SMA CITE

Enhancing skills for smart city tech

Work Package 4:

MOOC and Virtual Worlds for the upskilling/reskilling of Smart Cities technicians and Engineers

D4.1: Diagnostic Tool to identify the training needs of Smart Cities technicians and engineers

Final version

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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 role profiles.
- A Smart Cities curriculum combining both technical and non-technical skills and competences and promoting personalized 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 personalized 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 from enterprises providing Smart Cities solutions, as well as HEI and VET students interested in Smart Cities.

The curriculum will be tested through four 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

1.1 Objectives

The diagnostic tool is an online self-assessment guide utilized by ICT professionals to pinpoint the training courses requirements for following a career as Smart Cities technicians and engineers. The tool informs a tailored learning path for each SMACITE course based on learners' prior knowledge, skills, and competencies.

The tool has two objectives:

Objective 1: Increase awareness of the Smart Cities Technicians and Engineers profiles and target competencies by describing training program contents while providing access to the MOOC and getting users familiar with the training platform.

Objective 2: Suggest personalization of learning paths within SMACITE courses based on self-evaluation of learners' prior knowledge and skills.

The two objectives of the diagnostic tool contribute to the overall project goal by addressing the skills gap of Smart Cities technicians and engineers through personalised education and training. They support learners in understanding what skills and knowledge they will acquire once they enrol and complete a training course within the SMACITE curricula. Moreover, they enable learners with more experience in the domain of smart cities to enrich their competencies by focusing on modules that cover missing (or not well-developed) technical and/or non-technical knowledge and skills. Together, these objectives support a more effective learning journey focusing on specific gaps in line with the EU standards and frameworks in the domain.

1.2 Relevant Risk and Mitigation Action

The development and implementation of the SMACITE project come with certain risks. The risk identified for the diagnostic tool in the SMACITE Technical Description (Part B), Chapter 2.1.5 "Risk management" was that the "design for identifying personal learning pathways could be too complicated, leading to doubtable results/ recommendations". The likelihood of this happening was medium, and the impact would have been high, which could have had a severe impact on the project's success. The document proposed as a risk mitigation measure "recommendations done by the diagnostic tool to be validated by a project partner".

A learner-centric scope was adopted to mitigate the identified risk in the T4.1 execution. Thus, the produced tool is based on concrete learning objectives, knowledge, and skills per course. All learning objectives were defined by the academic and vocational training partners using the input from the respective deliverables. Therefore, the end-user gets a reliable output, complying with the EU standardisation efforts. After finishing the self-assessment, the learner is still able to select the content that she feels is appropriate for a career in the Smart Cities domain and produced recommendations are not mandatory (trainees still have access to all the lessons even to those not suggested by the assessment tool).

To address the complexity issue, interactive elements were included to help learners choose which parts of the tool to use and which to omit, thereby improving its usability.

A tool prototype was developed in increments, and each increment was demonstrated and discussed with the relevant project partners. The partners' suggestions from each demo were incorporated into the tool's subsequent increments.

Moreover, the tool is linked with the course content and quizzes, which further assess learners' knowledge and skills in the respective domains, ensuring that the course materials validate recommendations made by the tool. By implementing these measures, the risk of doubtable results/recommendations has been mitigated.

1.3 Structure of the Deliverable

This deliverable is divided into chapters as follows:

Chapter 1 Introduction describes the objectives of the web-based diagnostic tool for identifying the training needs of Smart Cities technicians and engineers. The section also discusses relevant risks and mitigation actions, the structure of the deliverable, and its dependencies on other work packages and deliverables.

Chapter 2. Approach and Requirements describes the overall approach and requirements for developing a diagnostic tool to assist Smart Cities technicians and engineers in understanding the SMACITE courses objectives and personalising their learning experience.

Chapter 3. Selection of Online Platform describes the selection process for an online platform for the SMACITE diagnostic tool, including criteria used for selecting the tool, the list of tools, evaluation, and the choice made.

Chapter 4. Development Approach describes the iterative development approach used to collect requirements and create the diagnostic tool.

Chapter 5 Scope describes the scope of the diagnostic tool, which was informed by the final job role profiles and the corresponding curricula for Smart Cities Engineer and Smart Cities Technician.

Chapter 6 Structure describes the structure of the diagnostic tool in detail. The chapter includes different sections, such as elements, high-level structure, forums, introduction lessons, and quizzes. The chapter aims to provide readers with a comprehensive understanding of the structure and organization of the diagnostic tool.

Chapter 7. Questions Embedded in the Lessons by Course contains the subject matter specific questions displayed in the lessons to help users better understand course domains.

Chapter 7. Relationships Embedded in the Quiz Logic provides tables that represent the relationship between Knowledge or Skills from Deliverable 2.2 "The SMACITE Curriculum for Smart Cities", the text of the respective question in the self-assessment Quiz and the relevant modules of the SMACITE course as structured in the Deliverable 2.2

"The SMACITE Curriculum for Smart Cities". Those relationships were used to construct the Quiz.

Chapter 8. Verification of Requirements describes in a table format how the requirements listed in Chapter 2. Approach and Requirements were addressed by the web-based diagnostic tool.

Chapter 9. Further Development and Support describes how the tool will be integrated into the MOOC and supported once the pilots are launched.

Annexes present screenshots and exports from Moodle. They indicatively illustrate how the tool structures and displays information for one of the sixteen SMACITE modules included in the tool. The other fifteen modules follow the same structure and logic All the course content is included in deliverables D2.1, D2.2, and D4.1. Still, if stakeholders are interested in browsing the complete web tool, they can request access by emailing smacite@esicenter.eu.

1.4 Dependencies with Other WPs and Deliverables

Development of the diagnostic Tool depended on Work Package 2: Smart Cities competences map and curriculum (WP2) that aims to set the methodological framework for the upskilling and reskilling of Smart Cities technicians and engineers. As per the SMACITE Technical Description (Part B), WP2 and more specifically Deliverable 2.1 "Smart Cities competences map and emerging job profiles" (D2.1) were determined as the main source of information for the development of the Diagnostic tool. The first version of the Deliverable 2.2 "The SMACITE Curriculum for Smart Cities" (D2.2), further elaborates on the knowledge and skills and provides information for the relationship between knowledge, skills and courses scope, learning objectives, and modules. Those relationships were used to design and develop the diagnostic tools. The Diagnostic tool was designed and developed in a way to be integrated with the learning management system developed as Deliverable 4.2 "MOOC for Smart Cities" (D4.2).

2. Approach and Requirements

The approach towards developing the diagnostic Tool for Smart Cities technicians and engineers is learner-centric. The tool is designed to cater to the learners' needs by providing them with a clear understanding of the course objectives and the specific knowledge and skills required to achieve those objectives. Moreover, it aims to help learners plan an efficient route toward achieving their goals.

The tool's development is based on extensive research on the learning needs of Smart Cities technicians and engineers. This research is described in detail in Deliverable 2.1 "Smart Cities Competencies Map and Emerging Job Profiles" and further developed in Deliverable 2.2 "The SMACITE Curriculum for Smart Cities" for Smart Cities." This resulted in a tool tailored to learners' needs and corresponding to the SMACITE project-specific structure.

To increase awareness about Smart Cities Technician and Engineer profiles, related knowledge, and skills per course, the tool provides relevant information in the form of descriptions and sample questions. The learners have the option to choose whether they want to try domain knowledge-related questions or only read the information about each topic.

The tool reports are generated from specially designed self-assessment quizzes focusing on relevant knowledge and skills. These reports are linked with the courses on the level of modules, supported by the domain knowledge related quizzes and exams. This feature enables the students to make informed decisions about personalizing their learning experience in each course.

Based on the approach described, the following are key business requirements for the diagnostic tool to identify the training needs of Smart Cities technicians and engineers:

1. The tool is based on the Smart Cities competences map and emerging job profiles (D2.1) and "The SMACITE curriculum for Smart Cities" to ensure the content is relevant and up-to-date.
2. The tool has two instances, one for Smart Cities Engineer profile, and one for Smart Cities Technician profile. The learners are able to navigate the tool and to choose for themselves, while browsing, the level of detail in which to follow the course information.
3. Learners easily use the tool - a proper number of questions and a simple description are included to ensure that learners can quickly and easily identify their training needs.
4. The tool provides recommendations on both course and module levels to ensure that learners clearly understand the specific knowledge and skills they need to acquire.
5. Based on self-evaluation questions, the learners can make informed decisions about personalising their learning paths.

6. The tool refers to the relevant course, allowing for easy navigation between the tool and the courses when developed and ensuring learners can access the relevant content.
7. The tool can either have respective diagnostic tool modules distributed in the courses or stay in a separate instance - the two courses - to ensure flexibility in deployment.
8. The tool results are complemented by the results of the relevant evaluation quizzes and assessments in each course to inform learners' decisions for the personalization of their learning path.

Those requirements are derived from the diagnostic tool objectives. Moreover, they were further developed and finalised in a series of meetings with relevant stakeholders in which the early prototypes of the tool were demonstrated.

3. Selection of Online Platform

We used a simplified process to review possible tools and to select the one that best fits the SMACITE Project mission and the already defined business requirements for the diagnostic tool.

As the first step, the following criteria were defined to select the tool:

1. **Relevance to the project requirements:** The Tool had to meet all the requirements listed for the project, including being based on the Smart Cities competences map and emerging job profiles, providing recommendations on course and module levels, and facilitating bi-directional links with the relevant courses.
2. **Integration with Moodle:** As Moodle is the platform used for course development, the tool needed to be easily integrated with Moodle and used with a single login.
3. **Semi-automated decision-making capabilities:** The Tool needed to have extensive built-in capabilities for diagnostic surveys and decision-making based on the results.
4. **Expenses:** The Tool needed to be affordable and sustainable in the long run, without per-user fees or other prohibitive costs.

In the second step, a list of tools with which the project partners had experience and could recommend was created. The list included four alternatives:

1. **Moodle** is open-source software, so it is free to use as code. **Moodle lesson and quiz** functionalities allow teachers to present information in a variety of formats, including text, images, audio, and video. The quiz feature can be used to conduct simple surveys and assessments but has limited capabilities to maintain complex surveys.
2. **Google Sheets** is a cloud-based spreadsheet program that allows users to create, edit, and share spreadsheets. Google Sheets can collect and analyse data from surveys. It can be used for free or at an affordable cost.
3. **Microsoft Forms is** a web-based survey tool that allows users to create surveys, quizzes, and polls. Microsoft Forms can collect survey data and conduct automated decision-making based on the results. Microsoft Forms is available as part of the Office 365 suite of products, so it may be a good option for organisations that already use Office 365.
4. **QuestionPro** is a cloud-based survey and research platform that allows users to create surveys, quizzes, polls, and forms. QuestionPro is ideal for conducting complex surveys, including automated decision-making based on the results. QuestionPro is a paid platform, and the cost varies depending on the number of users and features required.

In the next step, the tools were analysed in detail to determine how they satisfy the criteria. When needed, demo accounts were created and used for experiments. Here is a

comparison of the four tools based on the diagnostic Tool specific requirements as well as on the selection criteria:

- Based on Smart Cities Competencies Map and Emerging Job Profiles: All four tools are capable of incorporating the content of the Smart Cities Competencies Map and Emerging Job Profiles. Moodle, a content management system, has the best functionalities, including interactive content.
- Different Instances for Smart Cities Technician and Smart Cities Engineer Profiles: All tools can be customized to include separate instances for each profile.
- Navigation between the Tool and Course Information: All four tools have a user-friendly interface that allows for easy navigation between the tool and course information.
- Ease of Use: Moodle, Google Sheets, and Microsoft Forms all have a simple interface and they are easy for learners to use. QuestionPro has more extensive built-in capabilities, which can make it more complex to use.
- Self-Evaluation Questions: Moodle, Google Sheets, and Microsoft Forms can all be customized to include self-evaluation questions. QuestionPro has more extensive built-in capabilities for diagnostic surveys and decision-making.
- Recommendations on Course and Module Levels: All four tools can provide recommendations on both course and module levels based on aggregated data collected through questionnaires. Only QuestionPro can provide recommendations using predefined logical statements.
- References to Relevant Course: Moodle, Google Sheets, and Microsoft Forms can all be customized to include references to relevant courses in the MOOC. QuestionPro has capabilities but might need more efforts. Moodle is the best fit since it will not require the users to have two logins if they want to see user-specific data for the course on the two platforms.
- Distributed Tool Modules or Separate Instance: Moodle can be customized to include either distributed tool modules or a separate instance for the diagnostic tool. Google Sheets, Microsoft Forms, and QuestionPro do not have this capability built-in. In order to satisfy this requirement, one should develop additional functionalities in Moodle, which seem to be effort intensive task.
- Complementary Results with Relevant Evaluation Quizzes: All four tools can be customized to include complementary results with relevant evaluation quizzes. In the case of Google Sheets, Microsoft Forms, and QuestionPro, the user should log in if she or he wants to see user-specific content.

Finally, Moodle was selected as the best option for developing the diagnostic tool for the SMACITE project. While QuestionPro has more extensive built-in capabilities for diagnostic surveys and decision-making, it is not easy to integrate with Moodle and requires payment per user. The integration costs and per-user payments are not planned in the SMACITE budget. Google Sheets and Microsoft Forms are affordable but do not have the same level of customization and integration capabilities as Moodle. Moodle, on the other hand, is used for course development and is easy to integrate with SMACITE courses. By using

Moodle as the diagnostic tool, students will gain experience with it, which will be helpful when they start using Moodle to learn the courses. A significant advantage is that the diagnostic tool will be fully integrated into the MOOC, which will ensure a better user experience for the learners and optimised costs to maintain the system.

In conclusion, although Moodle does not have extensive built-in capabilities for diagnostic surveys and decision-making, these constraints could be overcome with the customization and innovative use of the existing quiz and lesson functionalities. Therefore, Moodle was selected as the best option for developing the diagnostic tool for the SMACITE project.

4. Development Approach

The development of the diagnostic tool followed an iterative approach, which involved several key steps.

Firstly, in September 2022, the initial idea was presented, and a discussion was facilitated with all project partners. General business requirements were agreed upon, including using a questionnaire (preferably in the same platform as the MOOC). Also, it was decided that, in addition to the assessment module, the tool had to present information about learning objectives, the structure of the curricula, and other relevant information about the courses.

An initial concept was then developed and maintained throughout the development process. An early prototype of the tool was created for one course in Moodle, which was then tested by internal users who provided valuable feedback on how to improve the user experience.

The suggestions were implemented and demonstrated to the UAH team at an internal meeting in February 2023, refining the tool's objectives. It was decided to include subject-matter questions in the tool's lessons to further educate learners about the course domains.

The prototype was enhanced with the new requirements and demonstrated in a regular project meeting, resulting in improvement suggestions being agreed upon regarding the tool's structure and content.

During the next iteration, the latest version of the prototype was developed and demonstrated to all partners at a project meeting in Sofia in March 2023. It was decided to research and find a better way to link the results of the diagnostic tool with the courses and vice versa. All partners that developed courses committed to contributing to the tool with subject-matter-specific questions.

A version with bidirectional links between the tool and future courses was developed and tested. It was demonstrated to all interested partners at a specially organized meeting. One partner thoughtfully reviewed the live version of the tool, provided improvement suggestions, and confirmed that the tool would serve its purpose. It was decided to develop the actual version of the diagnostic tool based on this version.

Then the tool was developed based on the prototype's final enhanced and approved version. Once developed, each module was reviewed by two persons using specially created student accounts to verify the module is working as expected. Any errors found in the verification were immediately corrected.

The tool and respective deliverable were reviewed as part of the formal quality assurance process institutionalized in the SMACITE project.

The diagnostic tool concept was updated throughout the process and kept accessible to all project partners in the shared drive. This allowed the concept to reflect the latest version of the objectives, context, and business requirements in real time.

The iterative approach used in developing the diagnostic tool was quite helpful in developing, refining, and improving the tool in multiple stages. With each iteration, the team gathered feedback from internal and external users, reviewed the tool's objectives, and made necessary adjustments. This approach helped to ensure that the tool met the business requirements, was user-friendly, and fulfilled the intended purpose. Additionally, by keeping the concept updated and accessible to all project partners in the shared drive, the team was able to collaborate and ensure that everyone was on the same page with the tool's development. The iterative approach also facilitated valuable feedback that was immediately applied in the next iteration, resulting in a well-refined solution. Overall, the iterative approach allowed for a more efficient and effective tool development process that was able to adapt to the incremental discovery of business needs and requirements of the project.

