SMACITE

Enhancing skills for smart city tech

SMACITE

Boosting the technical and non-technical skills and competences of smart cities technicians and engineers

WP5: Pilots and testing

D5.3: Report on SMACITE pilots

Version Final

Co-funded by the European Union

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0.1	Maria Rigou Vasileios Gkamas	UPATRAS	15/06/2024	Structure of the deliverable
1.0	Stefano Antona Annalisa Rizzo Francesco Bruno	APRO	19/11/2024	Release for review
1.1	Stefano Antona Annalisa Rizzo Francesco Bruno	APRO	27/11/2024	Updated version implementing suggested changes of internal project reviewers: Polina Kontodiakou (OTC) and Ioannis Voyiatzis (UNIWA)
1.2	Vasileios Gkamas Maria Rigou	UPATRAS	28/11/2024	Final review
1.3	Vasileios Gkamas	UPATRAS	24/05/2024	Updated with the final number of students gone through the certification exams

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PROJECT SUMMARY

The project aims to address the skills gap of Smart Cities technicians and engineers, by designing and testing a vocational education and training program that is based on a novel and multi-disciplinary curriculum combining digital skills on Smart Cities enabling technologies, with soft, entrepreneurship and green skills.

The expected project outputs are:

- A Smart Cities competences map and ESCO-compliant Smart Cities job profiles.
- A Smart Cities curriculum combining both technical and non-technical skills and competences and promoting personalised learning pathways.
- Learning resources for Smart Cities enabling technologies and for building the soft, entrepreneurship and green skills of Smart Cities technicians and Engineers.
- A diagnostic tool to identify personalised learning pathways.
- A MOOC for Smart Cities enabling technologies.
- Virtual Worlds for building the soft, green and entrepreneurship skills of Smart Cities technicians and engineers.

The main project beneficiaries are Smart Cities technicians and engineers either from the public sector (i.e. municipalities) or enterprises providing Smart Cities solutions, as well as HEI and VET students interested in Smart Cities.

The curriculum was tested through 4 national pilots in Greece, Bulgaria, Spain and Italy with at least 160 trainees. The certification of the skills and competences will follow a two-fold approach: (a) using micro-credentials to recognize the knowledge and skills gained through the successful completion of each online training module at the MOOC and Virtual Worlds and (b) designing the “Smart Cities Specialization Certification” that will be awarded to those passing online certifications exams with e-proctoring after the completion of the training modules.

The project will create an ecosystem for the co-design and co-development of an innovative curriculum and technology-enhanced learning tools for the upskilling/reskilling of Smart Cities technicians and engineers.

1 Introduction

The Report on SMACITE pilots – D5.3 summarises the results of the SMACITE pilot aiming to test and evaluate the effectiveness of the overall project approach. According to the application, the piloting phase represents indeed a crucial phase of the project consisting of its specific objective #8: Pilot the curriculum with Smart Cities technicians and engineers from Greece, Bulgaria, Italy, and Spain and evaluate the experience.

D5.1 Pilot plan (delivered on M15) is the document that guided the implementation of this phase, supporting the project partners in effectively carrying out a fruitful testing of the training program. The pilot plan includes the preparatory actions that took place before the implementation of the pilots, the actions planned during the pilots, as well as the actions planned to be implemented afterwards.

This document is the result of a consolidated report about the national pilots. It provides information about the implementation and evaluation, including challenges and problems faced, as well as their impact to the learners and involving organisations.

The main findings of this document will be used to make fine-tuning adjustments to the curriculum, learning resources, and eLearning platforms (MOOC and Virtual Worlds). In order to do so, each partner was asked for feedback via a questionnaire differentiated according to its role(s) in the piloting process (pilot organiser, content developer, tool developer), in order to evaluate the piloting.

1.1 Selection of the participants

According to the application, the piloting was planned to be implemented in (at least) four countries reaching a total number of 160 participants from Greece (40 learners), Bulgaria (40 learners), Italy (40 learners), and Spain (40 learners). The target profile of the participants was the following:

- Technicians and engineers from cities deploying (or interested to deploy) Smart Cities solutions.
- Technicians and engineers from enterprises operating (or interested to operate) in the Smart Cities sector.
- HEIs and VET students interested in Smart Cities.

A preliminary survey was conducted among the partners participating in the pilot to define the modalities of the activity and to express the estimated number of learners they can reach for every subject of the curriculum:

Institution	Expressed interest	Estimated learners
POLITEKNIKA IKASTEGIA TXORIERRI (ES)	Smart Cities, Cybersecurity, Soft skills, Entrepreneurship skills, Green skills	15
OLYMPIC TRAINING & CONSULTING LTD (EL)	No preferences	10
UNIVERSIDAD DE ALCALÁ (ES)	Smart Cities, Cloud Computing	20
APRO FORMAZIONE (IT)	Smart Cities, 3D Printing, Green skills	40
COMUNIDAD AUTÓNOMA DE MADRID (ES)	Smart Cities, Cloud Computing	20
BASSCOM (BG)	Smart Cities, Cybersecurity, Soft skills, Entrepreneurship skills, Green skills	20
UNIVERSITY OF WEST ATTICA (EL)	3D Printing, Blockchain, Drones, Autonomous Vehicles	20
ESI CEE EUROPEAN SOFTWARE INSTITUTE (BG)	Smart Cities, Cybersecurity, Data Analytics and Visualizations	20
GAIA (ES)	Smart Cities, Internet of Things / IoT, Green skills	12

Table 1 - Estimated numbers of learners

Analysing the data by country, it was obtained a preliminary estimation of:

- Italy: 40 pilot learners
- Spain: 57 pilot learners
- Greece: 30 pilot learners
- Bulgaria: 40 pilot learners

The piloting activities also included the involvement of companies and public organizations. The survey came up with the following estimation regarding this aspect.

Institution	Estimation of possible companies/public organizations involved	Estimated learners from companies/public organizations
POLITEKNIKA IKASTEGIA TXORIERRI (ES)	0	0
OLYMPIC TRAINING & CONSULTING LTD (EL)	6	6
UNIVERSIDAD DE ALCALÁ (ES)	0	0
APRO FORMAZIONE (IT)	2	2
COMUNIDAD AUTÓNOMA DE MADRID (ES)	0	0
BASSCOM (BG)	5	20
UNIVERSITY OF WEST ATTICA (EL)	2	4
ESI CEE EUROPEAN SOFTWARE INSTITUTE (BG)	5	5
GAIA (ES)	5	8

Table 2 - Estimated numbers of companies/entities

Analysing the data by country, it was obtained an estimation of:

- Italy: 2 pilot learners from companies/entities
- Spain: 8 pilot learners from companies/entities
- Greece: 10 pilot learners from companies/entities
- Bulgaria: 25 pilot learners from companies/entities

The participants in the pilots were selected with the minimum EQF 4/5 entry level.

1.2 Structure of the pilot

The pilots were organised in three phases:

- Online self-paced asynchronous courses at the MOOC
    - 1.1 Smart Cities
    - 1.2 Internet of Things
    - 1.3 Cybersecurity
    - 1.4 Cloud Computing
    - 1.5 Data Analytics and Visualisations
    - 1.6 Machine Learning with Big Data
    - 1.7 3D Printing
    - 1.8 Blockchain
    - 1.9 Drones
    - 1.10 Autonomous Vehicles
- Online synchronous training at the Virtual Worlds (in parallel with the MOOC)
    - 2.1 Soft skills
    - 2.2 Entrepreneurship skills
    - 2.3 Green skills
- Online exams leading to "Smart Cities Specialization Certification"

Two different types of certifications were available for students:

- A **Certification of Attendance** for each online course a student successfully completes by achieving at least 70% score at each of the evaluation quizzes and at the project.
- A **Smart Cities Engineer Certification** or a **Smart Cities Technician Certification** issued by UNICERT (the certification body of the consortium), after successfully passing the official online certification examination. The official certification procedure is detailed in D2.4 "Methodology for the certification of competences of Smart Cities technicians and engineers".

The majority of the participants in the pilots followed the activities in a self-paced mode as expected, because all MOOC courses could be attended without any time constraints, with the exception of the activities delivered in real-time via the Virtual World platform.

Support and assistance to the piloting students were guaranteed by the partners at any time through the Forums included in each course of the MOOC and thanks to specific periodic online meetings organised with the aim to discuss students' difficulties/questions and keep them engaged with the course.

1.3 Dissemination

In order to achieve the participation of various types of learners in the piloting of the SMACITE training program, various types of dissemination actions were put into place:

- A common Open Call published on the project website and social media in November 2023, and promoted by the partners participating in the pilot.
- Involvement of VET/HEI class groups of the SMACITE education and training providers that attended parts of the SMACITE curriculum as integration of their learning paths.
- Targeted promotional activities in companies, public organizations and professional associations.
- In July 2024 a special campaign named "SMACITE awards" was launched. The initiative, sponsored by the Greek Computer Society, offers three prizes for the best results in the certification exams and in the completion of courses.

From the preliminary survey, the partners expressed the intention to promote the open call as following:

Institution	Target audience	Promotion channels
POLITEKNIKA IKASTEGIA TXORIERRI (ES)	VET students (EQF level 5)	Through the TKNIKA and through the network of VET centres TXORIERRI belongs to (HETEL)
OLYMPIC TRAINING & CONSULTING LTD (EL)	HEI students Engineers and Technicians in SMEs and Public Administration Professionals in the sectors concerned	Social media (LinkedIn, Facebook), direct mailing to representation bodies, sector publication, participation in sector-specific FORAs, company website, Networks of Sustainable Cities / Hellenic Network of 100 Smart Cities
UNIVERSIDAD DE ALCALÁ (ES)	HEI students, VET students, etc.	Direct contact, institutional channels, etc. (together with Comunidad de Madrid)

APRO FORMAZIONE (IT)	Teachers and managers of VET/HEI institution Students of VET/HEI Municipalities Technical Enterprises	Social media, Mailing, Thematic newspapers
COMUNIDAD AUTÓNOMA DE MADRID (ES)	Students	Social networks, employment office and Alumni database.
BASSCOM (BG)	SMEs, Public Entities	Mailing, publications in social media and organisational website, others
UNIVERSITY OF WEST ATTICA (EL)	HEI, VET students	Site, email, social media
ESI CEE EUROPEAN SOFTWARE INSTITUTE (BG)	HEI institutions Public Entities Bulgarian SMEs in different sectors	Mailing, publications in social media and organisational website, HEI courses
GAIA (ES)	HEI/VET students SMEs	Share the information into Industry of Knowledge and Technology sector ● HAZITEK / ELKARTEK ● SPRI and others clusters

Table 3 - Proposed dissemination actions

1.4 Train-the-Trainers

Prior to the beginning of the pilots, a **"Train-the-Trainers"** online event was organized, and the D5.2 – Trainer Handbook was developed to support them. The "Train the Trainers" event presented (a) the different courses of the curriculum, (b) the training methodologies that could be applied to deliver the courses for Smart Cities key enabling technologies through the MOOC and (c) the training methodologies that could be exploited in order to deliver the courses for soft, entrepreneurship, and green skills through the Virtual Words. Moreover, it presented alternative techniques that could be used to monitor and assess the performance of learners during the pilots.

