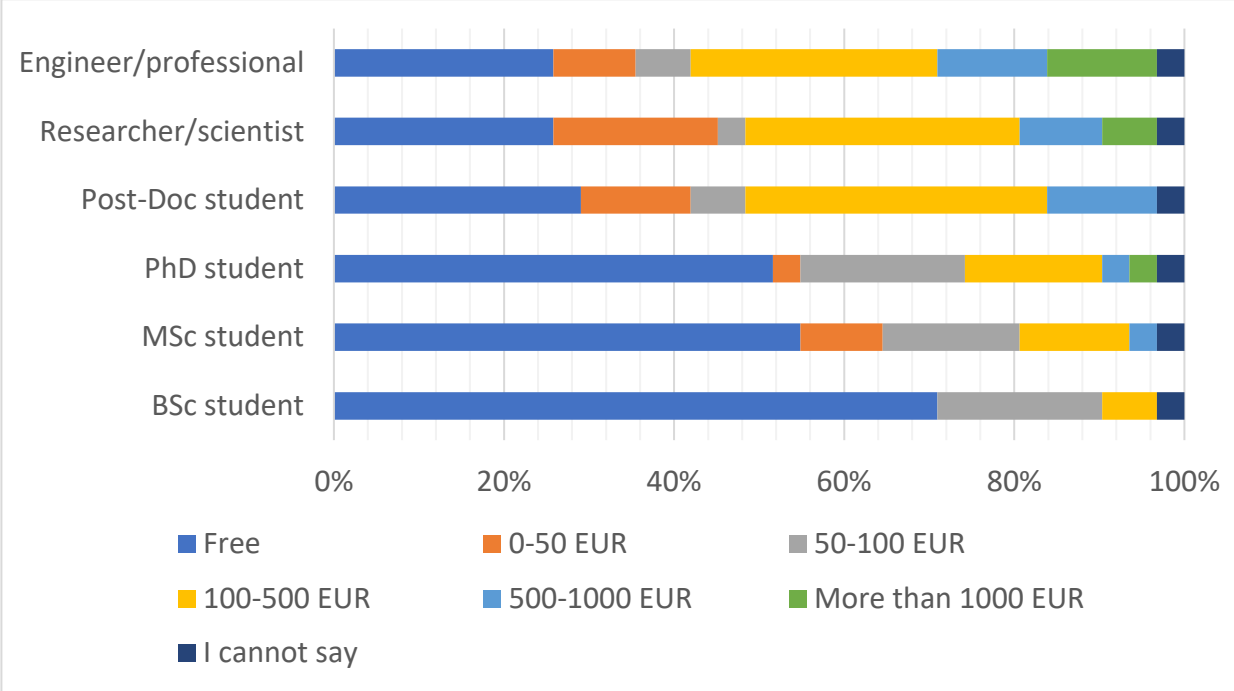
- Course fees charged when people register to the courses.
- Some funding obtained from new sources for the continuation of the project in some other forms.

Concerning course fees, the survey referred to above was also used to investigate what the former course applicants and recommenders consider to be a reasonable price, depending on the categories of applicants (BSc student, MSc student, PhD student, Post-Doc student, researcher/scientist, or engineer/professional). The results of the survey are summarized in Fig. 9 for the fully online version of the courses (i.e., when the participants opt for the online version of the synchronous sessions) and in Fig. 10 for the hybrid version of the course (i.e., when the participants opt for onsite participation to the synchronous sessions). As seen in those figures, the expected price for a course lies in the range of 50-500 EUR for Post-Doc students, researchers/scientists, and engineers/professionals. For PhD students,

the course fee should lie in the range of 0-50 EUR, whereas for BSc and PhD students, the courses are expected to be mostly free.