5. Scope

The final job role profiles for Smart Cities Engineer and Smart Cities Technician inform the diagnostic tool scope. Those profiles were defined in D2.1: Smart Cities competences map and emerging job profiles (Version 1.1/13/09/2022) as a result of the completion of T2.1 Design the Smart Cities competences map and emerging job profiles.

Both profiles have an identical structure of 8 knowledge and skills domains that were addressed key courses in the first version of D2.2: The SMACITE curriculum for Smart Cities produced as a result of T2.2: Design the SMACITE curriculum for Smart Cities. Those courses fit in the scope of the Diagnostic tool and they were realised as separate sections of the tool.

Domains under the scope of D2.1	**Courses of the curriculum (D2.2)**
IoT	Internet of Things
Security	Cybersecurity
Cloud computing	Cloud computing
Data analytics	Data analytics and visualization
Machine Learning with Big Data	Machine Learning with Big Data
Business and Management	Entrepreneurship skills
Green	Green skills
Soft Skills	Soft skills

Table 1 Domains under the scope of D2.1 and the corresponding courses of the curriculum (D2.2)

The tool has two instances realized as separate Moodle courses, the first for Smart Cities Engineers and the second for Smart Cities Technicians.

6. Structure

The modular diagnostic tool structure allows easy browsing and ensures the tool can operate as a separate instance, or the respective modules to be distributed within the technical courses once they are developed. The diagnostic tool can not be considered as a stand-alone, independent product. Contrariwise, it is strongly connected with the courses on the platform. Therefore, the structure is described in relation to the courses and other content uploaded to the platform.

6.1 Elements

The structure is realized using different elements in Moodle. Those elements sorted in alphabetical order are:

Element	Description
Cluster	A cluster is a container used when the teacher wants a series of questions in a lesson to appear in a different random order for each student within a Lesson.
Course	A course is a container for a set of related educational materials and activities, such as lessons, quizzes, and assignments.
Forum	A forum is an online discussion area in a course that allows learners and teachers to post messages, reply to each other, and collaborate on ideas.
Lesson	A lesson is a self-paced learning activity in a course that guides learners through a series of pages, questions, and feedback based on their responses. Lessons can be used to present branching scenarios, simulations, or interactive exercises. Lessons can also be graded and tracked by Moodle to provide learners with progress reports and feedback.
Module	A module is a self-contained unit of content in a course, such as a lesson, quiz, or forum. Modules are used to organize course content and help learners navigate the course.
Page	A page is a static web page in a course that displays content, such as text, images, videos, and links. Pages can be used to present information, instructions, or feedback to learners.
Quiz	A quiz is an online assessment activity in a course that allows learners to answer questions, receive feedback, and receive scores. Quizzes can be structured as multiple-choice, true-false, short-answer, or other question types. Quizzes can also be timed, randomized, or adaptive to ensure fairness and validity. Quizzes can be graded automatically by Moodle or by teachers depending on the settings. Quizzes can also be used for diagnostic purposes or as a formative feedback tool.
Section	A section is a container in a course that holds other elements. Each section can have a different name and a summary to provide learners with an overview of the content. Depending on the course design, sections can be organized into topics, weeks, or other structures.

Table 2 Moodle elements used by the diagnostic tool

6.2 High-level Structure

The diagnostic tool structure on a high level is represented in the table below:

Name	Element	Purpose
Forum	Section	Separate interactive sections for announcements and group communication
Announcement	Forum	Facilitates announcements and group communication
Questions and Answers	Forum	Facilitates questions and answers.
Introduction	Section	Groups pages that represent general information about the tool and the profile it covers.
Self-assessment Diagnostic Tool	Page	Describes the purpose and structure of the diagnostic tool
Functions Description	Page	Describes the Smart Cities Engineer or Smart Cities Technician profile functions
Internet of Things	Section	Groups a lesson and a quiz, which are related to the Internet of Things course.
IoT Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Internet of Things course.
Quiz: IoT Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about the Internet of Things knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Cybersecurity	Section	Groups a lesson and a quiz, which are related to the Cybersecurity course.
Cybersecurity Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Cybersecurity course
Quiz: Cybersecurity Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Cybersecurity knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Cloud Computing	Section	Groups a lesson and a quiz, which are related to the Cloud Computing course.

Name	Element	Purpose
Cloud Computing Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Cloud Computing course.
Quiz: Cloud Computing Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Cloud Computing knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Data Analytics and Visualization	Section	Groups a lesson and a quiz, which are related to the Data Analytics and Visualization course.
Data Analytics and Visualization Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Data Analytics and Visualization course.
Quiz: Data Analytics and Visualization Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Data Analytics and Visualization Knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Machine Learning and Big Data	Section	Groups a lesson and a quiz, which are related to the Machine Learning and Big Data course.
Machine Learning and Big Data Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Machine Learning and Big Data course.
Quiz: Machine Learning and Big Data Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Machine Learning and Big Data knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Entrepreneurship Skills	Section	Groups a lesson and a quiz, which are related to the Entrepreneurship Skills course.
Entrepreneurship Skills Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Entrepreneurship Skills course.
Quiz: Entrepreneurship Skills Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Entrepreneurship Skills knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Green Skills	Section	Groups a lesson and a quiz, which are related to the Green Skills course.

Name	Element	Purpose
Green Skills Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Green Skills course.
Quiz: Green Skills Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Green Skills knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.
Soft Skills	Section	Groups a lesson and a quiz, which are related to the Soft Skills course.
Soft Skills Course Description	Lesson	Provides an interactive interface to information and sample questions that describe the Soft Skills course.
Quiz: Soft Skills Self-Assessment	Quiz	Diagnostic self-assessment Tool that structures questions about Soft Skills knowledge and skills and, based on the answers, provides structured feedback about course modules that the learner can review and/or skip.

Table 3 Diagnostic tool high-level structure

6.3 Forums

Two forums are created to facilitate communication among the teachers, administrators, and students. Their structure will be dynamically developed based on the needs of the relevant stakeholders once the MOOC is operational.

The first forum, "Announcements," is a special forum for announcements and is automatically created when a course is created. A course can have only one announcements forum. Only teachers and administrators can post announcements. The "Latest announcements" block will display recent announcements.

The second forum, "Questions and Answers," is a standard forum displayed in a blog-like format - An open platform where anyone can start a new discussion at any time and where discussion topics are displayed on one page with "Discuss this topic" links.

6.4 Introduction Pages

The introduction pages, "Self-assessment Diagnostic Tool" and "Functions Description," inform learners about the diagnostic tool purpose and the profile functions of the Smart Cities Engineer and Smart Cities Technician profiles. Those sections are simple content pages.

Figure 4 Smart Cities Engineer Function Description presents the view of the Smart Cities Engineer profile content in the fully functional web tool.

The subchapter Smart Cities Engineer Profile Introduction Pages in Annex 2 Diagnostic Web Tool Structure for Internet of Things Course for Smart Cities Engineers presents the Smart Cities Engineer profile content. The tables are exported from the fully functional web tool.

6.5 Lessons

Each lesson in the courses has the same structure. The learner is asked to choose different options on the main content pages. The learner is redirected to another place in the lesson based on the selected option. The options in the table representing the lesson structure are illustrated in the Jumps column with small circles. When there is no option (small circle), the jump is automatically executed once the learner completes the activity. The lesson facilitates forward and backward moves that help the students skip some parts and return until they understand the course discipline well. Sample questions in the discipline support the process. The learner can decide to try to answer the questions or skip them. The questions are presented in three clusters, so in each attempt, the learner sees three questions – one per each cluster chosen randomly. The learner has two attempts to answer each question. After each answer, the learner receives feedback if the answer is right or wrong.

Once the learners understand the course domain, they are asked if they have knowledge and skills as defined by the SMACITE curricula. Learners without relevant knowledge and skills are redirected to a page that advises skipping the self-evaluation quiz. Learners with relevant knowledge and skills are redirected to a page that suggests taking the self-evaluation quiz.

The learners can browse the lesson as many times as they need.

The following table illustrates the structure of the lesson for each course. The name of the course is represented by <course>.

Page title	**Page type**	**Purpose**	**Jumps to page**
<course> Description	Content	Make the learner aware of the <course> scope, learning objectives, and modules. If the learners want to answer questions, they go to cluster 1; otherwise, they go to the Knowledge and Skills page	○ Yes, let me try to answer a few questions: Cluster 1 ○ No, let me go to the next page: <course> Knowledge and Skills
Cluster 1	Cluster	Facilitate jumping to one unseen question within a cluster. If the learners return to the cluster, they will see the question not displayed in the previous attempt.	Unseen question within a cluster

Page title	Page type	Purpose	Jumps to page
Q1 <course>	Multichoice question	The question helps learners better understand the content in <course>. The learner has two attempts to answer the question. After each attempt, feedback about the answer is displayed. After answering the question, the end of the cluster is reached.	End of cluster 1
Q2 <course>	Multichoice question	The question helps learners better understand the content in <course>. The learner has two attempts to answer the question. After each attempt, feedback about the answer is displayed. After answering the question, the end of the cluster is reached.	End of cluster 1
End of cluster 1	End of cluster	Redirects to cluster 2.	Cluster 2
Cluster 2	Cluster	Facilitate jumping to one unseen question within a cluster. If the learners return to the cluster, they will see the question not displayed in the previous attempt.	Unseen question within a cluster
Q3 <course>	Multichoice question	The question helps learners better understand the content in <course>. The learner has two attempts to answer the question. After each attempt, feedback about the answer is displayed. After answering the question, the end of the cluster is reached.	End of cluster 2
Q4 <course>	Multichoice question	The question helps learners better understand the content in <course>. The learner has two attempts to answer the question. After each attempt, feedback about the answer is displayed. After answering the question, the end of the cluster is reached.	Next page
End of cluster 2	End of cluster	Redirects to cluster 3.	Next page
Cluster 3	Cluster	Facilitates jumping to one unseen question within a cluster. If the learners return to the cluster, they will see the question not displayed in the previous attempt.	Unseen question within a cluster

Page title	Page type	Purpose	Jumps to page
Q5 <course>	Multichoice question	The question helps learners better understand the content in <course>. The learner has two attempts to answer the question. After each attempt, feedback about the answer is displayed. After answering the question, the end of the cluster is reached.	End of cluster 3
Q6 <course>	Multichoice question	The question helps learners better understand the content in <course>. The learner has two attempts to answer the question. After each attempt, feedback about the answer is displayed. After answering the question, the end of the cluster is reached.	End of cluster 3
End of cluster 3	End of cluster	Redirects to next page <course> Knowledge and Skills	Next page
<course> Knowledge and Skills	Content	Make learners aware of the definition of knowledge and skills they will gain once they complete the <course>. The learners are asked if they have knowledge and skills in the <course> domain as described on this page. If they do not have, they jump to "We recommend you to take the complete <course> course. You might skip the <course> Quiz." If they answer "YES" they jump to "We recommend you to take the <course> quiz" page. If they want to go back to read again the information about the course they jump to "Previous page: <course> Course Description" page.	○ I don't have K&S: We recommend you to take the complete <course> course. You might skip the <course> Quiz. ○ YES, I have K&S: We recommend you to take the <course> quiz ○ Previous page: <course> Course Description
We recommend you to take the <course> Quiz	Content	Recommend that learners take the self-assessment Quiz. Make the learners aware of the exact knowledge and skills around which the <course> and the Quiz are structured. If the learners want to read the Knowledge and skills descriptions or course information again, they are redirected to the previous page. Otherwise, they jump to the end of the lesson, where they have a link to the <course> quiz.	○ Previous page: Internet of <course> Knowledge and Skills ○ End of lesson: End of lesson

Page title	Page type	Purpose	Jumps to page
We recommend you to take the complete <course> course. You might skip the <course> Quiz.	Content	Recommend that learners might not take the self-assessment Quiz. Make the learners aware of the exact knowledge and skills around which the <course> is structured. If the learners want to read the Knowledge and skills descriptions or course information again, they are redirected to the previous page. Otherwise, they jump to the end of the lesson, where they have a link to the <course> quiz.	○ Previous page: <course> Knowledge and Skills ○ End of lesson: End of lesson
End of lesson	Page	Announces the end of the lesson and provides links to the Quiz and the course menu.	○ Go to Quiz: IoT Self-Assessment (SCE)Return to Smart Cities Engineers ○ Diagnostic Tool to Identify the Training Needs

Table 4 Lessons structure

The Multichoice questions per course are presented in Chapter 0.

Questions Embedded in Lessons by Course.

Sample lesson screens are illustrated in Annex 1 Diagnostic Web Tool Screens for Internet of Things Course.

Detailed structures, including the module's content, are exported from the tool and presented in Annex 2 Diagnostic Web Tool Structure for Internet of Things Course for Smart Cities Engineers.

6.6 Quizzes

6.6.1 Overall Quiz Structure

The quizzes were developed using as input the Knowledge and skills of the "Smart Cities Technician" and "Smart Cities Engineer" job profiles as defined under WP2/T2.1. and WP2/T2.2. They are self-evaluation questionnaires that reflect the relevant knowledge and skills covered in each course. The Quiz was developed considering the constraints of the Moodle platform chosen for both MOOC and Diagnostic tool development.

Based on the evaluation results, the tool informs learners about modules they need to know and provides recommendations for approaching them. The tools' recommendations are for their information, and the learners can take all the courses they want, regardless of the tools' results.

The scheme below illustrates the relationship used to generate recommendations based on questions in the Quiz:

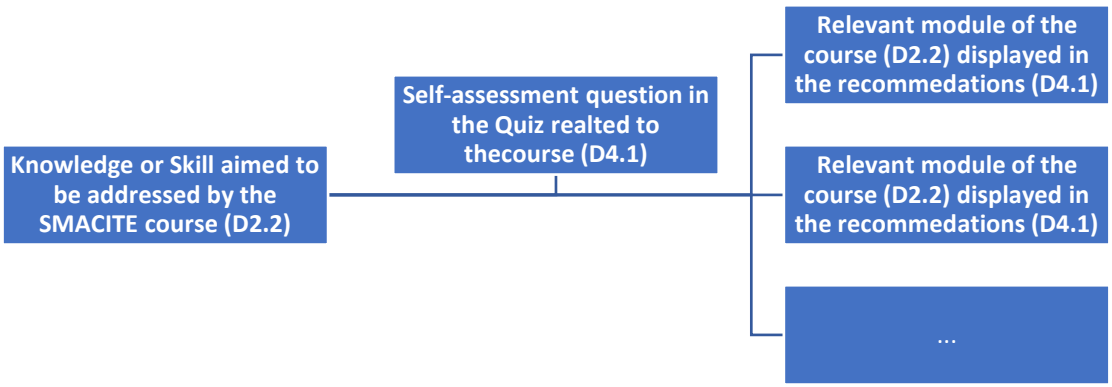

Figure 1 Relationship between knowledge/skill, quiz question, and relevant modules of the course

The corresponding tables for all Smart Cities Engineers and Smart Cities Technicians courses within this deliverable's scope are presented in Chapter 8. Relationships Embedded in the Quiz Logic.

The relationship model that has been chosen allows for links to be established between the self-assessment knowledge and skill quizzes in the diagnostic tool and assessment quizzes in the SMACITE courses. This enables learners to conduct thorough assessments of their knowledge and skills, which can then be used to inform their decision on how to customise their learning path.

6.6.2 Self-assessment Scale

A scale for knowledge and skills related to E-CF (European e-Competence Framework), EQF (European Qualificaiotn Framework), and ESCO (European Skills, Competences, Qualifications and Occupations) was elaborated. The scale is simplified to make it easier for learners to understand and assess their knowledge and skills in a particular domain. In this way they can identify areas where they need to improve and take appropriate steps to address gaps in their knowledge or skills.