2 Pilot report

The pilots run from January 2024 up to November 2024, for a period of 11 months. The pilots were initially planned as follows:

- From January to March 2024 (extended until October 2024): piloting of technical courses on the MOOC.
- From April to June 2024: piloting of non-technical courses on the MOOC and on the Virtual Worlds, with a second round in autumn 2024.
- From July to September 2024: piloting of the official certification procedure.

All these time frames have been extended to ensure greater participation of the students to the piloting activities considering also the SMACITE awards campaign announced in July 2024.

- From March to October 2024: piloting of technical courses on the MOOC.
- From June to October 2024: piloting of non-technical courses on the MOOC and on the Virtual Worlds.
- From September to November 2024: piloting of the certification procedure and the issuing of certificates

The completion of the piloting phase and its reporting represent a Milestone of the project (MS11 – National pilots, M30).

2.1 Preliminary phase

The campaign to promote the open call for participation in the project pilots started in November 2023. Information about the open call for participants was disseminated on the project website and social media, and by each partner through further dedicated posts, mailing actions and meetings.

The following table presents the results of the open calls and the courses selected by the potential students, according to their country of origin. The total number of courses selected appears to be strongly higher than the number of responders (**more than 400 individuals expressed interest to participate in the pilots**) because the majority of students selected more than one course.

Course	Greece	Spain	Italy	Bulgaria	Other	Total
1.1 Smart Cities	131	57	47	46	8	**289**
1.2 Internet of Things	114	32	27	27	4	**204**
1.3 Cybersecurity	110	28	15	31	2	**186**
1.4 Cloud Computing	97	44	14	22	4	**181**
1.5 Data Analytics and Visualizations	106	28	13	34	3	**184**
1.6 Machine Learning with Big Data	101	33	14	33	4	**185**
1.7 3D Printing	61	18	23	11	0	**113**
1.8 Blockchain	54	21	15	26	2	**118**
1.9 Drones	65	26	17	20	3	**131**
1.10 Autonomous Vehicles	71	24	12	20	2	**129**
2.1 Soft skills	139	41	17	46	7	**250**
2.2 Entrepreneurship skills	113	21	13	47	8	**202**
2.3 Green skills	93	28	51	26	3	**201**
TOTAL	**1255**	**401**	**278**	**389**	**50**	

Table 4 – Data about expression of interest

2.2 Piloting phase

Below we present the key results obtained from the piloting of the SMACITE training programme. All course at the MOOC available at https://mooc.smacite.eu/ are divided into two categories, i.e. for Smart Cities Engineers and for Smart Cities Technicians.

2.2.1 Self-assessment tool pilot

The Self-Evaluation Tool integrated in the MOOC platform was aimed to help users in identifying their training needs and propose flexible and personalised learning pathways, providing a more student-centred approach to the curriculum delivery and to enable students to follow their own tailor-making pathways.

The tool was developed smoothly and was used by around 2/3 of the MOOC users, with a significantly higher utilisation rate for content related to technical courses. The following table provides data about the usage of the diagnostic tool by Smart Cities Engineers and Smart Cities Technicians.

Content	Engineers	Technicians
Self-assessment Diagnostic Tool	55	26
Functions Description	51	26
Smart Cities Course Description	43	24
Quiz: Smart Cities Self-Assessment	44	16
IoT Course Description	30	15
Quiz: IoT Self-Assessment	24	12
Cybersecurity Course Description	28	16
Quiz: Cybersecurity Self-Assessment	26	15
Cloud Computing Course Description	24	14
Quiz: Cloud Computing Self-Assessment	17	11
Data Analytics and Visualisations Course Description	23	15
Quiz: Data Analytics and Visualisations Self-Assessment	16	10
Machine Learning with Big Data Course Description	23	14
Quiz: Machine Learning with Big Data Self-Assessment	16	8
Soft Skills Course Description	5	4
Quiz: Soft Skills Self-Assessment	4	4
Entrepreneurship skills Course Description	2	2
Quiz: Entrepreneurship skills Self-Assessment	2	2
Green Skills Course Description	5	4
Quiz: Green Skills Self-Assessment	0	0

Table 5 – Data about usage of diagnostic tool

2.2.2 MOOC pilot

MOOC was developed by the partner ESI CEE using the Moodle platform. During the course of the pilot, some fine-tuning activities was necessary at various points in time, due to a number of decisions taken on the basis of the analysis of activity trends.

The aspects that required limited intervention were the registration system with self-enrolment key with a time limit, some customisations on the organisation of content on individual courses, the modification of activity deadlines, and the release of certifications of attendance for courses that also included the use of Virtual World.

All interventions were implemented and validated in a test environment and then applied and tested in one active course before being rolled out across all courses when needed. This process ran smoothly helping to align all the courses and then generating a coherent environment without service interruptions.

According to the data collected through the expression of interest form, dedicated to potential students to recruit for the pilot and disseminated by the partners, **407 persons have expressed interest to join the SMACITE pilot training**.

Among these, 287 were male, 114 were female, and 6 preferred not to respond. According to their country, 198 were living in Greece, 75 in Bulgaria, 62 in Spain, 60 in Italy, and finally 12 came from other countries (Serbia, Romania, Germany, Portugal, Türkiye, Aruba).

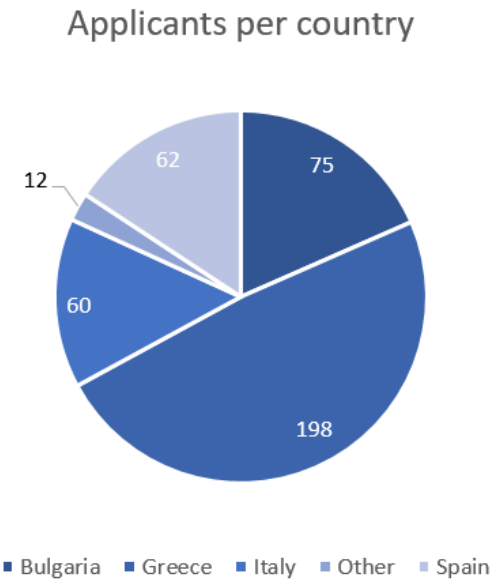

Figure 1 – Applicants per country

Taking into account their qualifications:

- 77 had a post-graduate degree (MSc and/or Phd) in the field of ICT from a Higher Educational Institution.
- 72 a post-graduate degree (MSc and/or Phd) in the field of engineering (other than ICT), physical sciences, life sciences, mathematics, financials and business administration from a Higher Educational Institution.
- 72 had a Bachelor in the field of engineering (other than ICT), physical sciences, life sciences, mathematics, financials and business administration from a Higher Educational Institution.
- 51 a Bachelor in the field of ICT from a Higher Educational Institution.
- 94 were attending a VET centre or a professional school.
- 41 had other qualifications.

Although 407 individuals have expressed interest to join the SMACITE pilot training, **331 have been registered in the MOOC** (which is above the target performance of 300 MOOC users identified in the application), which is a reasonable drop-out rate for free online training programs.

Considering the enrolled MOOC users, some relevant statistics are the following.

According to the country of origin, 150 students registered in MOOC came from Greece, 62 from Italy, 55 from Bulgaria, 43 from Spain, 10 from other countries and 11 did not express their origin.

Regarding their institution, 95 students were working in a company at the moment of registration in MOOC, 90 were university students, 46 were students in a VET centre, 29 were working for a public body and 71 of them did not reply in the question.

2.2.2.1 Engagement of students with the MOOC courses

In the following tables, for each course for engineers and technicians are provided the following data:

- the number of students enrolled,
- the number of students started the course (i.e. going at least through the first module of the course),
- the number of students completing the course,
- the number of students completing the course evaluation form and
- the number of students getting the certification of attendance by achieving at least 70% score at the quizzes and project (where applicable).

Engineers

Course	Students (engineers) enrolled	Students who started the course	Students who completed the course (% of enrolled)	Course evaluation	Certifications of attendance
1.1 Smart Cities	111	42	38 (34%)	37	16
1.2 Internet of Things	75	21	20 (27%)	19	7
1.3 Cybersecurity	90	26	22 (24%)	21	11
1.4 Cloud Computing	67	18	15 (22%)	14	6
1.5 Data Analytics and Visualizations	71	19	18 (25%)	17	2
1.6 Machine Learning with Big Data	70	15	12 (17%)	10	3
1.7 3D Printing	41	13	10 (24%)	10	2
1.8 Blockchain	62	16	15 (24%)	12	2
1.9 Drones	49	15	10 (20%)	10	1

1.10 Autonomous Vehicles	53	17	13 (25%)	15	2
2.1 Soft skills	26	12	11 (41%)	10	3
2.2 Entrepreneurship skills	9	3	3 (33%)	3	6
2.3 Green skills	27	16	15 (70%)	8	5

Table 6 – Data about usage of MOOC (engineers)