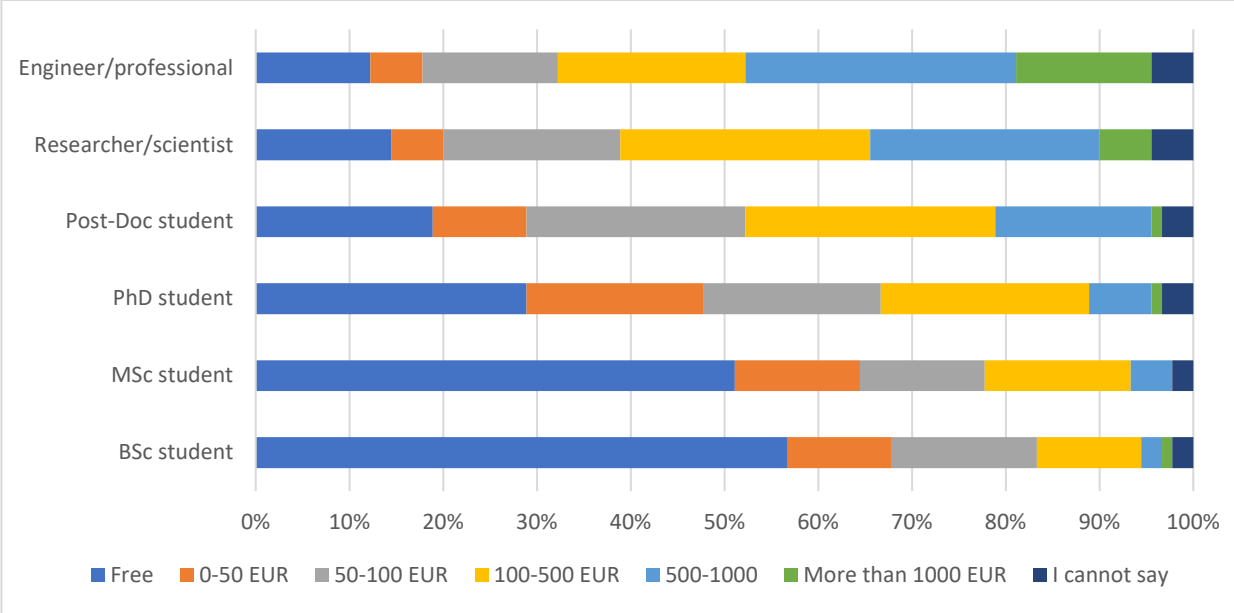


(a) Course applicants

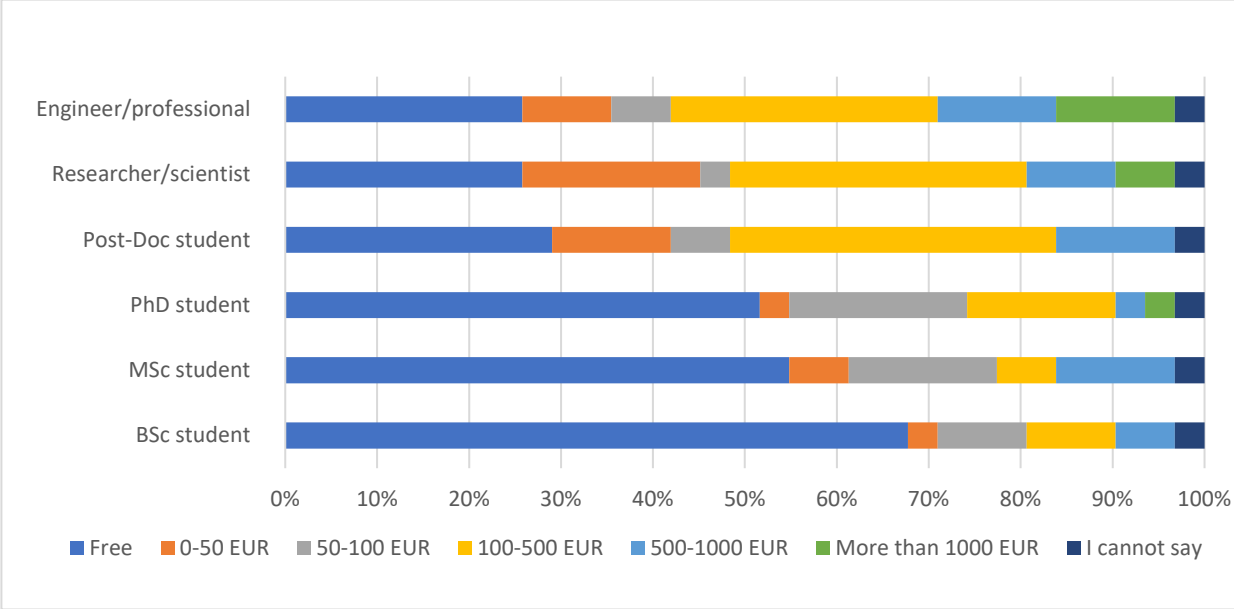


(b) Course recommenders

Fig. 4 Price suggested for the fully online version of the courses.



(a) Course applicants



(b) Course recommenders

Fig. 5 Price suggested for the hybrid version of the courses.

In order to match the expected course prices, the alliance has been very active in trying to secure some additional funding. In the spring of 2024, an application for funding was submitted to the Swedish Radiation Safety Authority (Strålsäkerhetsmyndingheten – SSM). The application was granted on June 28th, 2024, for covering some of the running costs of GRE@T-PIONEeR (such as the costs of the LMS, of some of the necessary software used in the courses, of the webpage updates and maintenance, and of the communication activities).

With this funding obtained, some simulations were carried out in order to find out the average price the GRE@T-PIONEeR courses would cost to the course participants. If no differential pricing is applied and assuming 30 paying participants/course for the courses and no session on the training reactors, the average course fee would be around 408 EUR/course/participant. Although this course fee might be a bit high for PhD students and even more for MSc/BSc students, it is also believed, after discussions with the AB of GRE@T-PIONEeR, that a course fee in the range of 1500-2000 EUR seems to be reasonable for professionals from developed countries. Having a significant amount of engineers/professionals following the courses would significantly reduce the course fee for students, possibly getting closer to the expected course fee that students expect. The alliance also believes that the courses should not be entirely free, even for BSc and MSc students. A small fee being charged would guarantee student commitment to the courses and would avoid any significant drop out. With respect to fully online versus hybrid options, it is also believed that no differential pricing should be applied. This could otherwise give the impression that the online version of the courses, if cheaper, does not guarantee the same learning outcomes as in their hybrid counterparts. This would also contradict one of the basic principles of GRE@T-PIONEeR, which is to provide the same learning experience irrespective of whether you attend the synchronous sessions online or onsite.

The alliance is also pursuing other funding opportunities to further lower the costs of the courses to the participants. In addition, the alliance is seeking stipends possibilities to cover travel, accommodation and subsistence costs of students who would opt for the onsite version.