Using the simplified scale, the learners can self-evaluate their knowledge and skills in four levels:

- **None or partial:** This level corresponds to EQF level 1 to level 2, which covers basic general knowledge and the ability to perform simple tasks. In terms of the ECF, this level is not covered, so we assume it is below ECF level e-1. (00 % contribution to the self-assessment quiz score)
- **Fundamental:** This level corresponds to EQF level 2 to level 3, which covers basic knowledge and skills and the ability to apply them in simple and routine tasks. In terms of the ECF, this level corresponds to level e-1 and below, which covers basic knowledge and skills and the ability to apply them in simple and routine tasks. (10 % contribution to the self-assessment quiz score)
- **Intermediate:** This level corresponds to EQF levels 3 to 5, which cover the ability to apply knowledge and skills in more complex and non-routine tasks, either under supervision or independently, and the ability to adapt to changing circumstances and learn from experience. Regarding the ECF, this level corresponds to levels e-1 to e-2, which cover the ability to apply knowledge and skills in more complex and non-routine tasks, either under supervision or independently, and the ability to adapt to changing circumstances and learn from experience. (66 % contribution to the self-assessment quiz score)
- **Advanced:** This level corresponds to EQF level 6 and above, which covers the ability to handle complex and non-routine tasks independently, evaluate and analyse information, identify and solve problems, plan and manage projects, and communicate effectively with others. Regarding the ECF, this level corresponds to level e-3 and above, which covers handling complex and non-routine tasks independently, evaluating and analysing information, identifying and solving problems, planning and managing projects, and communicating effectively with others. (100 % contribution to the self-assessment quiz score)

The scale is described in plain words for each question in the tool as follows:

1. NONE or PARTIAL
I do not have any knowledge, or I have partial knowledge of the domain.

2. FUNDAMENTAL
I have basic knowledge of the domain.

3. INTERMEDIATE
I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.

4. ADVANCED
I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.

The learner reviews the question and can choose only one option. The tool provides recommendations for a knowledge/skill level base considering each question's self-assessment score and the course module covering the relevant skill/knowledge.

The average score for all questions is used to provide generic recommendations on a course level.

6.6.3 Recommendations on Knowledge/Skill and Module Levels

The tool recommends modules based on the learner's answers about their knowledge and skills. It suggests modules that match the learner's current level of understanding and proficiency. By default, the learner needs to take all the recommended modules. But, if the learner is assessed as having Intermediate or Advanced Knowledge and skills, they only need to review the corresponding content in the module and take a quiz. This approach allows the learner to further learn about the module by scanning it and to additionally test their knowledge and skills through the selected course quizzes. All these opportunities ensure the best possible learning experience and achieve their desired learning outcomes. The customised recommendations are based on D2.2 "The SMACITE curriculum for Smart Cities review", which provides bidirectional relationships between course modules and the related knowledge and skills.

As a result, the tool provides personalised recommendations **for each knowledge and skill** based on the individual's answers to corresponding questions. The table below illustrates the recommendations for KA1: Know the implications of cybersecurity in Smart Cities. The question the learners should answer is, "How would you rate your knowledge of the implications of cybersecurity in Smart Cities?"

Level	Score	Description	***Recommendation (one per knowledge and skill)***
None or partial	0%	I do not have any knowledge, or I have partial knowledge of the domain.	n/a
Fundamental	10%	I have basic knowledge of the domain.	*n/a*
Intermediate	66%	I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	*To improve your learning experience, we suggest reviewing "Module 1. Introduction to Cybersecurity in Smart Cities" <module hyperlink> content and attempting the Quiz <quiz hyperlink>. This will help you determine if you need to further explore the module's material.*
Advanced	100%	I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	*You might skip "Module 1. Introduction to Cybersecurity in Smart Cities" <module hyperlink>. If you are not sure, you might take the Quiz <quiz hyperlink>, after the module to evaluate your proficiency in the topic. Based on your performance on the Quiz you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.*
Table notes: 1. n/a means no recommendation to review specific modules. By default, the learner should take all modules that are not included in the recommendations. 2. The hyperlinks will be added once the respective courses and modules are developed.			

Table 5 Recommendations on knowledge/skill and module level

6.6.4 Recommendations on a Course Level

As mentioned, Moodle does not have extensive built-in capabilities for diagnostic surveys based on logical or decision-making statements. Therefore, an approach of using aggregated average data from the Quiz was implemented. The tool calculates the average results of the learners' knowledge and skills quiz related to the corresponding course. The

average score achieved by the learners in the Quiz is the factor that determines recommendations on a course level.

Based on the aggregated results from quiz questions for each course**,** the tool will provide a recommendation as follow:

Average grade range	**Meaning**	***Recommendation (one per course)***
≥ 65%	Most knowledge and skills are at the Intermediate or Advanced levels.	*Based on your responses, we would like to suggest that you may not need to take the IoT course. However, we encourage you to consider taking the final exam before deciding to skip the course. In case you do not successfully take the final exam, we encourage you to complete the course taking into account the detailed feedback on knowledge and skills.*
≥45%, <65%	The majority of the knowledge and skills are at Intermediate or Advanced levels.	*Based on your responses, focus on those modules for which there are no references in the report below. We advise that you review the modules for which you have references and take the recommended quizzes. Then based on the results, make a final decision about which modules to review or skip.*
≥30%, <45%	A significant share of the knowledge and skills are at Intermediate or Advanced levels.	*Based on your responses, we recommend that you take the complete IoT course. However, you may also consider reviewing the modules and taking quizzes in the detailed feedback according to your knowledge and skills to determine if you need to cover them.*
<30%	Most knowledge and skills are at None or partial or Fundamental levels.	*Based on your responses, we suggest that you consider taking the complete IoT course without skipping any module.*

Table 6 Recommendations on course level

Sample quiz questions screens are illustrated in Annex 1 Diagnostic Web Tool Screens for Internet of Things Course for Smart Cities Engineers.

A detailed quiz structure extracted from Moodle, is presented in Annex 2 Diagnostic Web Tool Structure for Internet of Things Course for Smart Cities Engineers.

6.6.5 Reports

Learners have the option to take the Quiz multiple times. After completing the Quiz, a detailed report is generated and stored in their profile for future reference. That enables users to identify their areas of weakness and improve their knowledge and skills in those areas.

The report generated by the tool contains information about:

- Date, time, and duration
- State – in progress or finished.
- The average grade on a scale from 0 to 100, where 0 means none and partial knowledge of all knowledge and skills, and 100 means an advanced level of all knowledge and skills.
- Feedback on a course level with a general recommendation regarding the course and how to interpret the individual results on knowledge and skill level.
- Individual results on knowledge and skill level. If the answer is intermediate or advanced, the report provides specific feedback and hyperlinks to the modules and quizzes in the corresponding SMACITE course.

For learners' convenience, the reports will be accessible through the diagnostic tool and at the beginning of the respective courses, so the users will not need to switch between the tool and courses if they want to consult the report's recommendation when they study the course.

The reports can be shared with the respective SMACITE course teachers to inform them about the knowledge and skills of the students who enrol in the respective course.

A sample screen from a report is provided in Figure 25 Quiz report with detailed results and recommendations on course and modules levels.

7. Questions Embedded in Lessons by Course

Subject matter-specific questions were developed to help users better understand course domains. The tool displays them in the relevant lessons.

7.1 Internet of Things

Q1 What is IoT? (single choice)

A. Network of physical objects embedded with sensors
B. Network of virtual objects
C. Network of objects in the ring structure
D. Network of sensors

Q2 What is the component of an IoT system that executes a program? (single choice)

A. A sensor
B. An actuator
C. A digital to analog converter
D. A microcontroller

Q3 Which of the following are low-power wide-area network technologies used in IoT? (choose two answers)
A. Ethernet
B. LoRa
C. Sigfox
D. IEEE 802.11

Q4Which of the following is a common use case for edge computing in IoT systems? (single choice)A. Remote device management and monitoring
B. Real-time data processing and analysis
C. Cloud-based data storage and retrieval
D. Long-term trend analysis and forecasting

Q5 What is an actuator? (single choice)
A. A sensing device that collects industrial data
B. A device that acts as a IoT controller
C. A component of a IoT device that acts as the gateway between the sensors and the cloud
D. A component of a machine that is responsible for moving and controlling a mechanism or system

Q6 Which of the following is false about IoT devices? (single choice)
A. IoT devices are completely safe
B. IoT devices use the internet for collecting and sharing data
C. IoT devices need microcontrollers
D. IoT devices use wireless technology

7.2 Cybersecurity

Q1 Which of the following is part of the CIA pillars of cybersecurity? (choose one answer)

A. Integrity (correct)
B. Cooperation (incorrect)
C. Accessible (incorrect)
D. Intelligence (incorrect)

Q2 Which are some types of DDoS attacks? (choose two answers)

A. Password theft (incorrect)
B. Cross scripting (incorrect)
C. HTTP flood (correct)
D. Ping of Death (incorrect)

Q3 Which of the following is a cybersecurity standard? (choose one answer)

A. IEC 60388 (incorrect)
B. ISA 99 / IEC 62443 (correct)
C. TIA 3077 (incorrect)
D. UNE 10230 (incorrect)

Q4 Which could be considered hazards for an IOT system? (choose two answers)

A. Outdated digital systems included in the IOT ecosystem (correct)
B. Uncontrolled remote connections into the IOT ecosystem (correct)
C. Make backup copies of IOT critical data to avoid loss (incorrect)
D. Exclusive use of authorised official computer IOT applications (incorrect)

Q5 Which of the next options describes a Man in the Middle attack? (choose one answer)

A. An attacker intercepts the communication between two parties in an attempt to spy on the victims, steal personal information or credentials, or perhaps alter the conversation in some way (correct)
B. A network or system becomes overwhelmed and it cannot respond to service requests (incorrect)
C. If the database permissions have not been set properly, the attacker may be able to exploit a HTML form to execute queries that will create, read, modify or delete the data stored in the database. (incorrect)
D. Hackers send emails that appear to be from a trusted source (incorrect)

Q6 How does a VPN improve cybersecurity in a IOT system? (choose two answers)

A. It brings the encryption and authentication necessary to protect the remote connection (correct)
B. The information is only transmitted between devices authorised and configured for this purpose (incorrect)
C. It set a list of access control rules to allow communication among zones or deny it (incorrect)

D. It creates logical isolation between the different network segments (incorrect)

7.3 Cloud Computing

Q1 In which of the following deployment types is management outsourced to a third-party provider the most? (Single choice)
A. IaaS (incorrect)
B. PaaS (incorrect)
C. SaaS (correct)
D. On-premise (incorrect)

Q2 Typically, data centres are built by combining replicable units made up of servers, network and storage systems, and power distribution units. What are these replicable units called? (Single choice)
A. PoD (correct)
B. Rack (incorrect)
C. NIC (incorrect)
D. Core (incorrect)

Q3 What is a hypervisor? (Single choice)
A. The software used to create and run virtual machines (correct)
B. An application-level virtualization technology (incorrect)
C. A large cloud service provider (incorrect)
D. A tool for automating the deployment of containers (incorrect)

Q4 What is the name of the technology used on a cluster to process big volume of data in a parallel and distributed way? (Single choice)
A. MapReduce (correct)
B. Microservices (incorrect)
C. Serverless (incorrect)
D. DevOps (incorrect)

Q5 Which of the following database engines is ideal for storing documents without a fixed schema? (Single choice)
A. MongoDB (correct)
B. Cassandra (incorrect)
C. InfluxDB (incorrect)
D. PostgreSQL (incorrect)

Q6 What is the main benefit of edge computing systems? (Single choice)
A. Reduced latency and bandwidth usage (correct)
B. Higher processing power (incorrect)
C. More secure data storage (incorrect)
D. Easier deployment and management (incorrect)

7.4 Data Analytics and Visualizations

Q1 Big Data Analytics typically refers to: (single choice)
A. Fast growing volumes of complex datasets (incorrect)
B. Machine-to-machine interactions (incorrect)
C. The process of extracting information and insights from Big Data (correct)
D. Big Data management systems (incorrect)

Q2 In Data Visualization, information is organized: (single choice)
A. into histograms and scatter plots for real-time processing and interaction (incorrect)
B. into charts, graphs, plots and other forms of visual representations in order to formulate trends, patterns and conclusions (correct)
C. into tables in order to present data in a structured way (incorrect)
D. into histograms in order to identify outliers within a given dataset (incorrect)

Q3 Smart city as a "data-engine" includes the following processes: (choose two answers)
A. Data Production, Data Storage, Data Analytics & Data Visualization, Service Design (correct)
B. Data Production, Data Harvesting, Data Mining, Knowledge Acquisition, Service Implementation (correct)
C. Data Production, Data Analytics & Data Visualization (incorrect)
D. Data Production, Data Mining (incorrect)

Q4 A real-time analytics database must be able: (choose two answers)
A. To query only incoming real-time events (stream processing) (incorrect)
B. To query both incoming real-time events (stream processing) and historical data (batch processing) (correct)
C. To execute hundreds of queries per second (high concurrency) (correct)
D. To query only historical data (batch processing) (incorrect)

Q5 Typical components of a Big Data Analytics reference architecture are: (choose three answers)
A. Data acquisition and data preprocessing (correct)
B. Decentralized computing infrastructure and data-encryption interface (incorrect)
C. Online analytics and real-time analytics (correct)
D. Batch data repository and user interface (correct)

Q6 The most used non-linear scale in Data Visualization is (single choice)
A. The logarithmic scale (correct)
B. The cylindrical scale (incorrect)
C. The spherical scale (incorrect)
D. The cartesian scale (incorrect)

7.5 Machine Learning with Big Data

Q1 Which of the following is typically considered more complex than Predictive Analytics? (single choice)

A. Prescriptive analytics (correct)
B. Diagnostic analytics (incorrect)
C. Descriptive analytics (incorrect)
D. None, predictive analytics is the most complex of all (incorrect)

Q2 What is true about Machine Learning? (single choice)

A. Machine Learning (ML) is a field of computer science (incorrect)
B. ML is a type of artificial intelligence that extract patterns out of raw data by using an algorithm or method. (incorrect)
C. The main focus of ML is to allow computer systems to learn from experience without being explicitly programmed or human intervention. (incorrect)
D. All statements are true (correct)

Q3 Among the following option identify the one which is not a type of learning? (single choice)

A. Unsupervised learning (incorrect)
B. Semi unsupervised learning (correct)
C. Reinforcement learning (incorrect)
D. Supervised learning (incorrect)

Q4 What is the application of machine learning methods to a large database called? (single choice)

A. Big data computing (incorrect)
B. Internet of things (incorrect)
C. Data mining (correct)
D. Artificial Intelligence (incorrect)

Q5 Which of these is among the 3Vs of data? (choose two answers)

A. Velocity (correct)
B. Vulnerability (incorrect)
C. Volume (correct)
D. Virtuality (incorrect)

Q6 Companies that have large amounts of information stored in different systems should begin a big data analytics project by considering: (single choice)

A. The creation of a plan for choosing and implementing big data infrastructure technologies (incorrect)
B. The interrelatedness of data and the amount of development work that will be needed to link various data sources (correct)
C. The ability of business intelligence and analytics vendors to help them answer business questions in big data environments (incorrect)

D. The database with the most information storage first and working through the storage systems sequentially (incorrect)

7.6 Soft Skills

Q1 Which of the following statements about the goal setting process among team members is false? (single choice)
A. Team members are involved in the process (incorrect)
B. Team members identify what should be achieved (incorrect)
C. Team members set extremely specific goals (correct)
D. Team members create an action plan with deadlines included (incorrect)

Q2 Which of the following is a technique of creative thinking? (single choice)
A. Project Management (incorrect)
B. Problem solving (incorrect)
C. Storytelling (incorrect)
D. Mind mapping (correct)

Q3 At the beginning of a negotiation, which of the following is considered to be a mistake? (single choice)
A. Make pleasantries (incorrect)
B. Give away details of your bargaining position (correct)
C. Be cordial and respectful (incorrect)
D. Smile and shake hands (incorrect)

Q4 Which of the following are basic principles of change management? (choose three answers)
A. Understand change (correct)
B. Plan change (correct)
C. Implement change (correct)
D. Assess change (incorrect)

Q5 A leader and a manager DO NOT have practically (choose three answers)
A. The same contribution to the company's aims and objectives (correct)
B. Controversial contribution (correct)
C. Complementary contribution (incorrect)
D. Parallel roles in the company's operation (correct)

Q6 Which of the following are Soft skills? (choose three answers)
A. Communication (correct)
B. Critical Thinking (correct)
C. Financial Planning (incorrect)
D. Adaptability (correct)

7.7 Entrepreneurship Skills

Q1 A person involved in a company's inception is known as: (single choice)

A. businessman (incorrect)
B. merchant (incorrect)
C. entrepreneur (correct)
D. Sales manager (incorrect)

Q2 Other words for entrepreneurship include: (single choice)
A. employment seeker (incorrect)
B. employer (incorrect)
C. investor (incorrect)
D. self-employment (correct)

Q3 An entrepreneur's job in a growing economy is to: (single choice)
A. make people unemployed (incorrect)
B. raise average incomes for all citizens (correct)
C. maintain a comfortable level of living (incorrect)
D. throw off the local balance of growth (incorrect)

Q4 What are some skills that an entrepreneur should have? (choose three answers)
A. An ingrained dedication to hard work (correct)
B. Produce an opening and have a vision (correct)
C. Sales skills (correct)
D. B and C (incorrect)