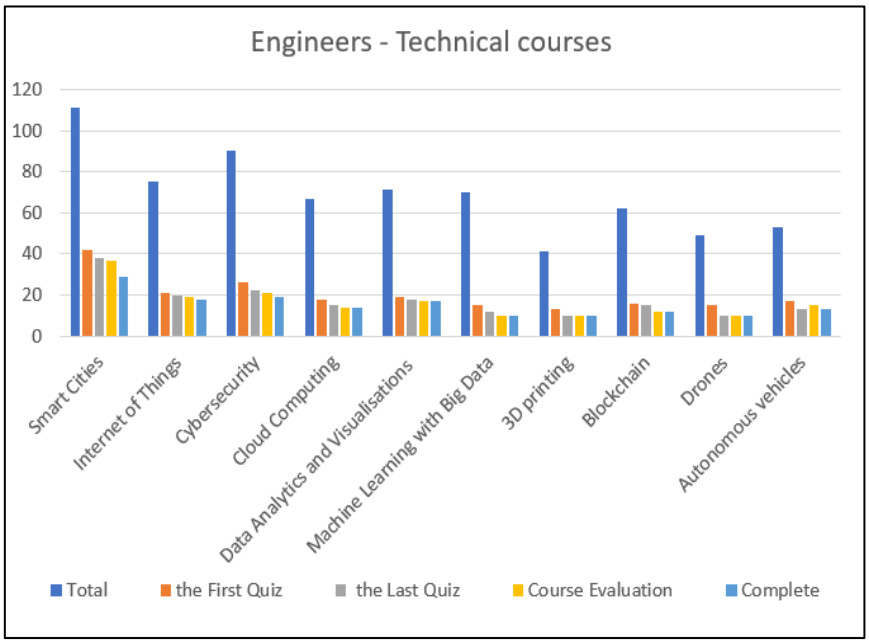

Figure 2 – Data about technical courses, engineers

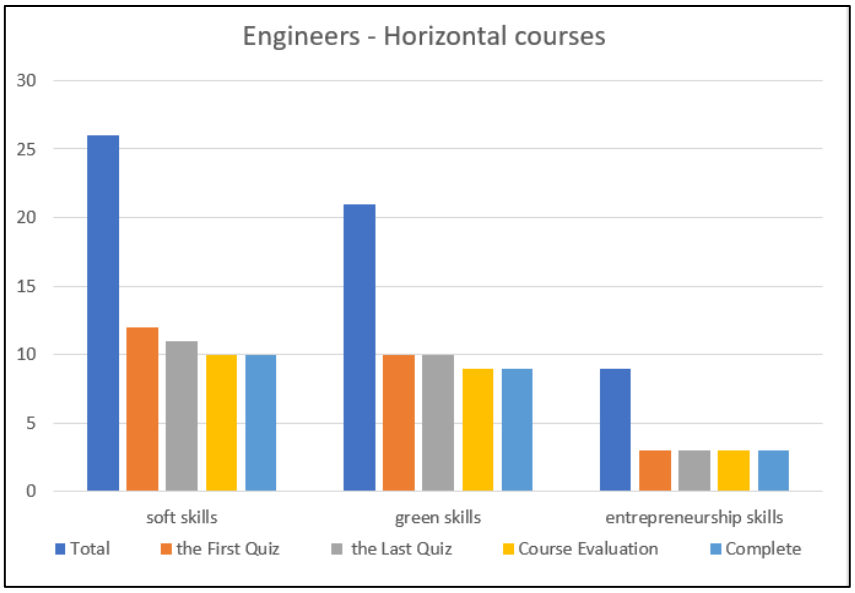

Figure 3 – Data about horizontal courses, engineers

Technicians

Course	Students (technicians) enrolled	Students who started the course	Students who completed the course (% of enrolled)	Course evaluation	Certifications achieved
1.1 Smart Cities	77	39	27 (35%)	24	7
1.2 Internet of Things	49	23	22 (45%)	20	3
1.3 Cybersecurity	38	7	5 (13%)	5	3
1.4 Cloud Computing	31	4	4 (13%)	4	2
1.5 Data Analytics and Visualisations	26	6	4 (15%)	3	0
1.6 Machine Learning with Big Data	27	3	1 (4%)	1	1
1.7 3D Printing	16	2	2 (13%)	2	1
1.8 Blockchain	26	4	4 (15%)	4	0
1.9 Drones	21	3	3 (14%)	3	2
1.10 Autonomous Vehicles	22	4	4 (18%)	4	1
2.1 Soft skills	10	3	2 (20%)	2	0
2.2 Entrepreneurship skills	4	1	1 (25%)	1	1
2.3 Green skills	41	28	23 (56%)	18	8

Table 7 – Data about usage of MOOC (technicians)

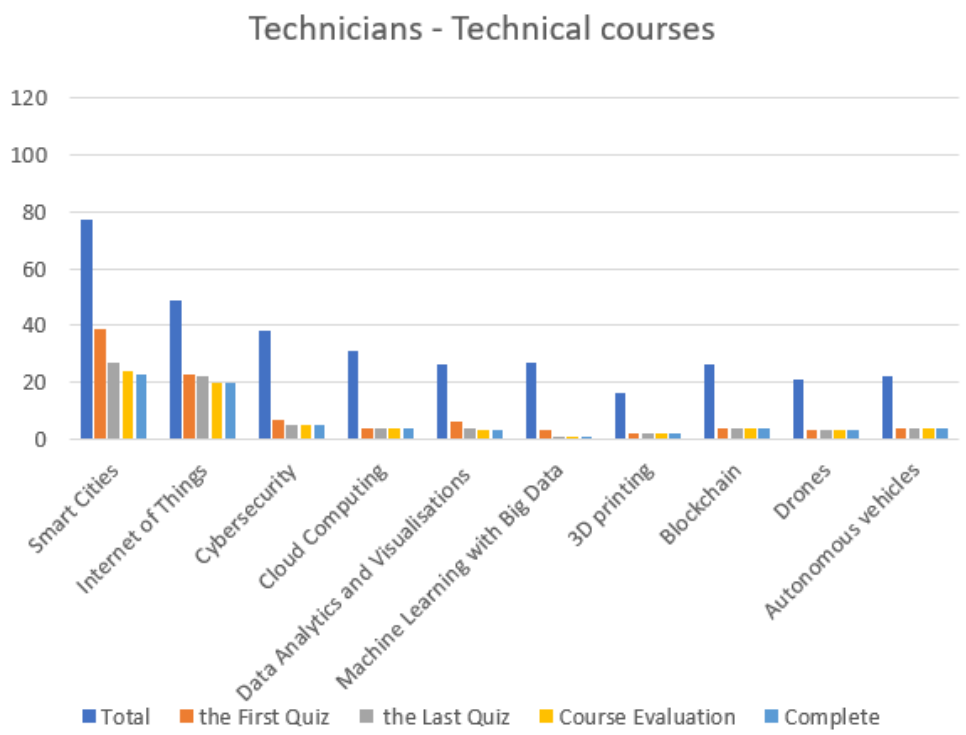

Figure 4 – Data about technical courses, technicians

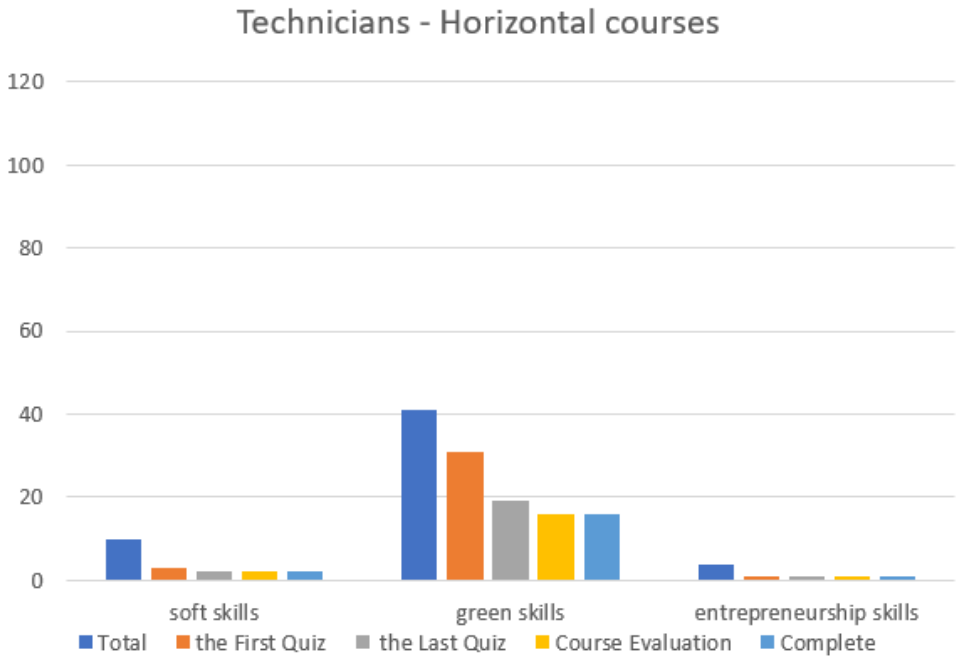

Figure 5 – Data about horizontal courses, technicians

As a general conclusion, from all MOOC students, **147 students have completed at least one module of a course, while 87 completed at least one course**. This means a **completion rate of 59%** which is good for MOOCs (especially un-paid ones) considering that the students completion rate of well-known MOOC providers (Coursera, EdX, and Udacity)) ranges between 9% and 36.1%[1].

Data on the differences among expressions of interest, enrolment, participation, and course completion were analysed in detail as well as feedback from participants. The critical factors that may in our opinion have contributed to this result, beyond the physiological difficulties in maintaining interest in experimental non-paying courses, are reported in the Lessons Learnt section of this deliverable.

A specific questionnaire was sent to users who have registered but have not participated in any activity at the end of the pilot. Data collection is still in progress but for the time being the most reported reason is the lack of time to follow the piloting activities.

2.2.2.2 Evaluation of MOOC courses

Altogether, 267 responses were collected through the MOOC platform through each course evaluation questionnaire. The overall results obtained are very positive. The following table presents the average score achieved for each evaluation criterion using a scale from 1 (not at all) to 5 (absolutely).

Evaluation aspects	Average score
I have enjoyed the course	**4.22**
This course was challenging	**4.15**
The course met my expectations	**4.16**
The quality of the training material was high	**4.17**
The content was well organised and easy to follow	**4.27**
The course will be useful in my work	**4.07**
The objectives of the course were clearly defined	**4.25**
The time allocated for the course was reasonable	**4.26**
The course enhanced my knowledge of the subject matter	**4.21**
In this course, I have been challenged to learn more than I expected	**4.06**
I will suggest this course to my colleagues	**4.11**
The overall visual design of the course content and material was attractive to the user	**4.15**

Table 8 – Feedback collected through evaluation forms about usage of MOOC

[1] Berkan Celik, Kursat Cagiltay, Uncovering MOOC Completion: A Comparative Study of Completion Rates from Different Perspectives, 2024.

Below we present the profile of the MOOC users that evaluated the SMACITE courses.

Gender

The collected responses were submitted by 98 single students: 75 men, 20 women, and 3 persons who preferred not to specify their gender. Taking into consideration the total number of course questionnaires, we can observe that 186 responses came from men, 69 from women and 12 from persons who preferred not to specify their gender.