Q5 To what end does an entrepreneur conduct a SWOT analysis? (choose three answers)
A. Identification of organisation's Strengths, Weaknesses, Opportunities, and Threats. (correct)
B. Helping a company capitalise on its strengths, fill its weaknesses, seize opportunities, and reduce threats. (correct)
C. A and B (incorrect)
D. Before settling on a new course of action, conduct a SWOT Analysis to evaluate the current state of the company. (correct)

Q6 What are the reasons for a loss in business? (choose three answers)
A. Problems with debtor management and surplus inventory (correct)
B. Bad debt, and overdue invoices (correct)
C. Only new customers should be eligible for discounts and other incentives (incorrect)
D. Failure to adequately fund your business or the selection of inappropriate funding sources (correct)

7.8 Green Skills

Q1 Which are the three sectors in which Sustainable Development is defined? (single choice)
A. Security, Environment, Economy (incorrect)
B. Environment, Economy, Society (incorrect)

C. Nature, Environment, Justice (incorrect)
D. Climate Change, Security, Energy (incorrect)

Q2 According to the European Green Deal, in which year should Europe be independent of fossil fuels? (single choice)
A. 2030 (incorrect)
B. 2040 (incorrect)
C. 2025 (incorrect)
D. 2050 (correct)

Q3 What are Energy Communities? (single choice)
A. Systems designed to interrupt the supply of electricity at certain times of the day (incorrect)
B. Intelligent network between buildings in the same neighborhood of a city that can optimise their energy consumption (correct)
C. Community of people who share electricity bills (incorrect)
D. Smart grids are able to identify where the energy losses of infrastructures are (incorrect)

Q4 What is the right order to make the most of waste from the 5Rs in Supply Chain Management? (single choice)
A. Recycle, Reduce, Reuse, Refurbish, Repair (incorrect)
0 0 (incorrect)
B. Reuse, Reduce, Refurbish, Repair, Recycle (incorrect)
C. Reduce, Reuse, Refurbish, Repair, Recycle (correct)
D. Reuse, Refurbish, Reduce, Repair, Recycle (incorrect)

Q5 Which are the benefits of Energy Management Systems? (choose three answers)
A. Understanding energy consumption and reducing energy costs (correct)
B. Calculating and reducing the carbon footprint (correct)
C. The sharing of personal data regarding citizens' energy consumption (incorrect)
D. Observing the compulsory legal framework in terms of energy efficiency (correct)

Q6 Which technologies may be used in smart cities in waste management? (choose three answers)
A. Use of waste tracking systems (correct)
B. Apps that allow citizens to carry out separate waste collection in the correct way and at the right time (correct)
C. LCA (Life Cycle Assessment) (incorrect)
D. Intelligent waste bins that communicate the filling status (correct)

8. Relationships Embedded in the Quiz Logic

The tables presented in this section describe the relationship between the knowledge (KA) or Skill (SA) as they are determined in D2.1 and D2.2, the corresponding question in the self-assessment quiz, and relevant modules in the SMACITE curricula courses (D2.2). These links are embedded in the quiz recommendations on knowledge and skill level.

8.1 Smart Cities Engineer (SCE)

8.1.1 Internet of Things (SCE)

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A1: Know the main principles of IoT technology	*How would you rate your knowledge of the main principles of IoT technology?*	Module 1. Introduction to IoT
K.A2 Learn the typical architecture of IoT	*What is your understanding of the typical architecture of IoT systems?*	Module 1. Introduction to IoT
K.A3 Be familiar with IoT application in Smart Cities	*How familiar are you with IoT applications in Smart Cities?*	Module 1. Introduction to IoT
K.A4 Learn the architecture of an IoT device, its distinct components and how they interact	*What is your understanding of an IoT device scheme, its distinct components, and how they interact?*	Module 2. IoT Devices
K.A5 Know the common limitations and vulnerabilities of IoT devices	*How would you rate your knowledge of the common limitations and vulnerabilities of IoT devices?*	Module 2. IoT Devices
K.A6 Be familiar with the different communication protocols applied in IoT and their main characteristics	*How familiar are you with the different communication protocols applied in IoT and their main characteristics?*	Module 3. IoT Communications
K.A7 Learn how they can use the IoT technology to build automation and control systems in Smart Cities	*What is your understanding of the IoT technology to build automation and control systems in Smart Cities?*	Module 4. IoT for automation and control

Knowledge (KA) or Skill (SA)	*The corresponding question in the quiz*	Relevant modules
K.A8 Be familiar with the role of cloud computing in IoT	*How familiar are you with the role of cloud computing in IoT?*	Module 5. IoT Cloud
S.A1 Identify different applications of IoT technology in Smart Cities by utilising smart connected devices and/or automatic control systems	*Based on your experience, what are your skills in identifying different applications of IoT technology in Smart Cities by utilising smart connected devices and/or automatic control systems?*	Module 1. Introduction to IoT Module 2. IoT Devices
S.A2 Design the architecture of smart systems for Smart Cities by exploiting the IoT technology	*Based on your experience, what are your skills in designing the architecture of smart systems for Smart Cities by exploiting the IoT technology?*	Module 1. Introduction to IoT

Table 7 Relationship between the knowledge/skill, Quiz question, and SMACITE IoT course modules for Smart Cities Engineers

8.1.2 Cybersecurity (SCE)

Knowledge (KA) or Skill (SA)	*The corresponding question in the quiz*	Relevant modules
KA1: Know the implications of cybersecurity in Smart Cities	*How would you rate your knowledge of the implications of cybersecurity in Smart Cities?*	Module 1. Introduction to Cybersecurity in Smart Cities
K.A2 Understand the digital architecture of a Smart City	*What is your understanding of the digital architecture of a Smart City?*	Module 1. Introduction to Cybersecurity in Smart Cities
K.A3 Learn the main cybersecurity threats in a Smart City	*What is your understanding of the main cybersecurity threats in a Smart City?*	Module 2. Cyber threats and attacks
K.A4 Know the main measures that improve cybersecurity	*How would you rate your knowledge of the main measures that improve cybersecurity?*	Module 3. Cybersecurity policies and measures

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A5 Know which are the most important cybersecurity techniques	*How would you rate your knowledge of the most important cybersecurity techniques?*	Module 4. Cybersecurity tools and techniques Module 5. Monitoring a Smart City
K.A6 Know what is the risk management plan	*How would you rate your knowledge of the risk management plan?*	Module 6. Risk management
S.A1 Explain the implications of cybersecurity in a Smart City	*Based on your experience, what are your skills in explaining the implications of cybersecurity in a Smart City?*	Module 1. Introduction to Cybersecurity in Smart Cities
S.A2 Identify the main cybersecurity threats in Smart Cities	*Based on your experience, what are your skills in identifying the main cybersecurity threats in Smart Cities?*	Module 2. Cyber threats and attacks
S.A3 Configure and use cybersecurity equipment and tools	*Based on your experience, what are your skills in configuring and using cybersecurity equipment and tools?*	Module 4. Cybersecurity tools and techniques
S.A4 Use cybersecurity monitoring tools	*Based on your experience, what are your skills in using cybersecurity monitoring tools?*	Module 5. Monitoring a Smart City
S.A5 Define a basic cybersecurity policy	*Based on your experience, what are your skills in defining a basic cybersecurity policy?*	Module 6. Risk management
S.A6 Propose a secure architecture for Smart Cities	*Based on your experience, what are your skills to propose a secure architecture for Smart Cities?*	Module 1. Introduction to Cybersecurity in Smart Cities

Table 8 Relationship between the knowledge/skill, Quiz question, and SMACITE Cybersecurity course modules for Smart Cities Engineers

8.1.3 Cloud Computing (SCE)

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A1: Identify the most appropriate Cloud Computing solution for each use case	*How would you rate your knowledge of identifying the most appropriate Cloud Computing solution for each use case?*	Module 1. Introduction to Cloud Computing Module 2. Cloud Computing Infrastructure
K.A2 Become familiar with deploying cloud infrastructures, platforms, and applications	*How familiar are you with deploying cloud infrastructures, platforms, and applications?*	Module 2. Cloud Computing Infrastructure Module 3. Deployment of Cloud Computing solutions
K.A3 Learn key maintenance and monitoring procedures in Cloud Computing solutions	*What is your understanding of the key maintenance and monitoring procedures in Cloud Computing solutions?*	Module 3. Deployment of Cloud Computing solutions
K.A4 Appreciate capabilities of major commercial Cloud Computing services	*How would you rate your knowledge of appreciating capabilities of major commercial Cloud Computing services*	Module 4. Hyperscalers: Amazon Web Services, Microsoft Azure and Google Cloud Platform
K.A5 Understand native programming paradigms for Cloud Computing	*What is your understanding of the native programming paradigms for Cloud Computing?*	Module 5. Introduction to software development and deployment for Cloud Computing
K.A6 Know the possibilities of edge computing	*How would you rate your knowledge of the possibilities of edge computing?*	Module 6. New technologies applied to Cloud Computing

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
S.A1 Choose the most appropriate Cloud Computing solution for each use case	*Based on your experience, what are your skills in choosing the most appropriate Cloud Computing solution for each use case?*	Module 1. Introduction to Cloud Computing Module 2. Cloud Computing Infrastructure Module 4. Hyperscalers: Amazon Web Services, Microsoft Azure and Google Cloud Platform
S.A2 Use deployment tools for different Cloud Computing solutions	*Based on your experience, what are your skills in using deployment tools for different Cloud Computing solutions?*	Module 2. Cloud Computing Infrastructure Module 3. Deployment of Cloud Computing solutions
S.A3 Point out key tasks to maintain and monitor Cloud Computing solutions	*Based on your experience, what are your skills in pointing out key tasks to maintain and monitor Cloud Computing solutions?*	Module 4. Hyperscalers: Amazon Web Services, Microsoft Azure and Google Cloud Platform
S.A4 Be inquisitive regarding new developments/technologies applied to Cloud Computing	*Based on your experience, how would you rate your inquisitiveness regarding new developments/technologies applied to Cloud Computing?*	Module 5. Introduction to software development and deployment for Cloud Computing Module 6. New technologies applied to Cloud Computing

Table 9 Relationship between the knowledge/skill, Quiz question, and SMACITE Cloud Computing course modules for Smart Cities Engineers

8.1.4 Data Analytics and Visualizations (SCE)

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A1: Know the key concepts of Data Analytics and Data Visualization	*How would you rate your knowledge of the key concepts of Data Analytics and Data Visualization?*	Module 1. Introduction to Data Analytics and Data Visualization
K.A2 Be familiar with applications of Data Analytics in SC	*How familiar are you with applications of Data Analytics in SC?*	Module 2. Data Analytics for SC
K.A3 Have an overall knowledge of the fundamental principles of visual information / information graphics / statistical graphics in the field of SC	*How would you rate your knowledge of the fundamental principles of visual information / information graphics / statistical graphics in the field of SC?*	Module 3. Data Visualization for SC
K.A4 Be aware of typical Data Analytics and Data Visualization SC use cases	*How would you rate your awareness of typical Data Analytics and Data Visualization SC use cases?*	Module 4. SM Use Cases
K.A5 Understand the integration of Data Analytics and Data Visualization with contemporary computing trends (i.e., Cloud Computing, IoT, Big Data, Augmented/Mixed Reality, Artificial Intelligence etc)	*What is your understanding of the integration of Data Analytics and Data visualization with contemporary computing trends (i.e., Cloud Computing, IoT, Big Data, Augmented/Mixed Reality, Artificial Intelligence etc)?*	Module 4. SM Use Cases
S.A1 Explain the methodologies and key components of Data Analytics and Data Visualization	*Based on your experience, what are your skills in explaining the methodologies and key components of Data Analytics and Data Visualization?*	Module 1. Introduction to Data Analytics and Data Visualization
S.A2 Identify how Data Analytics can be applied in SC applications	*Based on your experience, what are your skills in identifying how Data*	Module 2. Data Analytics for SC

Knowledge (KA) or Skill (SA)	*The corresponding question in the quiz*	Relevant modules
	analytics can be applied in SC applications?	
S.A3 Describe common Data Analytics and Data Visualization use cases	*Based on your experience, what are your skills in describing common Data Analytics and Data Visualization use cases?*	Module 4. SM Use Cases

Table 10 Relationship between the knowledge/skill, Quiz question, and SMACITE Data Analytics and Visualizations course modules for Smart Cities Engineers

8.1.5 Machine Learning and Big Data (SCE)

Knowledge (KA) or Skill (SA)	*The corresponding question in the quiz*	Relevant modules
K.A1: Describe the basic logic of Machine Learning techniques suitable for the data gathered from typical Smart Cities application domains and make effective decisions concerning which techniques are suitable	*How would you rate your knowledge of the basic logic of* Machine Learning *techniques suitable for the data gathered from typical SCs application domains and make effective decisions concerning which techniques are suitable?*	Module 1. Introduction to Machine Learning with Big Data
K.A2: Be familiar with examples of typical Machine Learning applications in the Smart Cities domain, the types and sources of smart cities data and available programming tools	*How familiar are you with examples of typical* Machine Learning *applications in the Smart Cities domain, the types and sources of smart cities data?*	Module 1. Introduction to Machine Learning with Big Data Module 2. Machine Learning for Smart Cities
K.A3: Explain the basic logic of Machine Learning techniques suitable for the data gathered from typical SCs application domains and how they can support effective decision making	*How would you rate your knowledge of the basic logic of* Machine Learning *techniques suitable for the data gathered from typical Smart Cities application domains and how they can support effective decision making?*	Module 2. Machine Learning for Smart Cities

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A4: Describe representative case studies of using Machine Learning and data mining from the Smart Cities domain and their implementation in relative programming environments	*How would you rate your awareness of representative case studies of using Machine Learning and data mining from the Smart Cities domain and their implementation in relative programming environments?*	Module 2. ML for Smart Cities Module 3. Machine Learning case studies for Smart Cities
K.A5: Understand the integration of Machine Learning with state-of-the-art technological trends such as Cloud Computing and IoT	*How would you rate your understanding of the integration of* Machine Learning *with state-of-the-art technological trends such as Cloud Computing and IoT?*	Module 4. Machine Learning combined with IoT and Cloud Computing
S.A1: Select appropriate Machine Learning techniques and effective decision making	*Based on your experience, what are your skills in selecting appropriate* Machine Learning *techniques and effective decision making?*	Module 2. Machine Learningfor Smart Cities
S.A2: Apply common Machine Learning techniques on datasets gathered from representative smart cities application domains	*Based on your experience, what are your skills in applying common* Machine Learning *techniques on datasets gathered from representative smart cities application domains?*	Module 3. Machine Learning case studies for Smart Cities
S.A3: Integrate Machine Learning with cutting-edge technologies (i.e., cloud computing, IoT generated data streams)	*Based on your experience, what are your skills in integrating* Machine Learning *with cutting-edge technologies (i.e., cloud computing, IoT generated data streams)? suitable?*	Module 4. Machine Learning ML combined with IoT and Cloud Computing

Table 11 Relationship between the knowledge/skill, Quiz question, and Machine Learning and Big Data course modules for Smart Cities Engineers

8.1.6 Soft skills (SCE)

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A1: Be familiar with the importance of soft skills for their professional and personal development	*How would you rate your awareness of the importance of soft skills for your professional and personal development?*	Module 1. Introduction to Soft Skills
K.A2: Identify the various forms of communication and principles of effective communication and negotiation	*What is your knowledge of the various forms of communication and principles of effective communication and negotiation?*	Module 2. Interpersonal Communication
K.A3: Be aware of the basic principles and advantages of collaboration and team working	*How would you rate your awareness of the basic principles and advantages of collaboration and team working?*	Module 3. Teamwork and Collaboration
K.A4: Recognize principles, phases and tools of creative problem-solving procedures and decision making	*How would you rate your understanding of the principles, phases and tools of creative problem-solving procedures and decision making?*	Module 4. Critical Thinking and Problem Solving
K.A5: Be aware of the difference between management and leadership and the importance of EQ and motivation	*How would you rate your awareness of the difference between management and leadership and the importance of EQ and motivation?*	Module 5. Leadership and Management
K.A6: Be familiar with the factors that lead to changes and the skills that need to be developed to successfully tackle them	*How familiar are you with the factors that lead to changes and the skills that need to be developed to successfully tackle them?*	Module 6. Managing Through Change

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
S.A1: Discern hard from soft skills and identify pathways for their development	*Based on your experience, what are your skills in discerning hard from soft skills and identifying pathways for their development?*	Module 1. Introduction to Soft Skills
S.A2: Communicate with clarity and conviction and tailor their communication strategy according to the specificities of each context	*Based on your experience, what are your skills in communicating with clarity and conviction and tailoring your communication strategy according to the specificities of each context?*	Module 2. Interpersonal Communication
S.A3: Create effective, flexible and resilient teams by motivating the team members and handling common conflicts that arise within teams	*Based on your experience, what are your skills in creating effective, flexible and resilient teams by motivating the team members and handling common conflicts that arise within teams?*	Module 3. Teamwork and Collaboration
S.A4: Gather information about a problem, identify and analyse problems and use techniques in order to come up with a decision	*Based on your experience, what are your skills in gathering information about a problem, identifying and analysing problems and using techniques in order to come up with a decision?*	Module 4. Critical Thinking and Problem Solving
S.A5: Use the design thinking process for problem analysis	*Based on your experience, what are your skills in using the design thinking process for problem analysis?*	Module 4. Critical Thinking and Problem Solving

Knowledge (KA) or Skill (SA)	*The corresponding question in the quiz*	Relevant modules
S.A6: Build and sustain trustful relationships with colleagues and supervisors through responsible leadership	*Based on your experience, what are your skills in building and sustaining trustful relationships with colleagues and supervisors through responsible leadership?*	Module 5. Leadership and Management
S.A7 Provide an example of changes occurring in their professional life and prepare a list with actions undertaken that will help them to adapt to the aforementioned changes	*Based on your experience, what are your skills in providing an example of changes occurring in your professional life and preparing a list with actions undertaken that will help you to adapt to the aforementioned changes?*	Module 6. Managing Through Change

Table 12 Relationship between the knowledge/skill, Quiz question, and Machine Learning and Soft Skills course modules for Smart Cities Engineers

8.1.7 Entrepreneurship skills (SCE)

Knowledge (KA) or Skill (SA)	*The corresponding question in the quiz*	Relevant modules
K.A1: Understand the significance and complexity of contemporary entrepreneurship	*How would you rate your understanding of the significance and complexity of contemporary entrepreneurship?*	Module 1. Introduction to Entrepreneurship Module 2. Entrepreneurship
K.A2: Identify and describe areas for business process improvement	*How would you rate your knowledge to identify and describe areas for business process improvement?*	Module 2. Entrepreneurship
K.A3: Have the capacity to comprehend management principles and methods applicable to projects	*How would you rate your capacity to comprehend management principles and methods applicable to projects?*	Module 3. Project management

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A4: Select sustainable business models through critical and analytical reasoning	*How would you rate your knowledge to select sustainable business models through critical and analytical reasoning?*	Module 4. Entrepreneurship and Innovation
K.A5: Recognize the necessary connection between entrepreneurship and innovation	*How would you rate your knowledge to recognize the necessary connection between entrepreneurship and innovation?*	Module 4. Entrepreneurship and Innovation
K.A6: Develop a plan of action for the business and a strategy for the business's future	*How would you rate your knowledge to develop a plan of action for the business and a strategy for the business's future?*	Module 5. Business Plan
S.A1: Promote or develop entrepreneurship	*Based on your experience, what are your skills in promoting or developing entrepreneurship?*	Module 1. Introduction to Entrepreneurship Module 2. Entrepreneurship Module 4. Entrepreneurship and Innovation
S.A2: Recognize investment and development incentives and take advantage of professional opportunities	*Based on your experience, what are your skills in recognizing investment and development incentives and taking advantage of professional opportunities?*	Module 4. Entrepreneurship and Innovation
S.A3: Create detailed business plans	*Based on your experience, what are your skills in creating detailed business plans?*	Module 3. Project management Module 4. Entrepreneurship and Innovation Module 5. Business Plan

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
S.A4: Collaborate, coordinate, and manage the parties involved in business venture planning and implementation	*Based on your experience, what are your skills in collaborating, coordinating, and managing the parties involved in business venture planning and implementation?*	Module 3. Project management
S.A5: Evaluate the impact of a variety of external and internal factors on entrepreneurship	*Based on your experience, what are your skills in evaluating the impact of a variety of external and internal factors on entrepreneurship?*	Module 2. Entrepreneurship Module 4. Entrepreneurship and Innovation Module 5. Business Plan

Table 13 Relationship between the knowledge/skill, Quiz question, and Entrepreneurship Skills a course modules for Smart Cities Engineers

8.1.8 Green Skills (SCE)

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
KA1: Understand the concepts of sustainability (environmental, economic and social)	*What is your understanding of the concepts of sustainability (environmental, economic and social)?*	Module 1. Apply the circular economy concept
K.A2: Know the main stages of history of sustainable development and main international and European agreements related to sustainability (SDG's and Green New Deal)	*How would you rate your knowledge of the main stages of history of sustainable development and main international and European agreements related to sustainability (SDG's and Green New Deal)?*	Module 1. Apply the circular economy concept

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
K.A3: Learn the difference between the concepts of circular economy and green economy	*How would you rate your knowledge of the difference between the concepts of circular economy and green economy?*	Module 1. Apply the circular economy concept Module 3. Waste management
K.A4: Be familiar with LCA (life cycle assessment) and circular economy assessment concepts and what are their main principles	*How familiar are you with LCA (life cycle assessment) and circular economy assessment concepts and what are their main principles?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
K.A5: Have an overall knowledge of the main methods of sustainable management of the city	*How would you rate your knowledge of the main methods of sustainable management of the city?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
K.A6: Learn the main descriptive parameters of sustainability and the main environmental certifications	*How would you rate your knowledge of the main descriptive parameters of sustainability and the main environmental certifications?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.A1: Identify strengths and weaknesses in smart city management	*Based on your experience, what are your skills in identifying strengths and weaknesses in smart city management?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management

Knowledge (KA) or Skill (SA)	***The corresponding question in the quiz***	**Relevant modules**
S.A2: Process the collected data and design sustainable solutions	*Based on your experience, what are your skills in processing the collected data and designing sustainable solutions?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.A3: Develop alternative management strategies	*Based on your experience, what are your skills in developing alternative management strategies?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.A4: Use green skills to promote changes in social habits towards more sustainable ways	*Based on your experience, what are your skills in using green skills to promote changes in social habits towards more sustainable ways?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.A5: Identify possible future applications of technology and ICT to increase the sustainability of smart cities	*Based on your experience, what are your skills in identifying possible future applications of technology and ICT to increase the sustainability of smart cities?*	Module 2. Energy conservation and Module 3. Waste management

Table 14 Relationship between the knowledge/skill, Quiz question, and Green Skills course modules for Smart Cities Engineers

8.2 Smart Cities Technician (SCT)

8.2.1 Internet of Things (SCT)

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
K.B1: Know the main principles of IoT technology	*How would you rate your knowledge of the main principles of IoT technology?*	Module 1. Introduction to IoT
K.B2 Learn the typical architecture of IoT	*What is your understanding of the typical architecture of IoT systems?*	Module 1. Introduction to IoT
K.B3 Be familiar with IoT application in Smart Cities	*How familiar are you with IoT applications in Smart Cities?*	Module 1. Introduction to IoT
K.B4 Learn the architecture of an IoT device, its distinct components and how they interact	*What is your understanding of an IoT device scheme, its distinct components, and how they interact?*	Module 2. IoT Devices
K.B5 Know the common limitations and vulnerabilities of IoT devices	*How would you rate your knowledge of the common limitations and vulnerabilities of IoT devices?*	Module 2. IoT Devices
K.B6 Be familiar with the different communication protocols applied in IoT and their main characteristics	*How familiar are you with the different communication protocols applied in IoT and their main characteristics?*	Module 3. IoT Communications
K.B7 Learn how they can use the IoT technology to build automation and control systems in Smart Cities	*What is your understanding of the IoT technology to build automation and control systems in Smart Cities?*	Module 4. IoT for automation and control

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
S.B1 Install and configure IoT devices	*Based on your experience, what are your skills in installing and configuring IoT devices?*	Module 2. IoT Devices
S.B2 Interconnect IoT devices with sensors and the IoT system	*Based on your experience, what are your skills in interconnecting IoT devices with sensors and the IoT system?*	Module 2. IoT Devices

Table 15 Relationship between the knowledge/skill, Quiz question, and SMACITE IoT course modules for Smart Cities Technicians

8.2.2 Cybersecurity (SCT)

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
K.B1 Learn the main cybersecurity threats in a Smart City	*What is your understanding of the main cybersecurity threats in a Smart City?*	Module 2. Cyber threats and attacks
K.B2 Know the main measures that improve cybersecurity	*How would you rate your knowledge of the main measures that improve cybersecurity?*	Module 3. Cybersecurity policies and measures
K.B3 Know which are the most important cybersecurity techniques	*How would you rate your knowledge of the most important cybersecurity techniques?*	Module 4. Cybersecurity tools and techniques Module 5. Monitoring a Smart City
S.B1 Identify the main cybersecurity threats in Smart Cities	*Based on your experience, what are your skills in identifying the main cybersecurity threats in Smart Cities?*	Module 2. Cyber threats and attacks

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
S.B2 Configure and use cybersecurity equipment and tools	*Based on your experience, what are your skills in configuring and using cybersecurity equipment and tools?*	Module 4. Cybersecurity tools and techniques
S.B3 Use cybersecurity monitoring tools	*Based on your experience, what are your skills in using cybersecurity monitoring tools?*	Module 5. Monitoring a Smart City
S.B4 Define a basic cybersecurity policy	*Based on your experience, what are your skills in defining a basic cybersecurity policy?*	Module 6. Risk management

Table 16 Relationship between the knowledge/skill, Quiz question, and SMACITE Cybersecurity course modules for Smart Cities Technicians

8.2.3 Cloud Computing (SCT)

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
K.A1: Identify the most appropriate Cloud Computing solution for each use case	*How would you rate your knowledge of identifying the most appropriate Cloud Computing solution for each use case?*	Module 1. Introduction to Cloud Computing Module 2. Cloud Computing Infrastructure
K.A2 Become familiar with deploying cloud infrastructures, platforms, and applications	*How familiar are you with deploying cloud infrastructures, platforms, and applications?*	Module 2. Cloud Computing Infrastructure Module 3. Deployment of Cloud Computing solutions
K.A3 Learn key maintenance and monitoring procedures in Cloud Computing solutions	*What is your understanding of the key maintenance and monitoring procedures in Cloud Computing solutions?*	Module 3. Deployment of Cloud Computing solutions

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
K.A4 Appreciate capabilities of major commercial Cloud Computing services	*How would you rate your knowledge of appreciating capabilities of major commercial Cloud Computing services*	Module 4. Hyperscalers: Amazon Web Services, Microsoft Azure and Google Cloud Platform
S.A1 Choose the most appropriate Cloud Computing solution for each use case	*Based on your experience, what are your skills in choosing the most appropriate Cloud Computing solution for each use case?*	Module 1. Introduction to Cloud Computing Module 2. Cloud Computing Infrastructure Module 4. Hyperscalers: Amazon Web Services, Microsoft Azure and Google Cloud Platform
S.A2 Use deployment tools for different Cloud Computing solutions	*Based on your experience, what are your skills in using deployment tools for different Cloud Computing solutions?*	Module 2. Cloud Computing Infrastructure Module 3. Deployment of Cloud Computing solutions
S.A3 Point out key tasks to maintain and monitor Cloud Computing solutions	*Based on your experience, what are your skills in pointing out key tasks to maintain and monitor Cloud Computing solutions?*	Module 4. Hyperscalers: Amazon Web Services, Microsoft Azure and Google Cloud Platform

Table 17 Relationship between the knowledge/skill, Quiz question, and SMACITE Cloud Computing course modules for Smart Cities Technicians

8.2.4 Data Analytics and Visualizations (SCT)

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
K.B1: Know the key concepts of Data Analytics and Data Visualization	*How would you rate your knowledge of the key concepts of Data Analytics and Data Visualization?*	Module 5. Introduction to Data Analytics and Data Visualization
K.B2 Be familiar with applications of Data Analytics in SC	*How familiar are you with applications of Data Analytics in SC?*	Module 2. Data Analytics for SC
K.B3 Have an overall knowledge of the fundamental principles of visual information / information graphics / statistical graphics in the field of SC	*How would you rate your knowledge of the fundamental principles of visual information / information graphics / statistical graphics in the field of SC?*	Module 3. Data Visualization for SC
K.B4 Be aware of typical Data Analytics and Data Visualization SC use cases	*How would you rate your awareness of typical Data Analytics and Data Visualization SC use cases?*	Module 4. SM Use Cases
K.B5 Understand the integration of Data Analytics and Data Visualization with contemporary computing trends (i.e., Cloud Computing, IoT, Big Data, Augmented/Mixed Reality, Artificial Intelligence etc)	*What is your understanding of the integration of Data Analytics and Data visualization with contemporary computing trends (i.e., Cloud Computing, IoT, Big Data, Augmented/Mixed Reality, Artificial Intelligence etc)?*	Module 4. SM Use Cases
S.B1 Apply common Data Analytics techniques and methods to real SC datasets	*Based on your experience, what are your skills in applying common Data Analytics techniques and methods to real SC datasets?*	Module 2. Data Analytics for SC

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
S.B2 Apply common Data Visualization techniques and methods to real SC datasets	*Based on your experience, what are your skills in applying common Data Visualization techniques and methods to real SC datasets?*	Module 3. Data Visualization for SC
S.B3 Assist in the integration of Data Analytics and Data Visualization frameworks with cutting-edge technologies (i.e., cloud computing, AR/MR)	*Based on your experience, what are your skills in assisting in the integration of Data Analytics and Data Visualization frameworks with cutting-edge technologies (i.e., cloud computing, AR/MR)?*	Module 4. SM Use Cases

Table 18 Relationship between the knowledge/skill, Quiz question, and SMACITE Data Analytics and Visualizations course modules for Smart Cities Technicians

8.2.5 Machine Learning and Big Data (SCT)

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
K.B1: Understand the basic Machine Learning (ML) concepts, types of techniques and how ML relates to data mining, information retrieval and statistics	*What is your understanding of the basic Machine Learning (ML) concepts, types of techniques and how ML relates to data mining, information retrieval and statistics?*	Module 1. Introduction to Machine Learning with Big Data
K.B2: Explain the basic logic of Machine Learning techniques suitable for the data gathered from typical Smart Cities application domains and how they can support effective decision making	*How would you rate your knowledge of the basic logic of* Machine Learning *techniques suitable for the data gathered from typical Smart Cities application domains and how they can support effective decision making?*	Module 1. Introduction to Machine Learning with Big Data Module 2. Machine Learning for Smart Cities

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
K.B3: Describe representative case studies of using Machine Learning and data mining from the Smart Cities domain and their implementation in relative programming environments	*How would you rate your awareness of representative case studies of using Machine Learning and data mining from the Smart Cities domain and their implementation in relative programming environments?*	Module 2. Machine Learning for Smart Cities Module 3. Machine Learning case studies for Smart Cities
K.B4: Understand the integration of Machine Learning with state-of-the-art technological trends such as Cloud Computing and IoT	*How would you rate your understanding of the integration of* Machine Learning *with state-of-the-art technological trends such as Cloud Computing and IoT?*	Module 4. Machine Learning combined with IoT and Cloud Computing
S.B1: Apply common Machine Learning techniques to explore large datasets to reveal patterns	*Based on your experience, what are your skills in applying common* Machine Learning *techniques to explore large datasets to reveal patterns?*	Module 3. Machine Learning case studies for Smart Cities
S.B2: Assist in the integration of Machine Learning with cutting-edge technologies (i.e., cloud computing, IoT generated data streams)	*Based on your experience, what are your skills in integrating* Machine Learning *with cutting-edge technologies (i.e., cloud computing, IoT generated data streams)?*	Module 4. Machine Learning combined with IoT and Cloud Computing

Table 19 Relationship between the knowledge/skill, Quiz question, and Machine Learning and Big Data course modules for Smart Cities Technicians