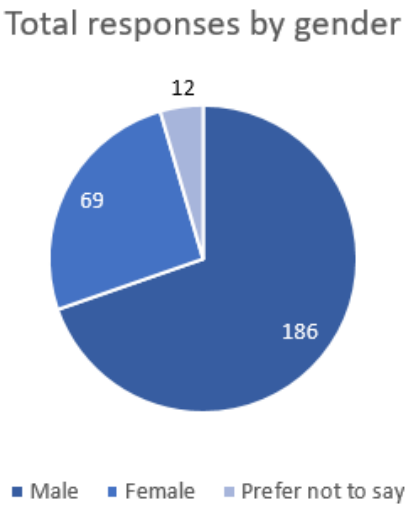

Figure 6 – Total responses by gender, MOOC courses evaluations

Age groups

About age representation, 32 students that responded to course evaluation questionnaires, are younger or equal to 19 years old, while 45 are between 20 and 39, 18 between 40 and 63, and eventually 3 are equal to or older than 64 years old. Taking into consideration the total number of course questionnaires, we can observe that 47 responses came from students younger than 19 years old, 136 responses came from students between 20 and 39, 76 from students between 40 and 63, and 8 from students who are equal to or older than 64 years old.

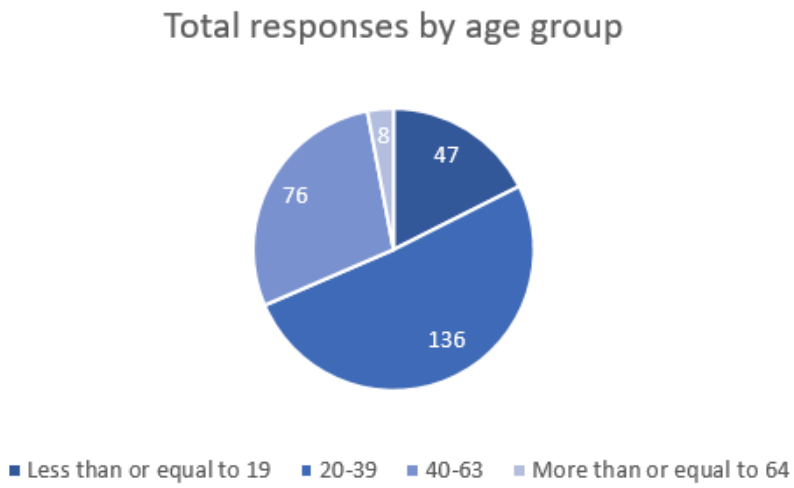

Figure 7 – Total responses by age group, MOOC courses evaluations

Country

Considering the country, 38 responders are from Greece, 13 from Bulgaria, 15 from Spain, and 32 from Italy. Taking into consideration the total number of responses, Greek students replied to 143 questionnaires, Bulgarians to 33, Spanish to 43, and finally Italians to 48.

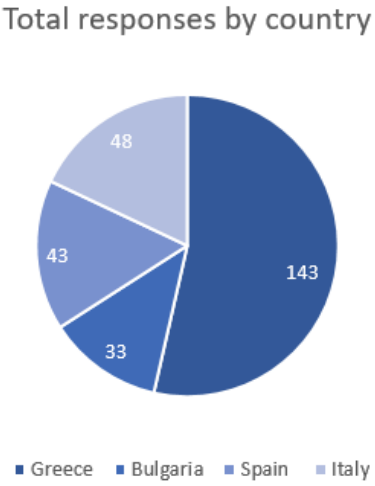

Figure 8 – Total responses by country, MOOC course evaluations

Professional status

Considering the professional status, 26 responders are university students, 37 are VET students, 31 are professionals currently working, 2 are professionals currently unemployed, and 2 responded have another professional status.

Among all the responses, 101 came from university students, 57 from VET students, 96 from professionals currently working, 3 from professionals currently unemployed, and 10 from those with other statuses.

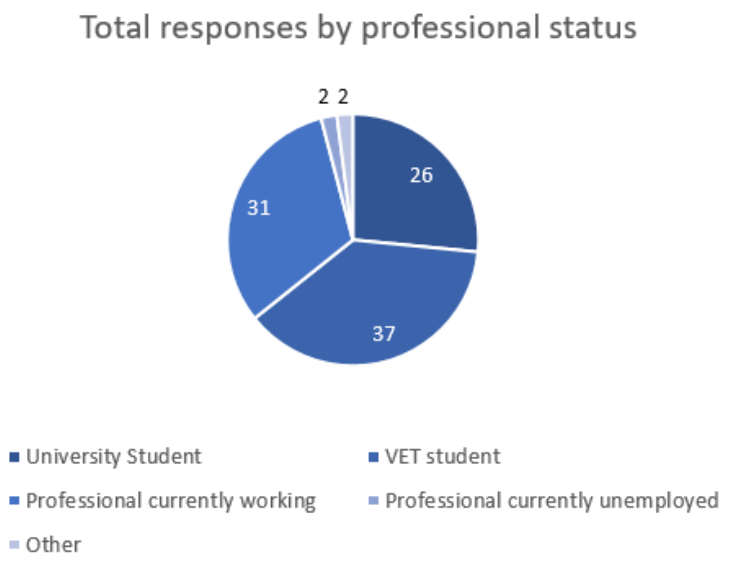

Figure 9 – Total responses by professional status, MOOC course evaluations

2.2.3 Virtual World pilot

The implementation of the Virtual Worlds, managed by the UPATRAS partner, was successfully completed slightly later than initially planned, causing a slight change in the Virtual Worlds piloting schedule which was handled without any particular complications.

The Virtual Worlds platform piloting offers practical insights into how effective immersive environments are in teaching, especially for building non-technical skills such as soft, green, and entrepreneurial skills.

3 Virtual Worlds have been piloted one for the soft skills, one for the entrepreneurship skills and one for the green skills.

2.2.3.1 Engagement of students with the Virtual Worlds

The online real-time training sessions at the Virtual Worlds platform was more appreciated by technicians than engineers and by younger students. Young participants appreciated the hands-on approach, more motivating than conventional learning settings and potentially leading to improved learning retention and outcomes.

Course	Students who participated in Virtual World	Virtual World evaluation	Certifications achieved
2.1 Soft skills	5	3	3
2.2 Entrepreneurship skills	16	7	16
2.3 Green skills	5	3	5

Table 9 – Data about usage of Virtual World (engineers)

Course	Students who participated in Virtual World	Virtual World evaluation	Certifications achieved
2.1 Soft skills	8	9	0
2.2 Entrepreneurship skills	10	4	10
2.3 Green skills	29	21	8

Table 10 – Data about usage of Virtual World (technicians)

2.2.3.2 Evaluation of Virtual Worlds

The online training sessions on the Virtual Worlds were evaluated by 26 students: among them, 16 evaluated one course; 9 evaluated 2 courses (in particular, 2.1 Soft skills and 2.3 Green skills), and just 1 evaluated all 3 courses. Below is presented the average score reached for each evaluation criteria (in some questions, a scale 1-5 have been used).

Evaluation aspects	Average score
I have enjoyed the course	**4.22**
Did the training meet your expectations?	**Yes (100%)**
How well are the courses of the curriculum organised and structured for effective learning? (1-5 scale, with 1 not well and 5 very well)	**4.23**
Please rate the overall quality of the online training at the Virtual Worlds (1-5 scale, with 1 being very bad and 5 being very good)	**4.00**
Were the training materials (e.g., videos, documents) easy to access and understand?	**Yes (96%)**
How would you rate the pace of the training program? (1-5 scale, with 1 being too slow and 5 being too fast)	**3.96**
Were the training sessions interactive and engaging?	**Yes (100%)**
How familiar were you with virtual worlds before taking this training program? (1-5 scale, with 1 being not familiar at all and 5 being very familiar)	**3.58**
Did you experience technical issues while using virtual worlds for training?	**Yes (69%)** **No (31%)**
Did the training help you become more comfortable and confident in using virtual worlds?	**Yes (73%)** **No (27%)**
Please rate the instructor's knowledge and expertise in virtual worlds. (1-5 scale, with 1 being poor and 5 being excellent)	**4.85**
Were the instructors responsive to your questions and concerns?	**Yes (100%)**
How would you rate the support and resources provided during the online training? (1-5 scale, with 1 being inadequate and 5 being excellent)	**4.38**

In the case you participated in the soft skills training, did the training help you to build your soft skills? (1-5 scale, with 1 being Not at all and 5 being Absolutely)	**4.29**
In the case you participated in the entrepreneurial skills training, did the training helped you to build your entrepreneurial skills (1-5 scale, with 1 being Not at all and 5 being Absolutely)	**4.33**
In the case you participated in the green skills training, did the training helped you to build your green skills (1-5 scale, with 1 being Not at all and 5 being Absolutely)	**4.42**
Would you recommend this training program to others? (1-5 scale, with 1 being Not at all and 5 being Absolutely)	**4.15**

Table 11 – Feedback collected through evaluation form about usage of Virtual World

Gender

All the 26 responders were men.

Age group

About age representation, 14 students that responded to evaluation forms are younger or equal to 19 years old, while 9 are between 20 and 39, 3 between 40 and 63, and eventually none are equal to or older than 64 years old.

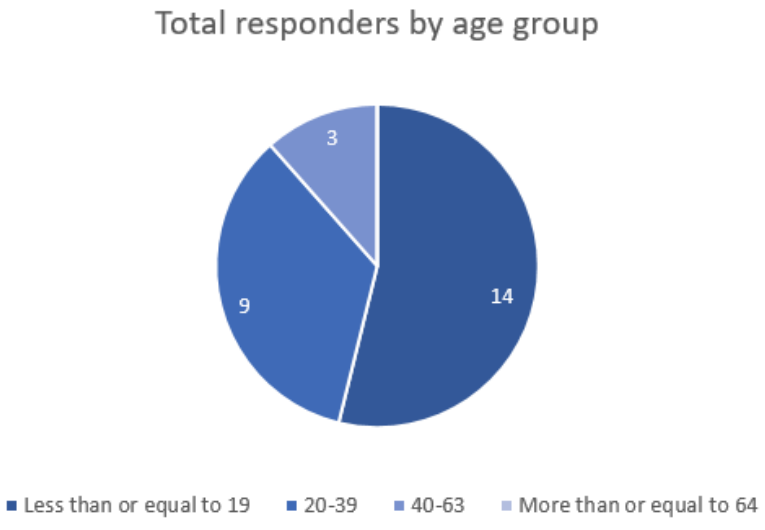

Figure 10 – Total responses by age group, Virtual World evaluations

Country

Considering the country, 4 responders are from Greece, 1 from Bulgaria, 11 from Spain, and 10 from Italy.