8.2.6 Soft skills (SCT)

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
K.B1: Be familiar with the importance of soft skills for their professional and personal development	*How would you rate your awareness of the importance of soft skills for your professional and personal development?*	Module 1. Introduction to Soft Skills
K.B2: Identify the various forms of communication and principles of effective communication and negotiation	*What is your knowledge of the various forms of communication and principles of effective communication and negotiation?*	Module 2. Interpersonal Communication
K.B3: Be aware of the basic principles and advantages of collaboration and team working	*How would you rate your awareness of the basic principles and advantages of collaboration and team working?*	Module 3. Teamwork and Collaboration
K.B4: Recognize principles, phases and tools of creative problem-solving procedures and decision making	*How would you rate your understanding of the principles, phases and tools of creative problem-solving procedures and decision making?*	Module 4. Critical Thinking and Problem Solving
K.B5: Be aware of the difference between management and leadership and the importance of EQ and motivation	*How would you rate your awareness of the difference between management and leadership and the importance of EQ and motivation?*	Module 5. Leadership and Management
K.B6: Be familiar with the factors that lead to changes and the skills that need to be developed to successfully tackle them	*How familiar are you with the factors that lead to changes and the skills that need to be developed to successfully tackle them?*	Module 6. Managing Through Change

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
S.B1: Discern hard from soft skills and identify pathways for their development	*Based on your experience, what are your skills in discerning hard from soft skills and identifying pathways for their development?*	Module 1. Introduction to Soft Skills
S.B2: Communicate with clarity and conviction and tailor their communication strategy according to the specificities of each context	*Based on your experience, what are your skills in communicating with clarity and conviction and tailoring your communication strategy according to the specificities of each context?*	Module 2. Interpersonal Communication
S.B3: Create effective, flexible and resilient teams by motivating the team members and handling common conflicts that arise within teams	*Based on your experience, what are your skills in creating effective, flexible and resilient teams by motivating the team members and handling common conflicts that arise within teams?*	Module 3. Teamwork and Collaboration
S.B4: Gather information about a problem, identify and analyse problems and use techniques in order to come up with a decision	*Based on your experience, what are your skills in gathering information about a problem, identifying and analysing problems and using techniques in order to come up with a decision?*	Module 4. Critical Thinking and Problem Solving
S.B5: Build and sustain trustful relationships with colleagues and supervisors through responsible leadership	*Based on your experience, what are your skills in building and sustaining trustful relationships with colleagues and supervisors through responsible leadership?*	Module 5. Leadership and Management

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
S.B6 Provide an example of changes occurring in their professional life and prepare a list with actions undertaken that will help them to adapt to the aforementioned changes	*Based on your experience, what are your skills in providing an example of changes occurring in your professional life and preparing a list with actions undertaken that will help you to adapt to the aforementioned changes?*	Module 6. Managing Through Change

Table 20 Relationship between the knowledge/skill, Quiz question, and Machine Learning and Soft Skills course modules for Smart Cities Technicians

8.2.7 Entrepreneurship skills (SCT)

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
K.B1: Recognize the relevance and complexities of modern entrepreneurship	*How would you rate your knowledge to recognize the relevance and complexities of modern entrepreneurship?*	Module 1. Introduction to Entrepreneurship Module 2. Entrepreneurship
K.B2: Report on opportunities for business process improvement	*How would you rate your knowledge to report on opportunities for business process improvement?*	Module 2. Entrepreneurship
K.B3:Understanding of management ideas and practices applicable to projects	*How would you rate your capacity to understanding of management ideas and practices applicable to projects?*	Module 3. Project management
K.B4: Manage long-term business models	*How would you rate your knowledge to manage long-term business models?*	Module 4. Entrepreneurship and Innovation

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
K.B5: Recognize the critical link between entrepreneurship and innovation	*How would you rate your knowledge to recognize the critical link between entrepreneurship and innovation?*	Module 4. Entrepreneurship and Innovation
K.B6: Understand the business's plan of action as well as its future strategy	*How would you rate your understanding of the business's plan of action as well as its future strategy?*	Module 5. Business Plan
S.B1: Recognise entrepreneurship	*Based on your experience, what are your skills in recognising entrepreneurship?*	Module 1. Introduction to Entrepreneurship Module 2. Entrepreneurship Module 4. Entrepreneurship and Innovation
S.B2: Take advantage of investment and development incentives, as well as professional prospects	*Based on your experience, what are your skills in taking advantage of investment and development incentives, as well as professional prospects?*	Module 4. Entrepreneurship and Innovation
S.B3: Manage the parties engaged in the planning and implementation of a commercial initiative	*Based on your experience, what are your skills in managing the parties engaged in the planning and implementation of a commercial initiative?*	Module 3. Project management
S.B4: Evaluate the effect of internal and external variables	*Based on your experience, what are your skills in evaluating the effect of internal and external variables?*	Module 2. Entrepreneurship Module 4. Entrepreneurship and Innovation

Table 21 Relationship between the knowledge/skill, Quiz question, and Entrepreneurship Skills course modules for Smart Cities Technicians

8.2.8 Green Skills (SCT)

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
KB1: Understand the concepts of sustainability (environmental, economic and social)	*What is your understanding of the concepts of sustainability (environmental, economic and social)?*	Module 1. Apply the circular economy concept
K.B2: Know the main stages of history of sustainable development and main international and European agreements related to sustainability (SDG's and Green New Deal)	*How would you rate your knowledge of the main stages of the history of sustainable development and main international and European agreements related to sustainability (SDG's and Green New Deal)?*	Module 1. Apply the circular economy concept
K.B3: Learn the difference between the concepts of circular economy and green economy	*How would you rate your knowledge of the difference between the concepts of circular economy and green economy?*	Module 1. Apply the circular economy concept Module 3. Waste management
K.B4: Be familiar with LCA (life cycle assessment) and circular economy assessment concepts and what are their main principles	*How familiar are you with LCA (life cycle assessment) and circular economy assessment concepts and what are their main principles?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
K.B5: Have an overall knowledge of the main methods of sustainable management of the city	*How would you rate your knowledge of the main methods of sustainable management of the city?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management

Knowledge (KA) or Skill (SA)	**The corresponding question in the quiz**	**Relevant modules**
K.B6: Learn the main descriptive parameters of sustainability and the main environmental certifications	*How would you rate your knowledge of the main descriptive parameters of sustainability and the main environmental certifications?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.B1: Identify strengths and weaknesses in smart city management	*Based on your experience, what are your skills in identifying strengths and weaknesses in smart city management?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.B2: Identify collected data and verify proper functioning of data collection tools	*Based on your experience, what are your skills in identifying collected data and verifying proper functioning of data collection tools?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.B3: Support the development of procedures to manage and maintain infrastructures and data collecting tools	*Based on your experience, what are your skills in supporting the development of procedures to manage and maintain infrastructures and data collecting tools?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management

Knowledge (KA) or Skill (SA)	The corresponding question in the quiz	Relevant modules
S.B4: Use green skills to promote changes in social habits towards more sustainable ways	*Based on your experience, what are your skills in using green skills to promote changes in social habits towards more sustainable ways?*	Module 1. Apply the circular economy concept Module 2. Energy conservation Module 3. Waste management
S.B5: Collaborate in the implementation of future applications of technology and ICT to increase the sustainability of smart cities	*Based on your experience, what are your skills in collaborating in the implementation of future applications of technology and ICT to increase the sustainability of smart cities?*	Module 2. Energy conservation Module 3. Waste management

Table 22 Relationship between the knowledge/skill, Quiz question, and Green Skills course modules for Smart Cities Technicians

9. Verification of Requirements

In each phase of the tool development, the tool was compared to the business requirements to verify that they were met. The table below summarises the final results of the verification.

Requirements	Coverage	Note
The tool is based on the Smart Cities competences map and emerging job profiles (D2.1) and "The SMACITE curriculum for Smart Cities" to ensure the content is relevant and up-to-date.	complete	The content in the tool is based on the latest versions of D2.1 and D2.2. Sample questions were provided by the respective course authors.
The tool has two instances, one for Smart Cities Engineer profile, and one for Smart Cities Technician profile.	complete	Two instances have been developed in Moodle, one for Smart Cities Engineer profile and one for Smart Cities Technician profile.
The learners are able to navigate among the tool and to choose how much in detail to browse the tool information. Learners easily use the tool - a minimum number of questions and a simple description are included to ensure that they can quickly and easily identify their training needs.	complete	The tool provides learners with a menu and specially designed buttons so that they can navigate within the tool. Based on their interests and needs, learners can view or skip different parts of the content.
The tool provides recommendations on both course and module levels to ensure that learners clearly understand the specific knowledge and skills they need to acquire.	complete	The tool report provides recommendations on both course and module levels.
Based on self-evaluation questions, the learners can make informed decisions about personalising their learning paths.	complete	The tool lessons inform learners about the SMACITE profile, course learning objectives, and knowledge and skills. Curious learners have the option to answer specific questions. The quiz reports provide recommendations and links to the course modules and quizzes.
The tool refers to the relevant course, allowing for easy navigation between the tool and the courses when developed and ensuring learners can access the relevant content.	partially complete	The tool has proven capability to maintain bidirectional links from the tool to the course elements and from course elements to the tool. The actual links will be created once the SMACITE courses are developed.

Requirements	Coverage	Note
The tool can either have respective diagnostic tool modules distributed in the courses or stay in a separate instance - the two courses - to ensure flexibility in deployment.	complete	The tool has a modular structure and can be realised as monolith tools, one per Smart Cites Engineer and one per Smart Cities Technician, or as modules integrated into the respective SMACITE courses.
The tool results are complemented by the relevant evaluation quizzes and assessments in each course to inform learners' decisions for personalising their learning path.	complete	The reports link the respective quizzes and exams in the corresponding SMACITE course if the learners need further assessment of their knowledge and skills.

Table 23 Verification of the diagnostic tool requirements

10. Further Development and Support

The diagnostic tool is a part of the SMACITE MOOC and will be supported using the tools, policies, and practices for MOOC support. It has been completed as a fully functional system, but the hyperlinks to the corresponding SMACITE course modules and quizzes are missing because those modules and quizzes have not been developed yet. The placeholders marked with <> in the tool content will be replaced with actual data once the SMACITE course modules and quizzes are developed in the MOOC.

The diagnostic tool content is based on the versions of Deliverable 2.1 “Smart Cities competencies map and emerging job profiles” and Deliverable 2.2 “The SMACITE Curriculum for Smart Cities” – version as of 27 April 2023. If the SMACITE curriculum is updated or changed, the diagnostic tool will be modified accordingly.

The current version of the diagnostic tool consists of modules in two separate instances in Moodle. However, if project stakeholders decide that it’s more appropriate to accommodate the modules in the respective SMACITE courses, the tool will be fully integrated into the SMACITE MOOC courses. Feedback from learners and teachers during the pilots will be collected and analysed, and the tool will be updated, enhanced, and modified to meet their actual needs.

Annex 1 Diagnostic Web Tool Screens for Internet of Things Course for Smart Cities Engineers

The Annex illustrates the web-based tool by providing screenshots for Internet of Things course. The remaining courses Cybersecurity, Cloud computing, Data analytics and visualization, Machine Learning and Big Data for engineers and Internet of Things, Cybersecurity, Cloud computing, Data analytics and visualization, Machine Learning and Big Data for engineers have the same structure. All the content of those courses is presented in D2.1, D2.2, and D4.1

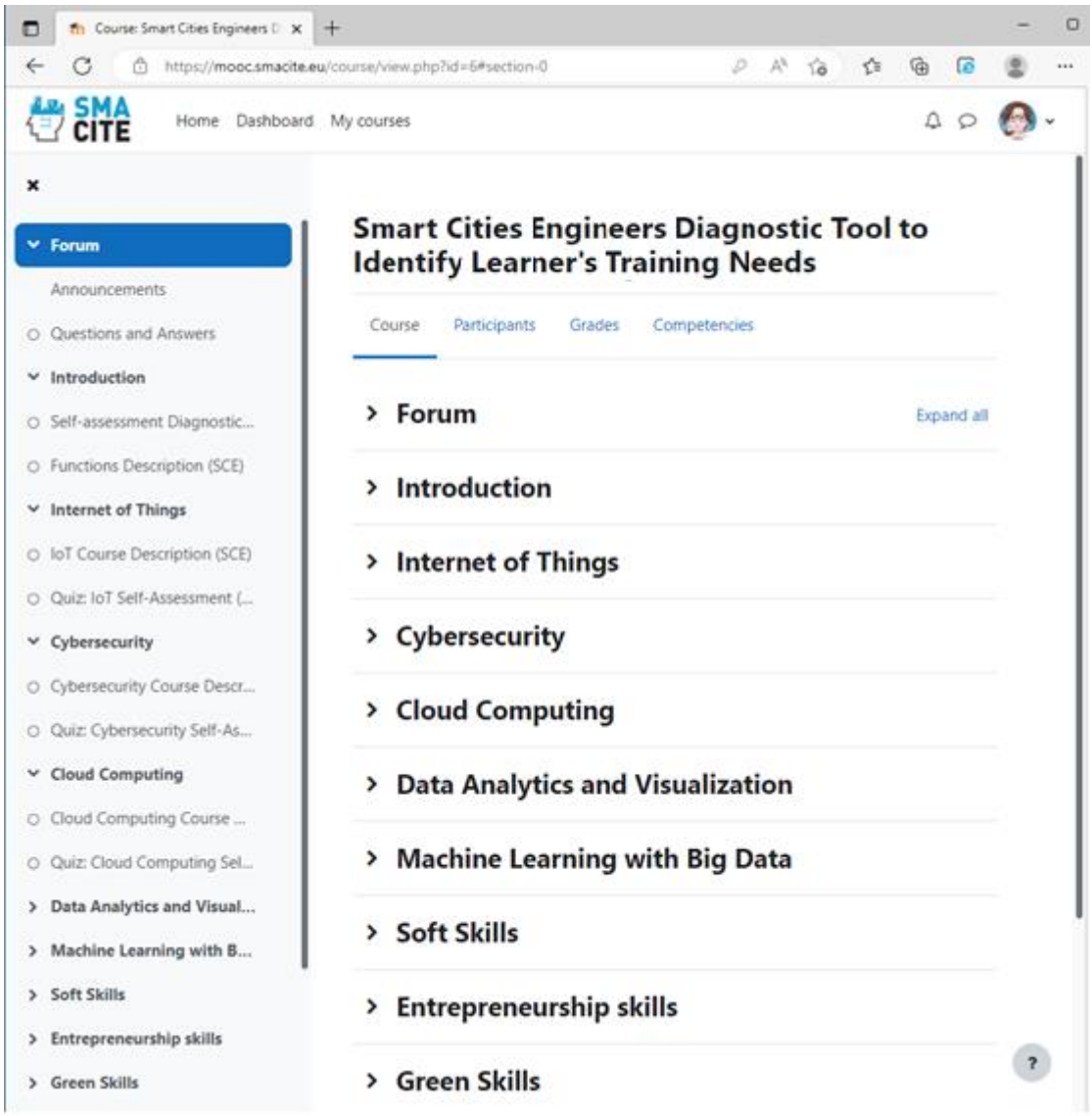

Figure 2 Entry screen with menus

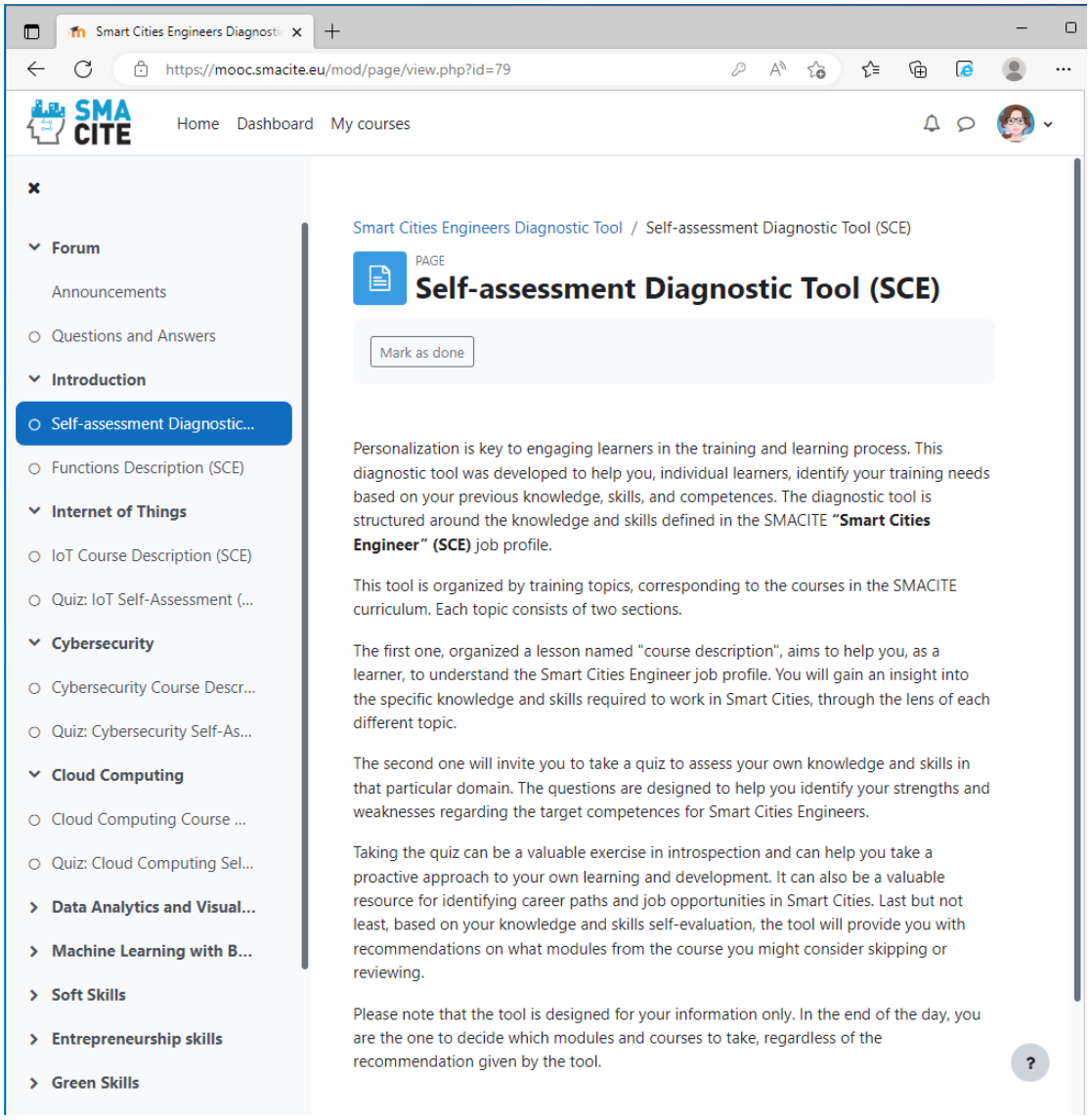

Figure 3 Self-assessment Diagnostic Tool for Smart Cities Engineer Description

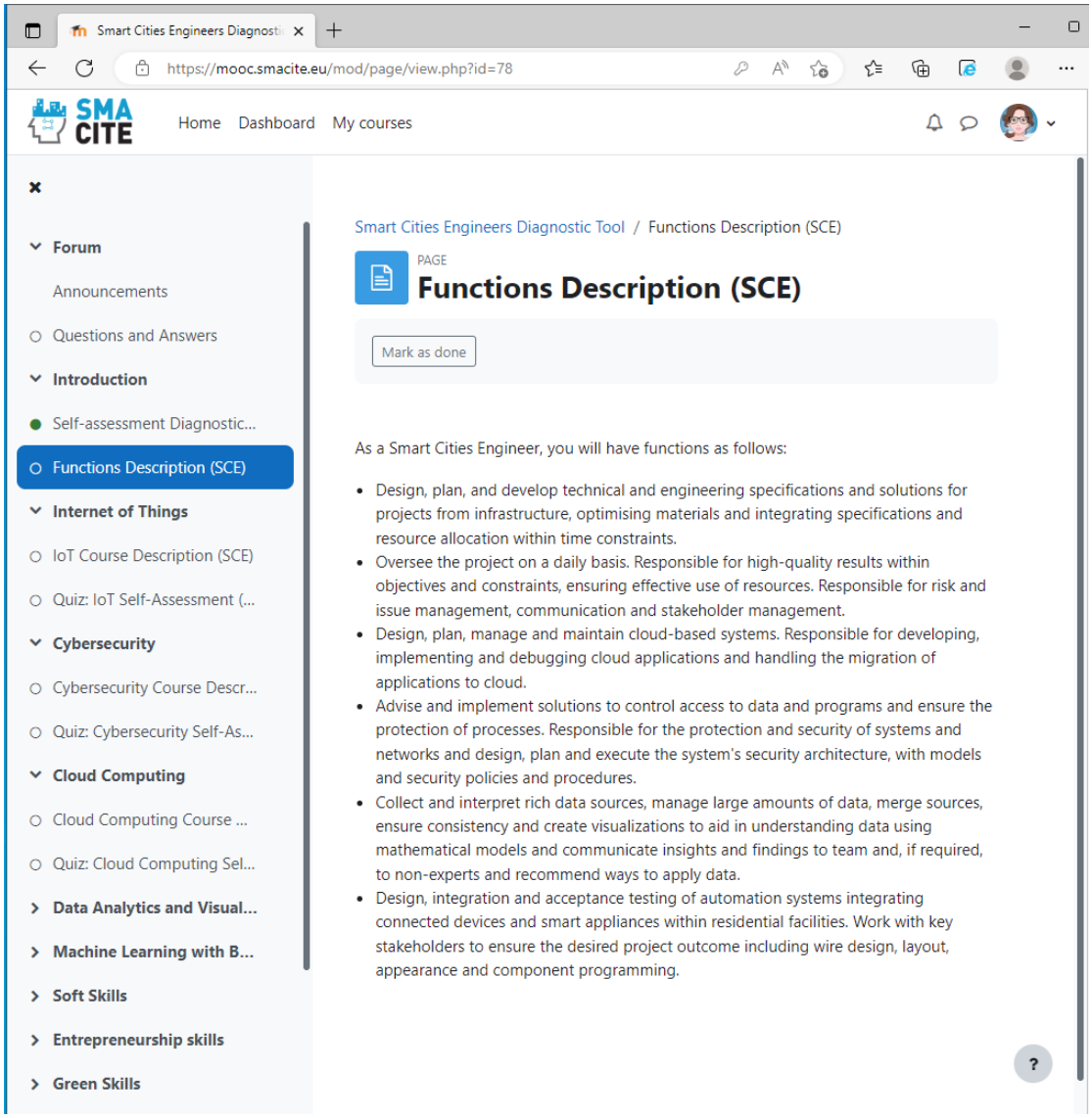

Figure 4 Smart Cities Engineer Function Description

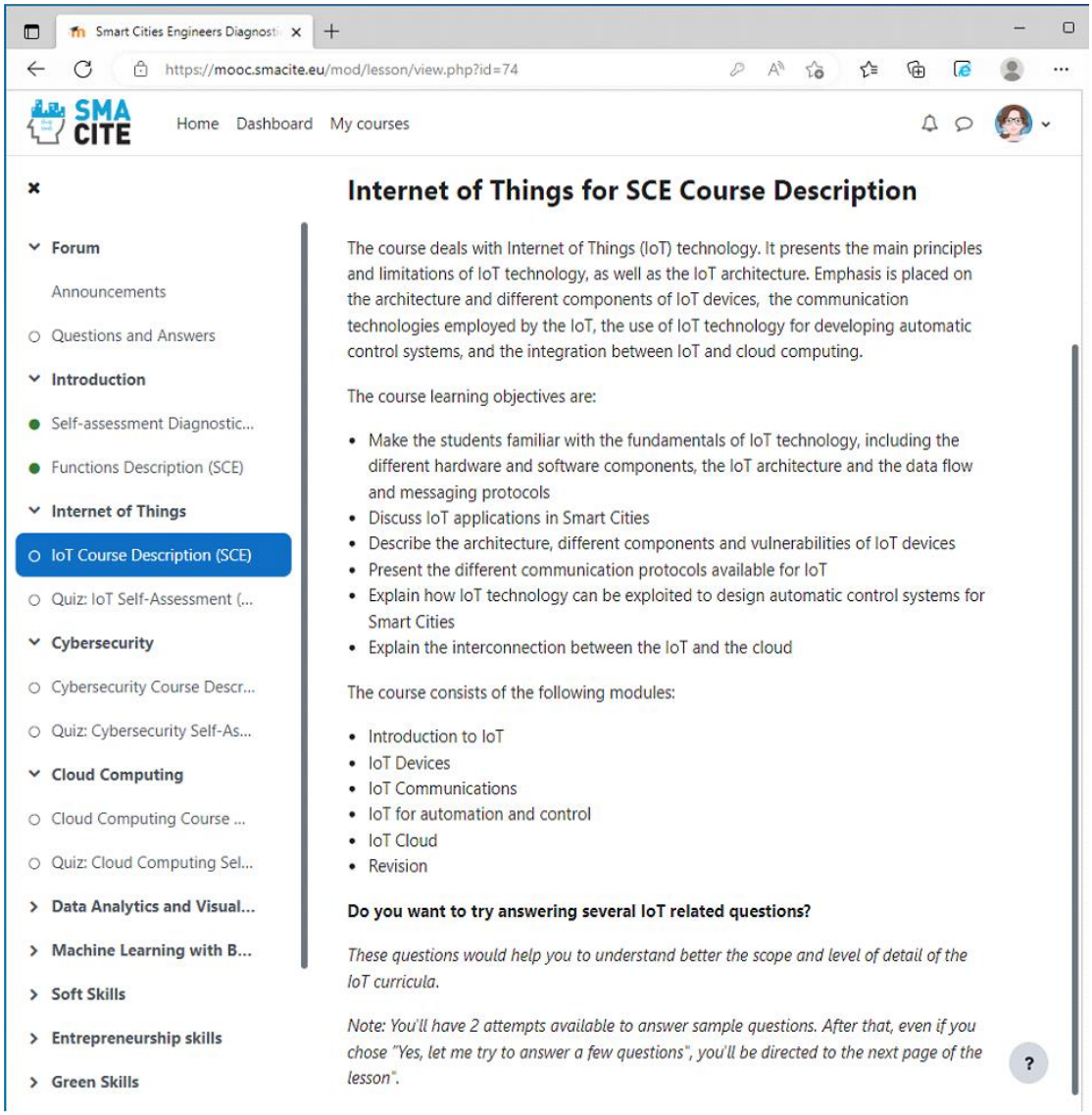

Figure 5 Internet of Things for Smart Cities Engineer Course Description

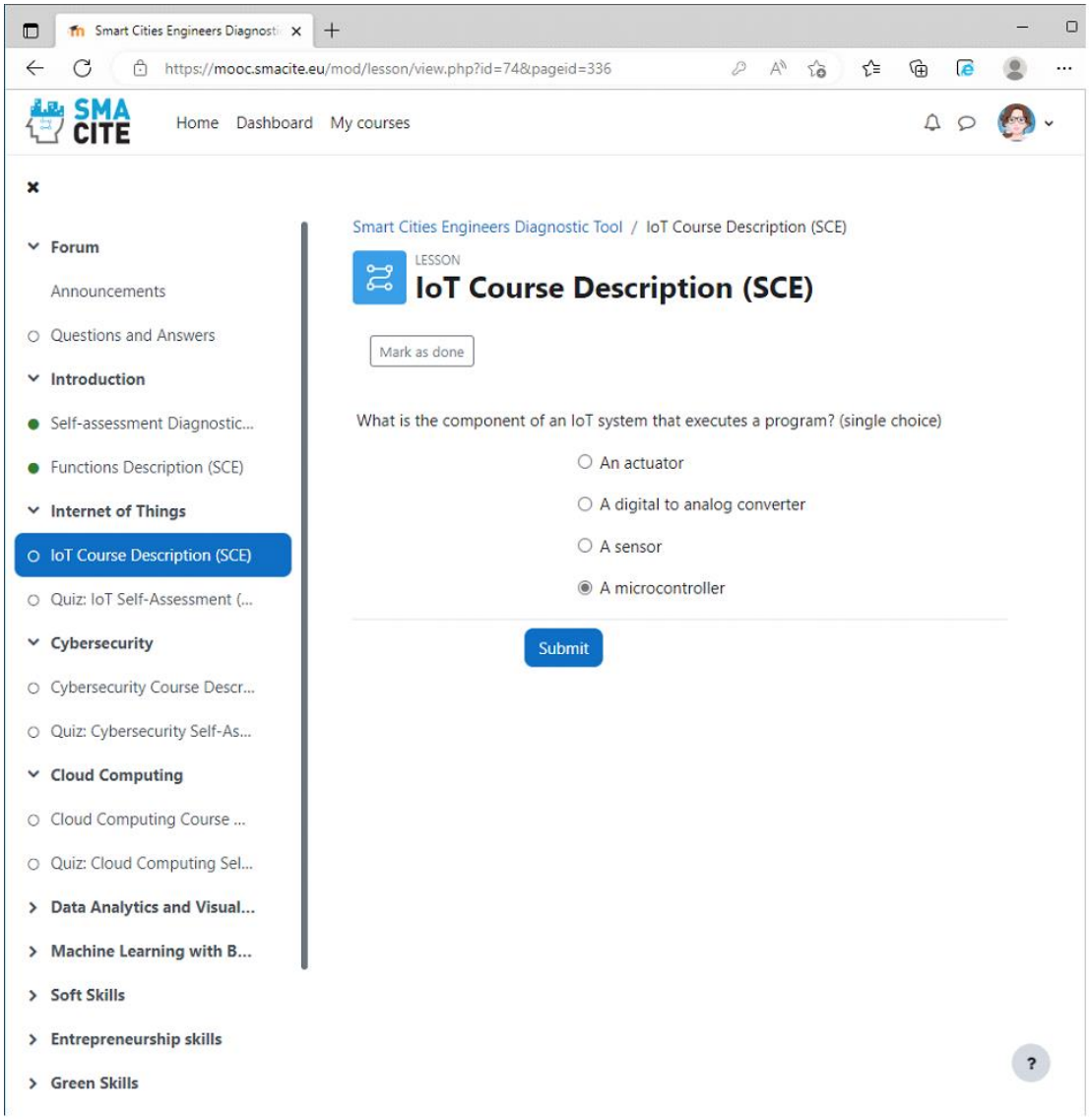

Figure 6 Internet of Things for Smart Citeis Engineer Question 1

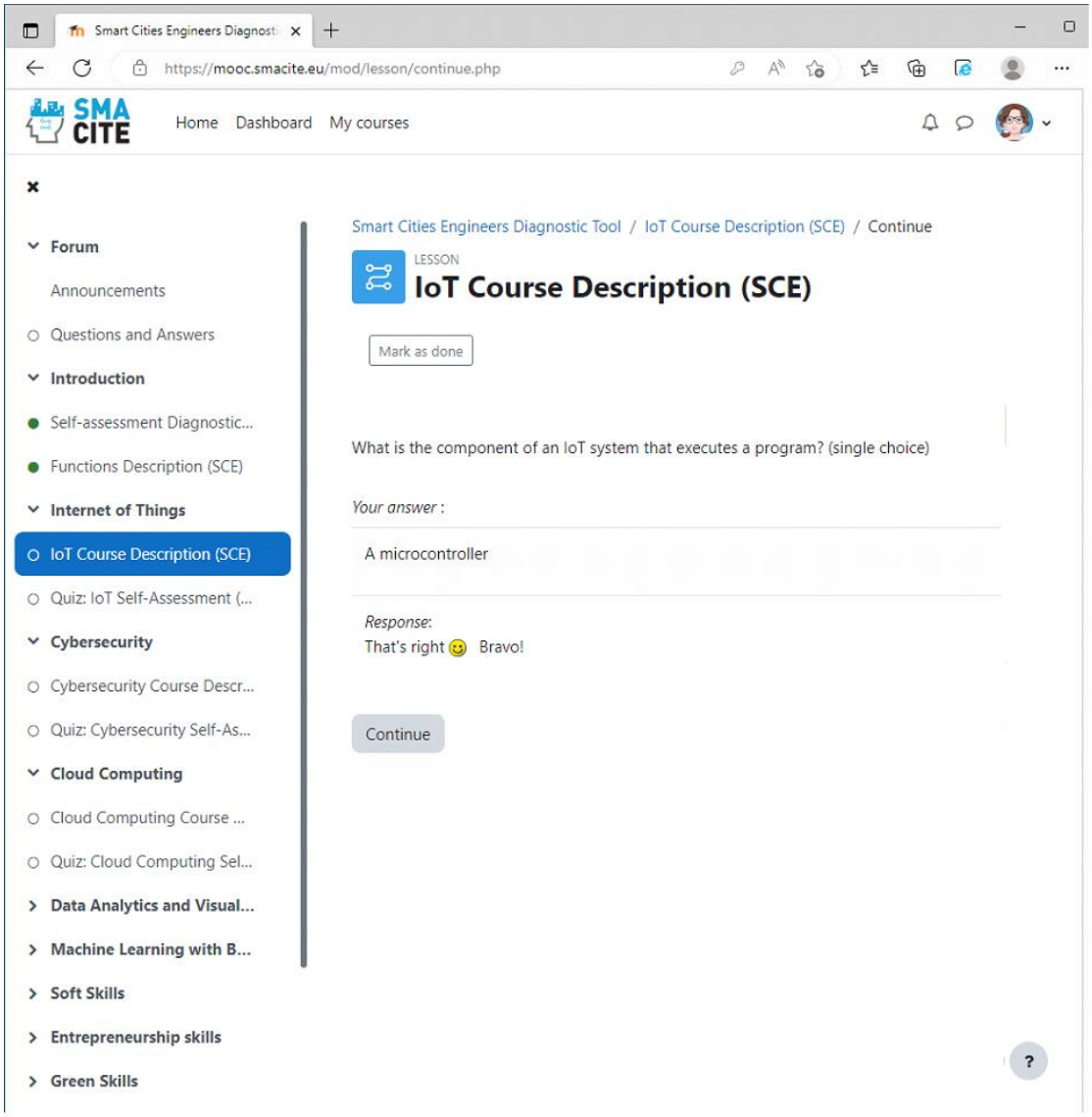