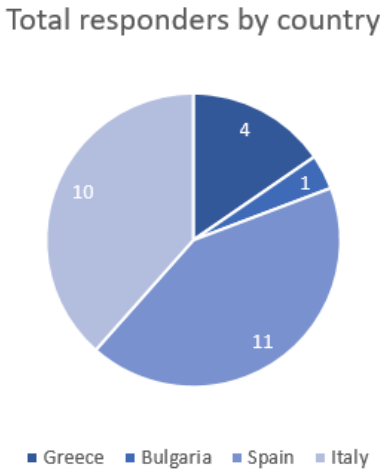

Figure 11 – Total responses by country, Virtual World evaluations

Professional status

Considering the professional status, only 1 responder is a university student, 21 are VET students, 4 are professionals currently working, while no professionals currently unemployed responded.

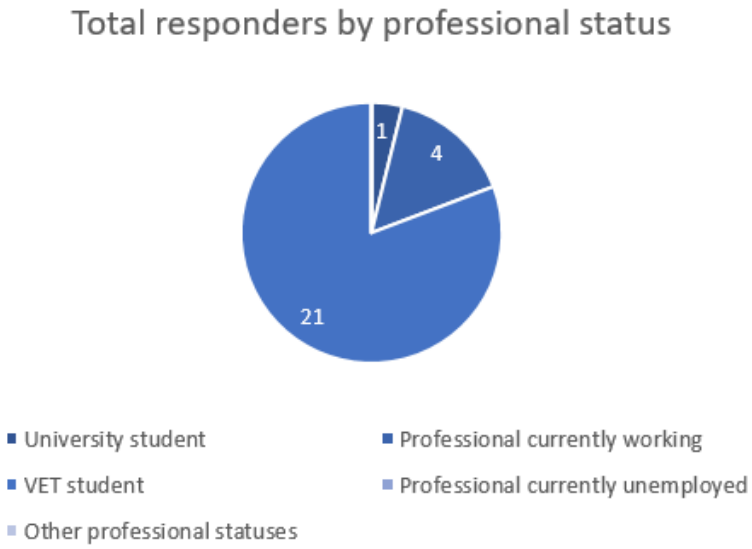

Figure 12 – Total responses by professional status, Virtual World evaluations

On qualitative terms, students that evaluated the Virtual World courses underlined some difficulties they faced during the implementation of the lessons, in particular technical problems linked to the audio system (10 students notified it) that created confusion, and

the high-speed Internet connection needed to maintain the stability (10 students notified it) of the Virtual Worlds.

In this sense, students suggested to improve the technical stability of the platform and to implement a live transcription of the online lessons, in order to help those who face difficulties linked to audio.

There were 14 requests for assistance, the majority of which related to support for downloading and installing the necessary software package for Virtual World access. The release of an updated installation package of the Virtual Worlds led to an improvement in the quality of the experience and a reduction in problem reports.

During the pilot, corrective actions were taken to improve the experience both from a technological point of view, with the release of a new installation package to correct some bugs, and from an organisational point of view such as increasing the number of sessions but limiting the number of subscribers to reduce fluidity and audio management problems.

Positive aspects of Virtual World reported by the students are:

1. Interactivity and the activities proposed (for 11 students).
2. The graphics and the environments of Virtual Worlds (for 7 students).
3. The contents of the course (for 4 students).

All the students that evaluated the courses appreciated the trainers and their preparation in the specific subjects they taught.

2.2.4 Certification pilot

The certification exams process leading to the Smart Cities Engineer Certification or Smart Cities Technician Certification has been piloted from July to November 2024 including a round of exams in May 2025. To be eligible to participate in the online certification exams, a student had to successfully complete (i.e. get the Certification of Attendance) the Smart Cities course + 1 additional technical course + 1 course on horizontal skills

In total, 30 students have gone through the online exams leading to the certification and finally, 24 students got the Smart Cities Specialization Certification. However, at the time of writing this deliverable the certification process is still on-going, so more students are expected to be involved in.

All students interested in participating in the certification exams had to complete this online from.

Moreover, you can find as an annex the instructions send to the students for the participation in the online exams with e-proctoring.

3 Lessons learnt

The pilot had an overall positive outcome; however, some areas for improvement from a management and operational perspective were identified thanks to specific questionnaires for participants in the pilots and project partners.

The risks identified during the design phase that are most closely related to piloting are as follows:

- ***Risk n°4 Project implementation delays (WP1) - Likelihood: Medium - Impact: High***
  There was a delay in the release of the demo version of the Virtual World, but this did not lead to delays in the overall project delivery thanks to the commitment of the partners involved in the experimentation who rescheduled activities in a timely manner.
- ***Risk n°10 Difficulty to reach the expected numbers of pilot users with the needed requirements (WP5)*** - Likelihood: Low - Impact: High
  Despite of an open call with results far exceeding our expectations, the number of registered MOOC users was 331, which was still above the target of 300 MOOC users. 147 students completed at least one module of one course, while 87 completed at least one course resulting to a completion rate of 59% which is good for unpaid MOOCs. The extension of the time available to complete the activities and the prize initiative created in cooperation with the Greek Computer Society contributed to the achievement of this goal.
- ***Risk n°11 Discovery of missing requirements or findings of unsolvable steps during pilots implementation. (WP6) -*** Likelihood: Low - Impact: High
  No unsolvable steps were encountered, minor technical interventions to solve some critical issues and improve the quality of the experience were introduced in a timely manner without affecting the activities.

Lessons learned for the MOOC.

The time lag between the expression of interest and the start of the MOOC courses and the requirement to make a further registration to the MOOC via enrolment keys with a deadline, created a procedure that was not so flexible. The feature of temporary enrolment keys, designed for greater IT security, was changed as soon as the issue was identified, thanks to the readiness of partners to gather feedback. The final version of the platform will therefore not have this kind of problem.

Moreover, the majority of the MOOC users who did not started any course (although enrolled in the MOOC) reported the lack of time as the main reason. So, courses with a shorter duration could work better in order to meet the time constraints requirements especially of employed professionals.

Lessons learned for the Virtual Worlds

The issue of audio management and possible problems in the event of high attendance in the Virtual Worlds, which emerged during the pilot, were immediately resolved: the

updated release allows the trainer to mute the participants' microphones, avoiding noise and interruptions when necessary, and the tests identified a maximum sustainable number of simultaneously active users. The creation of a Virtual World test area where the PC configuration and audio operation could be an improvement to consider for future developments as well as a specific hands-on session for teacher training.

Lessons learned for the Specialization Certification

Although at this phase of the project the certification exams are a pending task, up to now the interest of the students to join the exams was limited. The partners consider that the main reason is the strict and demanding requirements identified by the consortium for a student to sit the certification exams, i.e. to be eligible a student to participate in the online certification exams you should successfully complete (i.e. get the Certification of Completion) the Smart Cities course + 1 additional technical course + 1 course on horizontal skills.

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ANNEX
Certification Examinations
SKILLS

1. General Requirements

- Computer-Laptop
- Internet connection
- Camera & Microphone & Speakers
- E-mail

2. Install required programs

In order to implement the exam and before the date of the examination, you need to install the following:

1. Zoom Meetings (Download here). Make sure your microphone and speaker are working before testing.

2. Any browser.

3. Anydesk Remote Access Program . (Download here)

It is required for the intervention of a technician of the company to solve any technical problem.

3. Preparation of the exam

- ✓ Do you have an ID or Passport available?.
- ✓ There are no other persons in the room during the examination.
- ✓ No background noise.
- ✓ There is sufficient lighting that does not disturb the camera though, make sure you can clearly see your entire face on camera.

4. Before the exam

Before the exam, you will receive an e-mail that includes:

- Date and time of written exam.
- A link to the examination platform (link), in which there is a button entitled "Export **Participation Form"** which we select, as below:

After selecting the "Export Participation Form" a file will be downloaded which will include:

- The meeting ID for connecting to the scheduled Zoom Meeting.
- Username and Password for the **testing platform**.

As below:

Dear Candidate,
We are sending you the program for the candidate's online examination named:
[redacted]

Date: 13/02/2024
Start time: 15:50
Connection at: 20' earlier

You are not allowed to open any other tab on your computer except from ZOOM and the website of the examination.

Enter ZOOM and connect with the following credentials:
Meeting ID : [redacted]
Your name : Enter your name as written on your ID card

The supervisor will send you the link of the exams. Use the following information to enter the exams:
Username: [redacted]
Password: [redacted]

When connecting to ZOOM, the candidate must have a personal document available, i.e. identity card or passport.

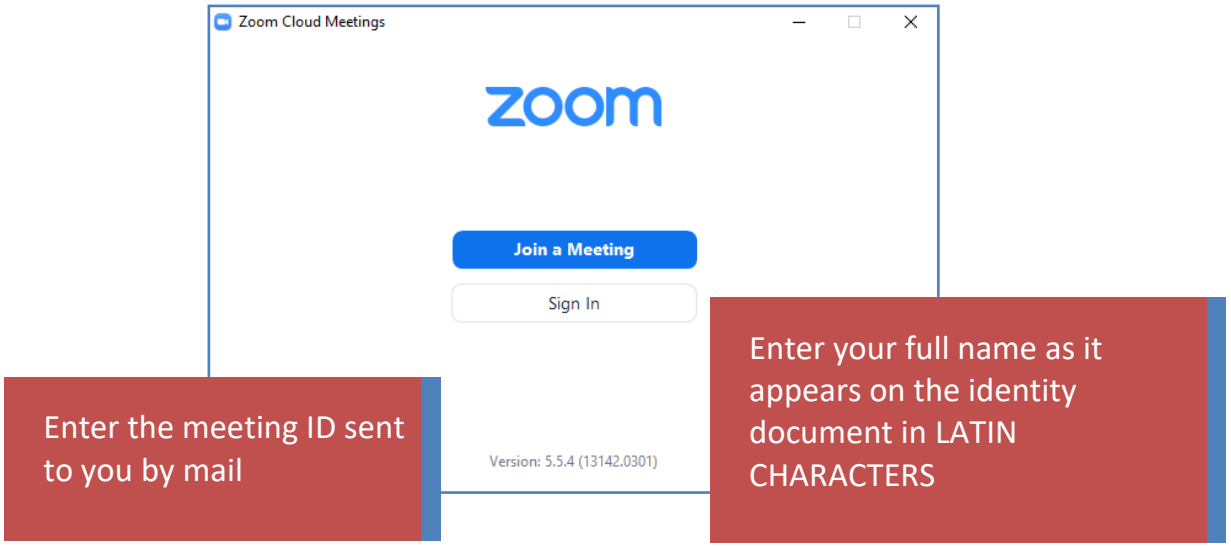
Please copy or print this page so that you have access to your USERNAME, CONTACT PHONE NUMBERS and other information as you will NOT be allowed to access your e-mail on the day of the exam.

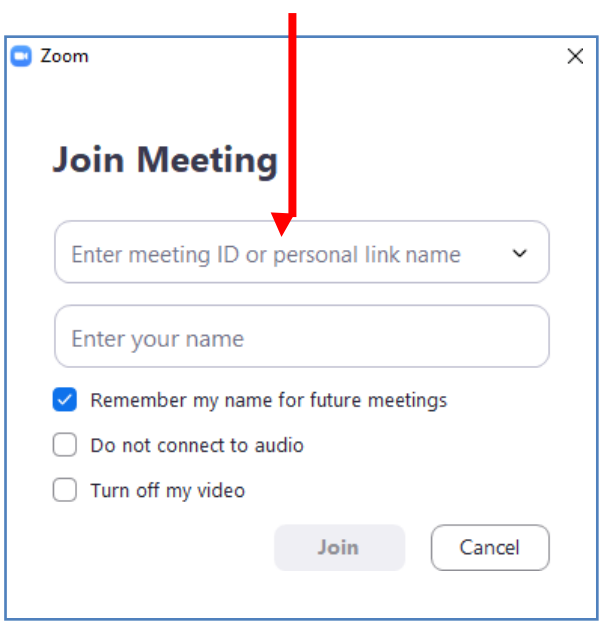
Good Luck!

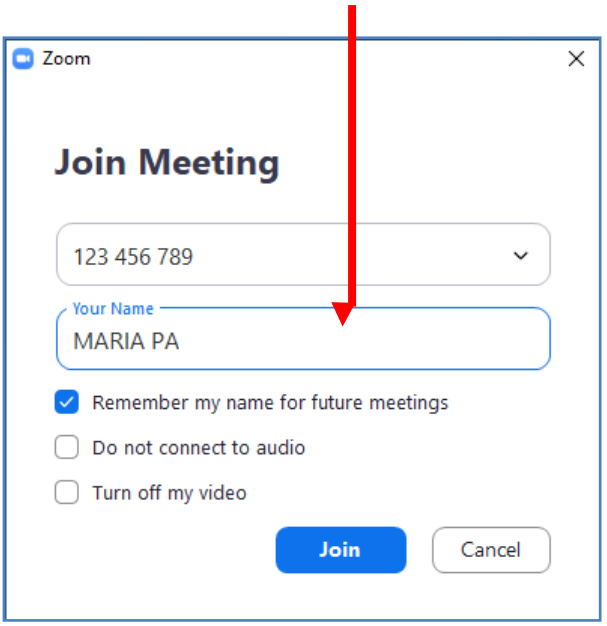
5. Check-In

Start a conference call

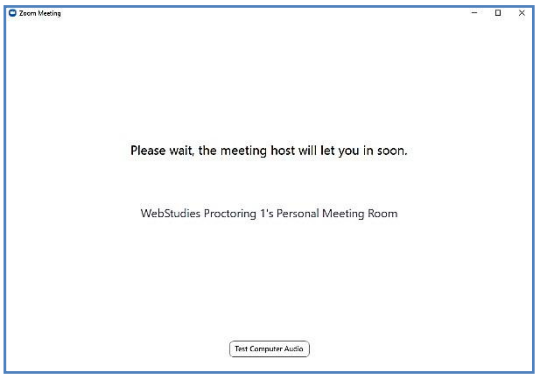
At least 15 minutes before the scheduled test time, open the **ZOOM app**. In the Zoom window, select "**Join a Zoom meeting**" and enter the meeting ID sent to you via email and **your full name**, as stated on the identity document.



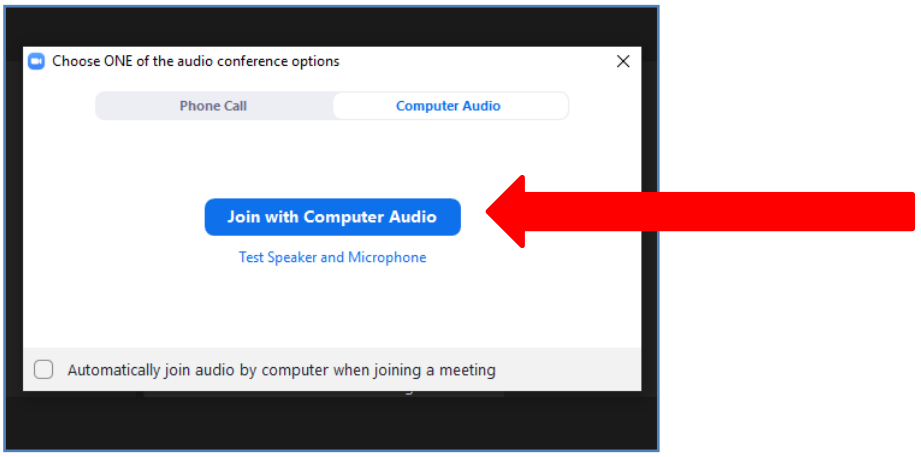




Then you enter a "waiting room" and **wait until** the invigilator accepts you .



In the next window that will appear when you enter the Video Conference, select **Join with computer audio**.



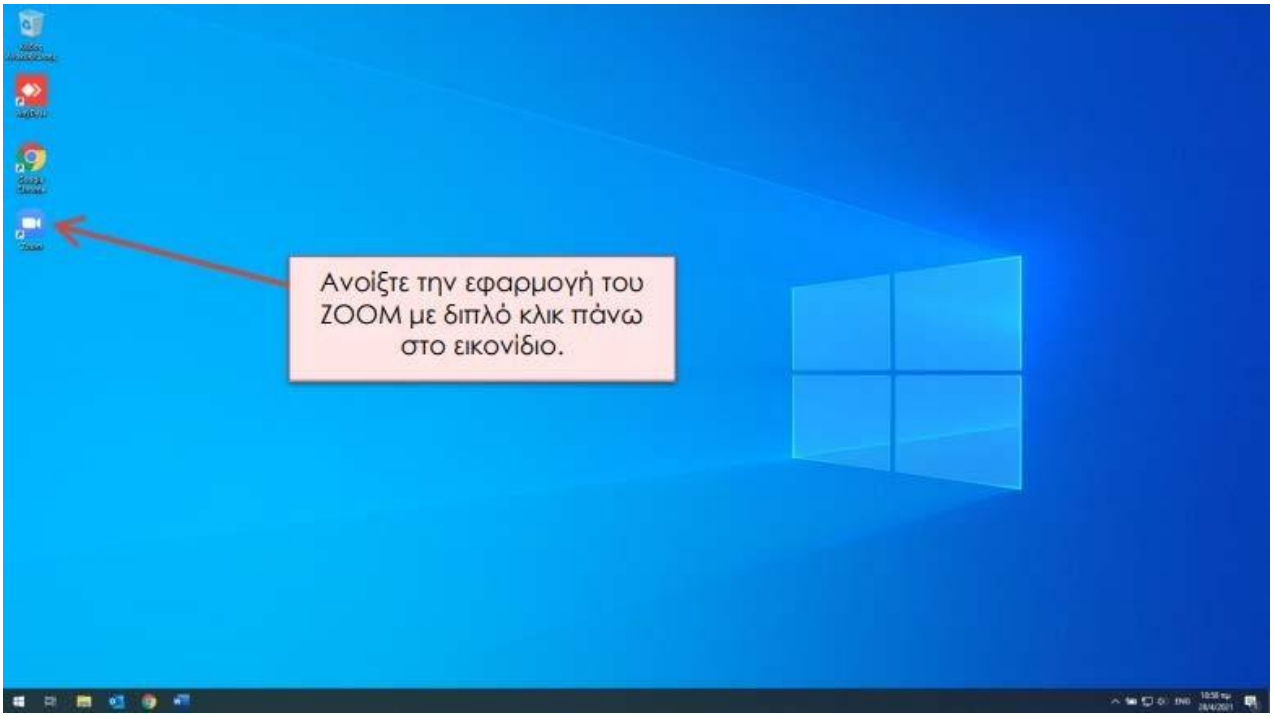
If you skip this step, you can then click at the bottom left of the **Join Audio**.

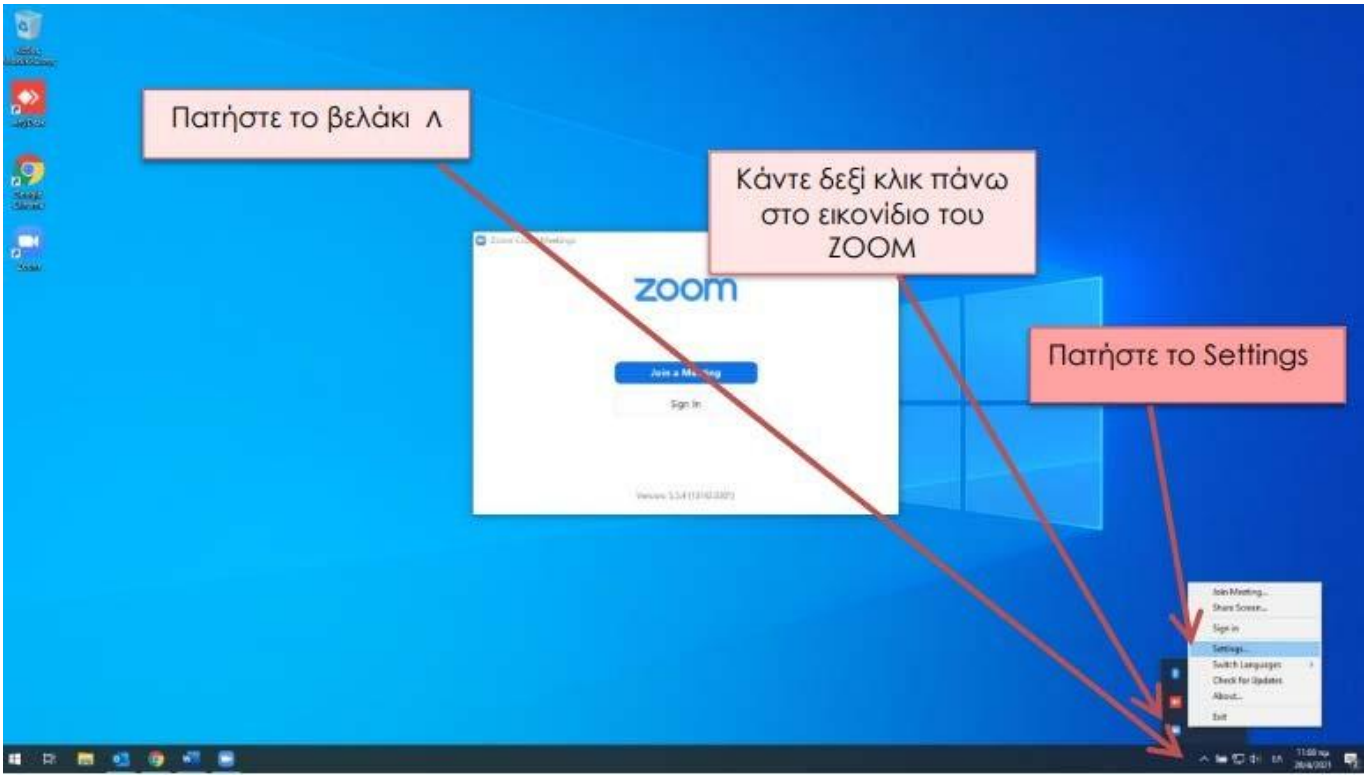
Once you enter the Video Conference Room, the following procedures take place:

- Check Video & Sound settings.
- Using the camera, the Invigilator verifies your identity.
- Do you expect all candidates to be admitted?.

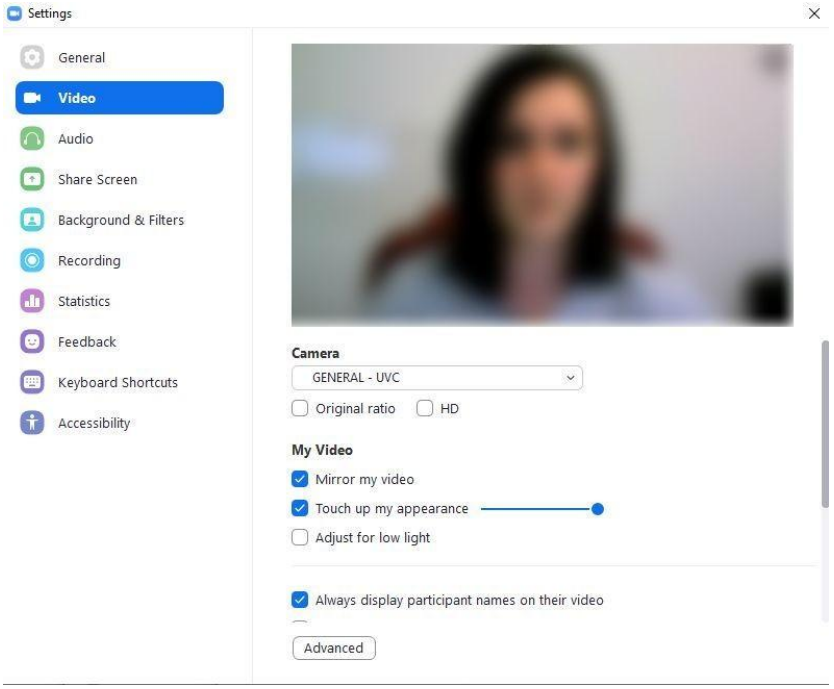
5.1. Diagnostics

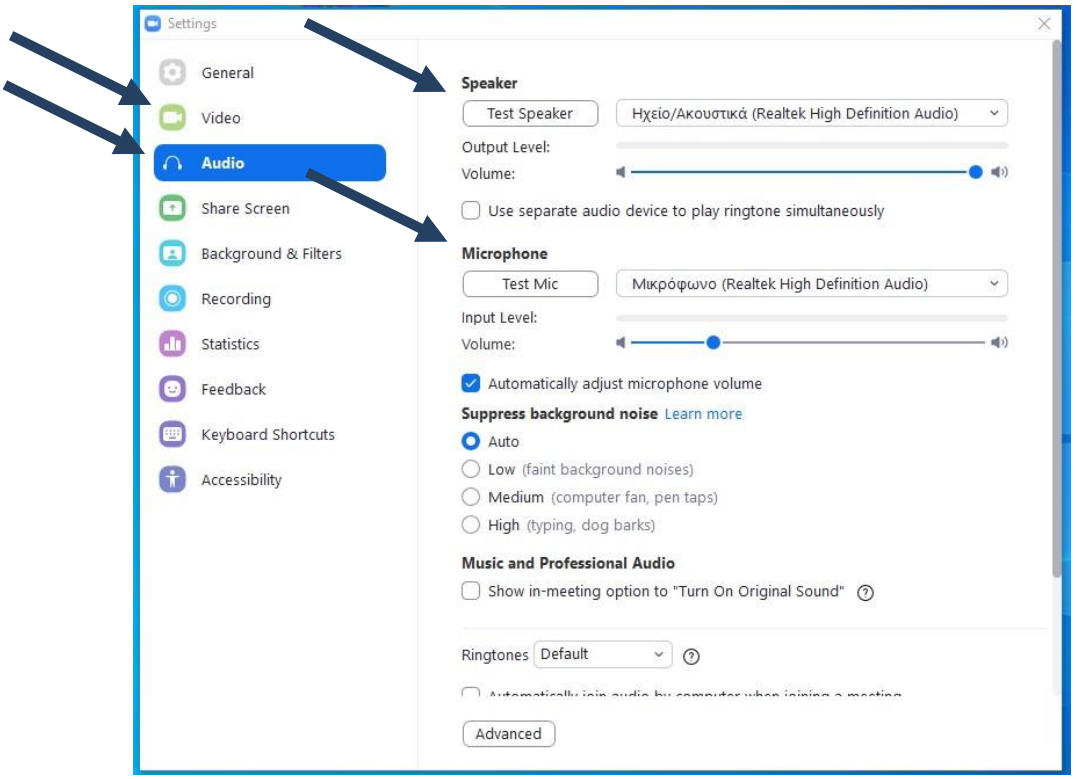
To check the correct operation of the camera and microphone please follow the steps below :


Ανοίξτε την εφαρμογή του ZOOM με διπλό κλικ πάνω στο εικονίδιο.


Πατήστε το βελάκι ^
Κάντε δεξί κλικ πάνω στο εικονίδιο του ZOOM
Πατήστε το Settings
zoom
Join a Meeting
Sign In
Join Meeting...
Share Screen...
Sign in
Settings...
Switch Languages
Check for Updates
About...
Exit

1. In the window that opens, click Video from the menu on the left and make sure that the camera is working and adjust it to center on the patient's face.
2. Then press the next Audio option and press Test Speaker and make sure you hear the sound.
3. Finally, speak into the microphone and see the bar at the Input Level fluctuate.





6. Examination

During the examination:

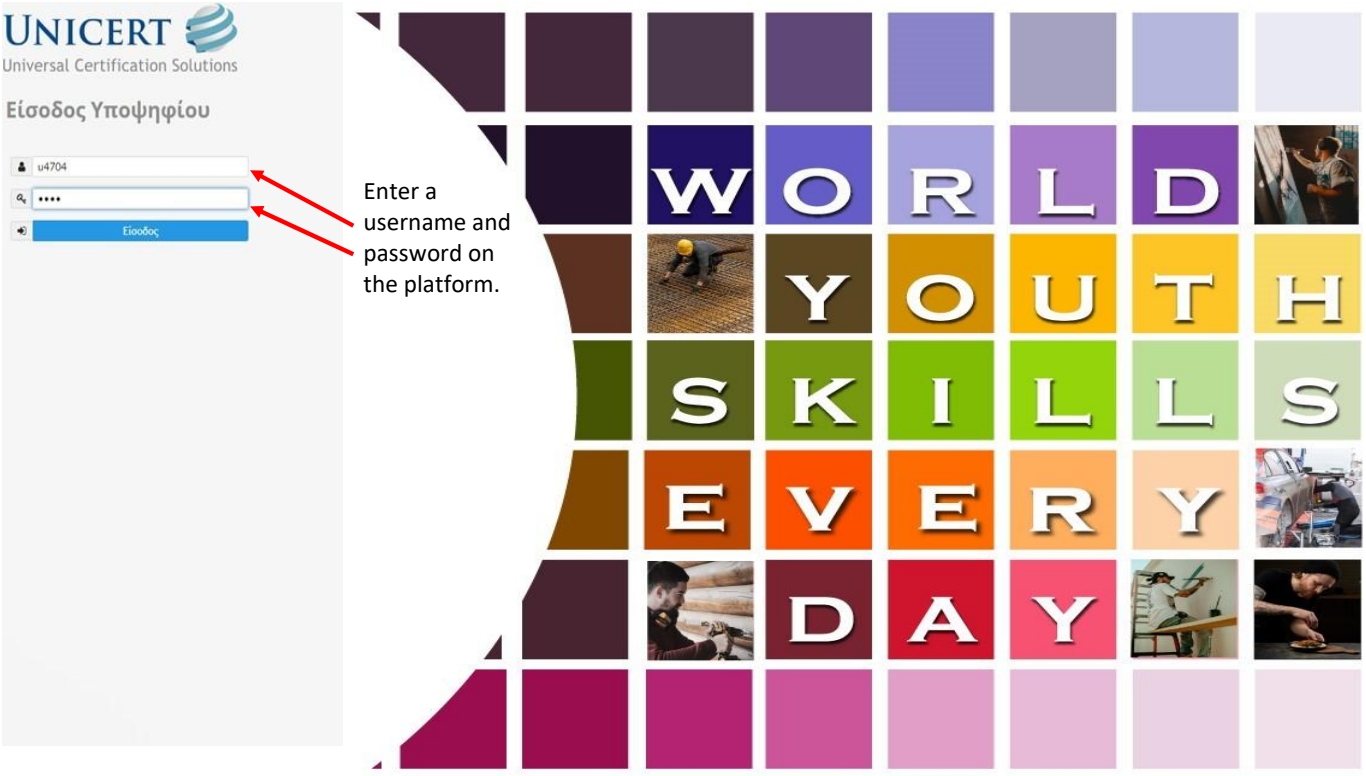
The Invigilator monitors your movements. He sees you, you don't see him. Where required, the Invigilator makes relevant announcements.
Prohibited :

- cover your face with your hands,
- there must be another person in the exam area,

You are allowed to have water, as well as the use of WC after informing the supervisor in the ZOOM chat .

Entry procedure:

Attention: You **will press** the Login button **ONLY** when indicated by the Invigilator.



****In case you press login before the relevant announcement, the exam and your time starts automatically and does not return to the original indicator (reset).****

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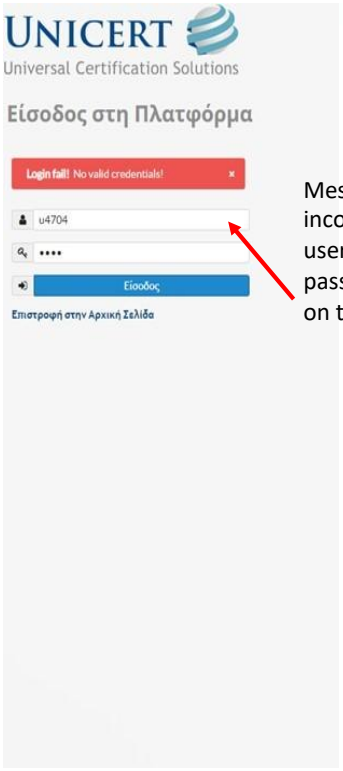
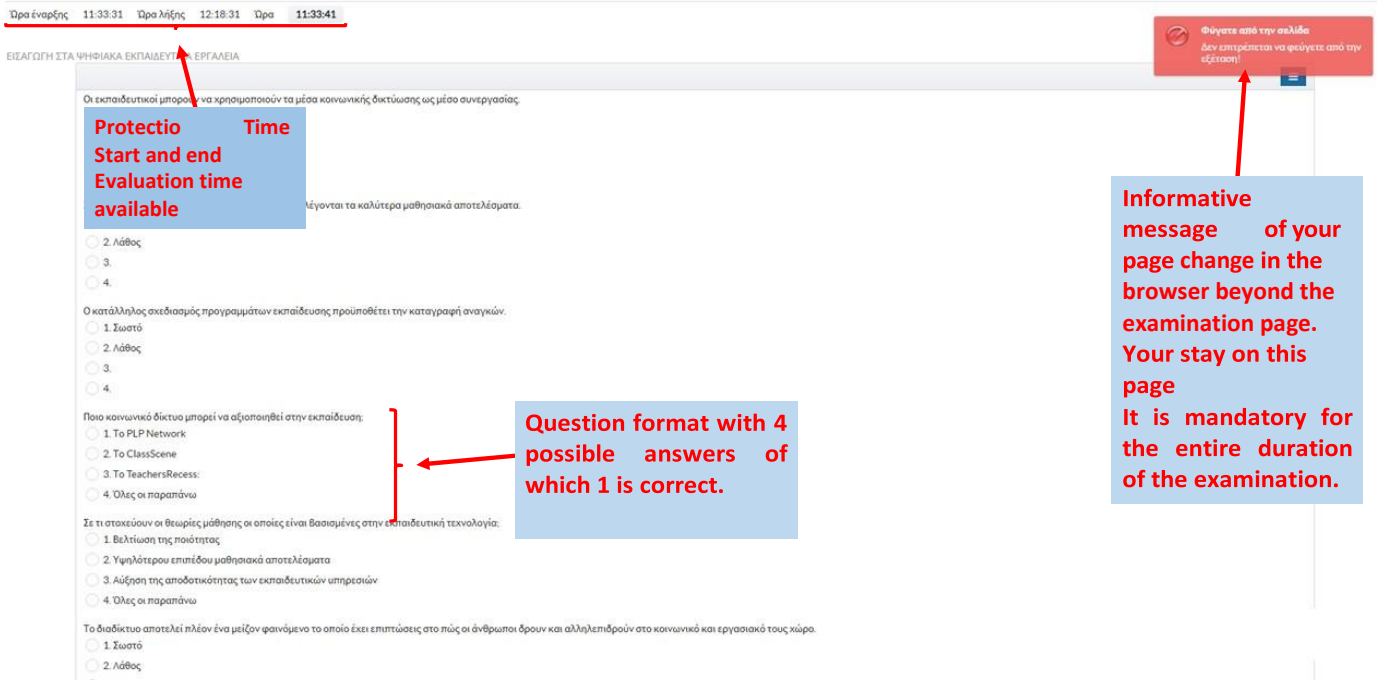
Universal Certification Solutions



Message incorrect entry of username and/or password details on the platform.

By entering the platform, you are ready for your evaluation.

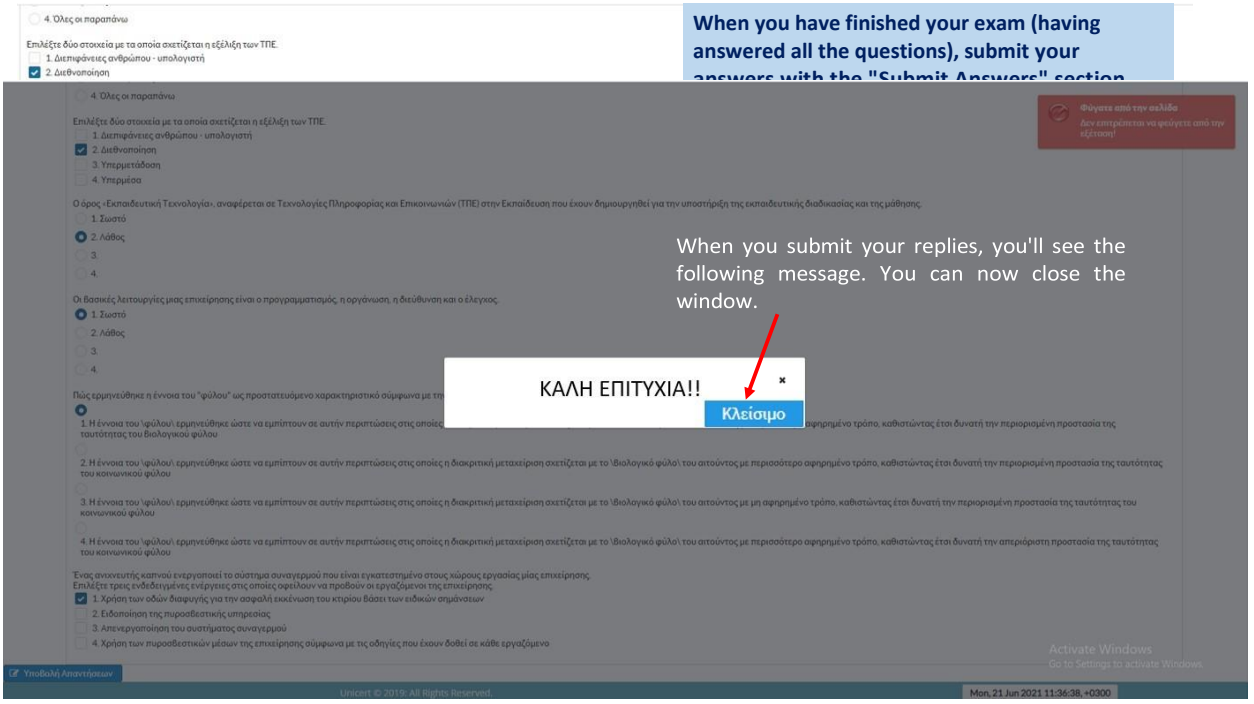


7. Check -Out

When you have completed the exam, click on the relevant button of the platform (Submit Answers) to declare the end and inform the ZOOM chat from the invigilator

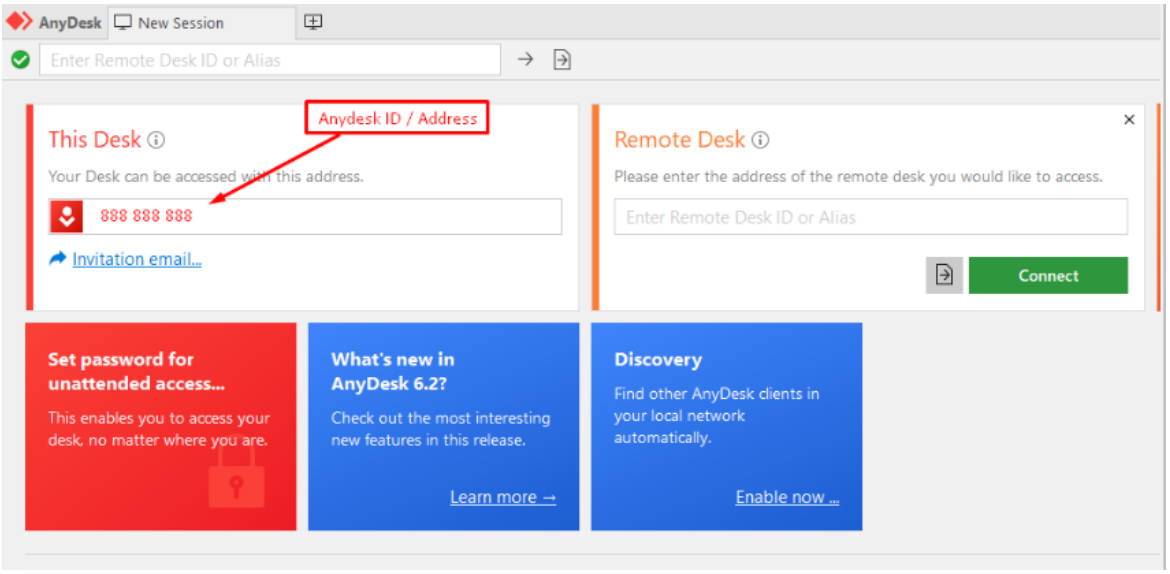
Wait until the Invigilator confirms that he has taken your exam for the successful completion of the process and only then can you close ZOOM .

Replies are submitted automatically and NO changes are made.



8. Help

In case of any technical problem it will be possible to contact technical support, so start Anydesk (which you can download from here) and give the technician the **9-digit code** that appears on the top left as shown in the image below.



Good luck!