Figure 7 Internet of Things for Smart Cities Engineer Question 1 Feedback

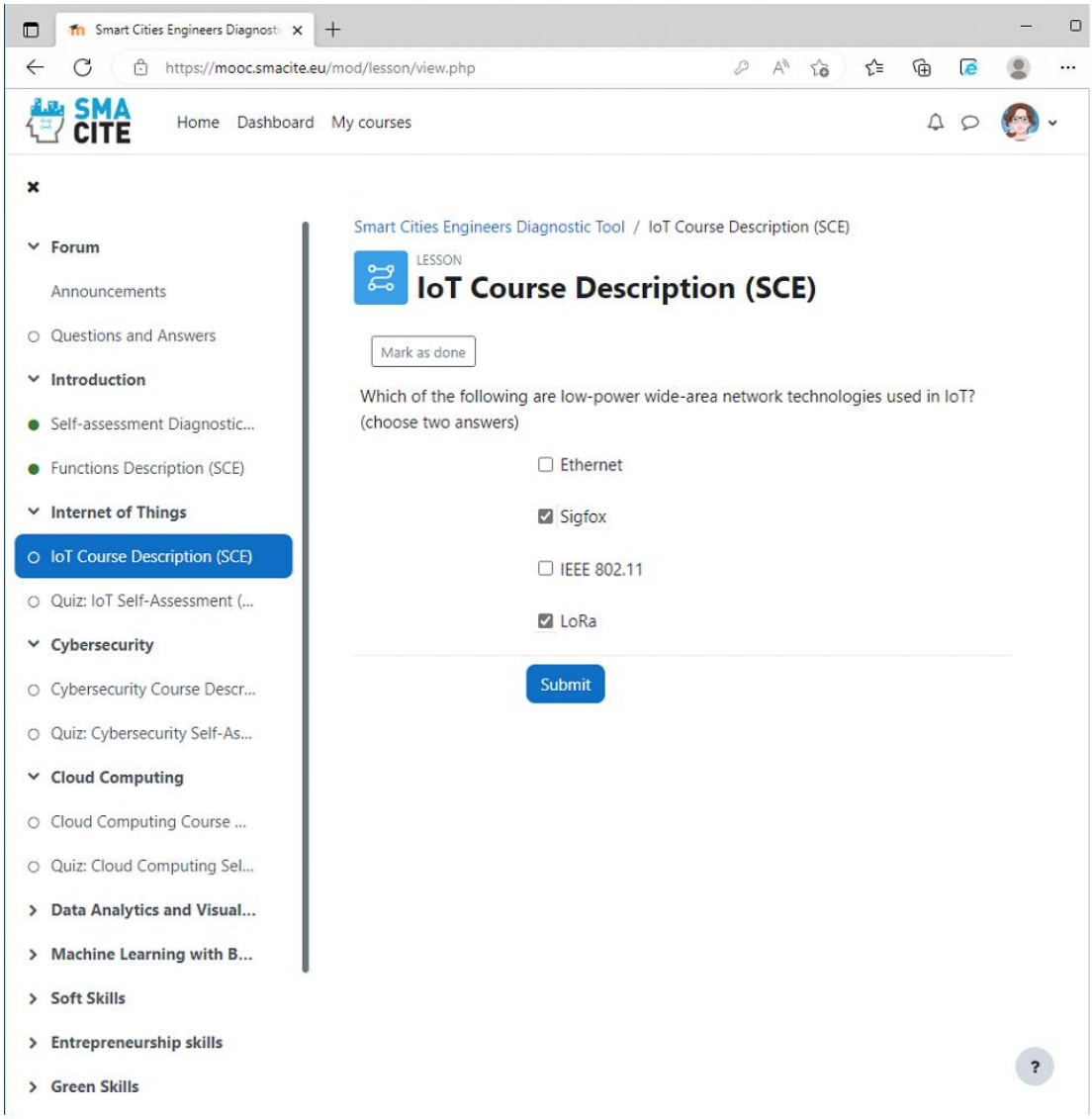

Figure 8 Internet of Things for Smart Cities Engineer Question 2

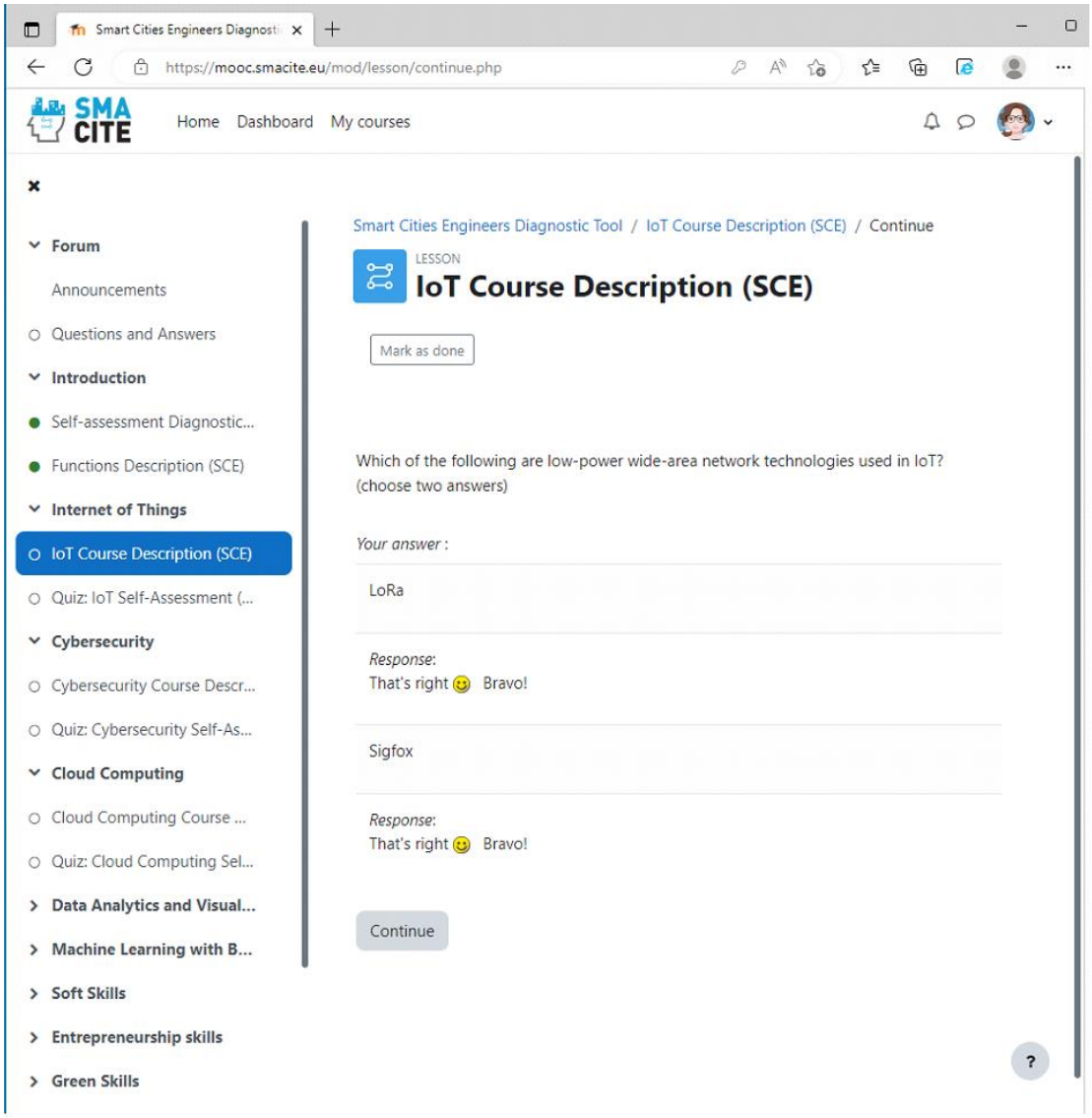

Figure 9 Internet of Things for Smart Cities Engineer Question 2 Feedback

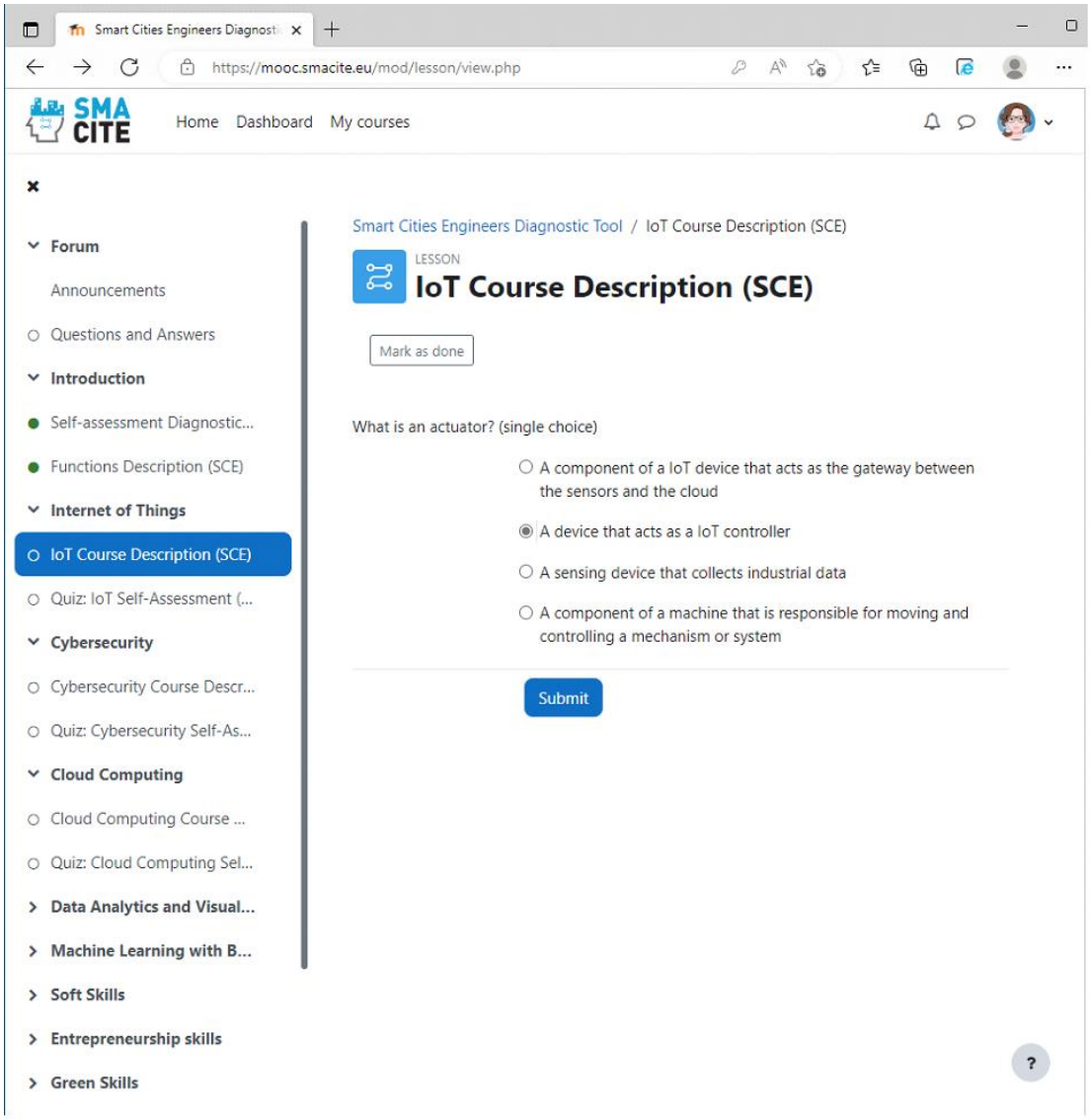

Figure 10 Internet of Things for Smart Cities Engineer Question 3

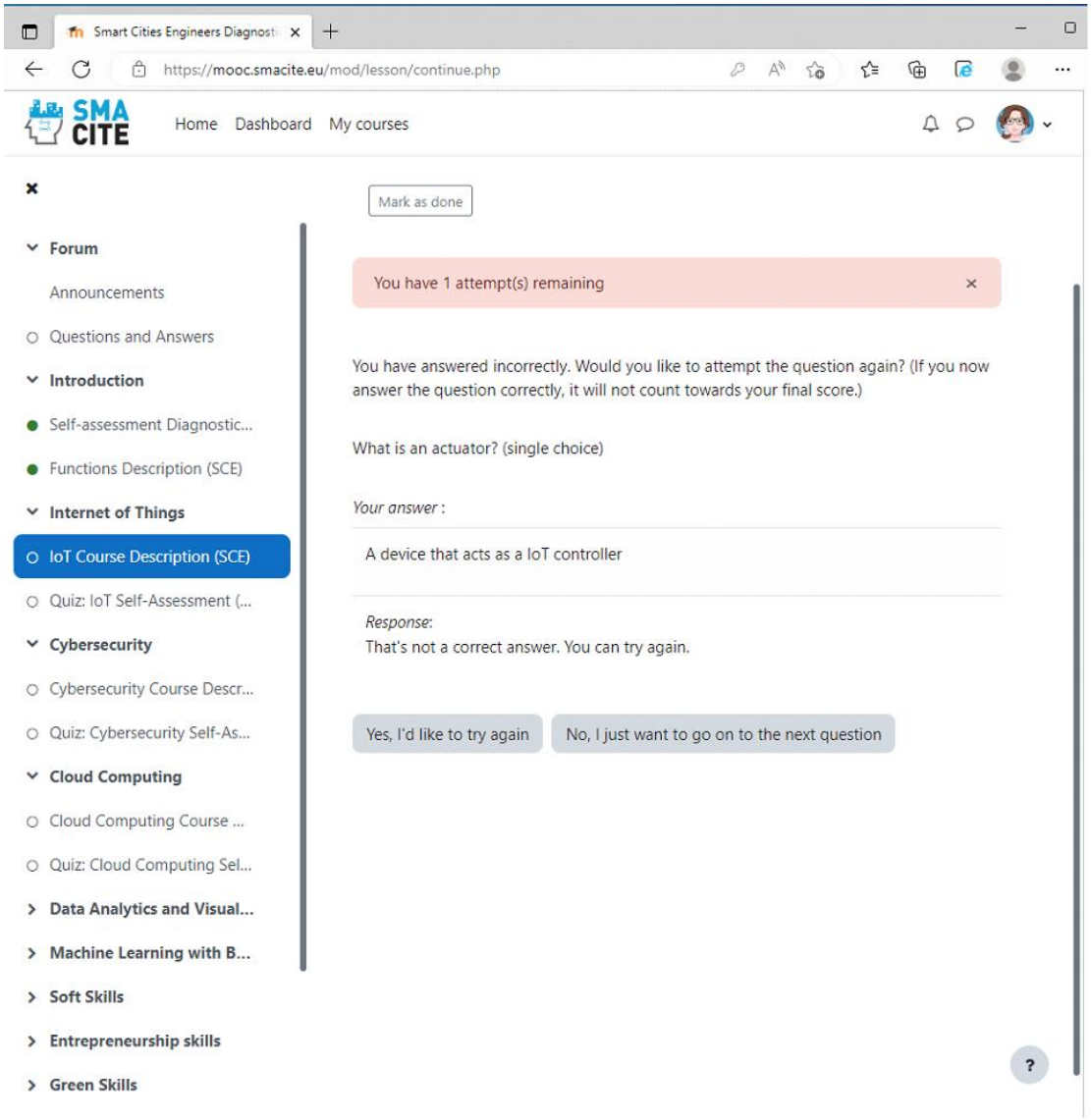

Figure 11 Internet of Things for Smart Cities Engineer Question 3 Feedback

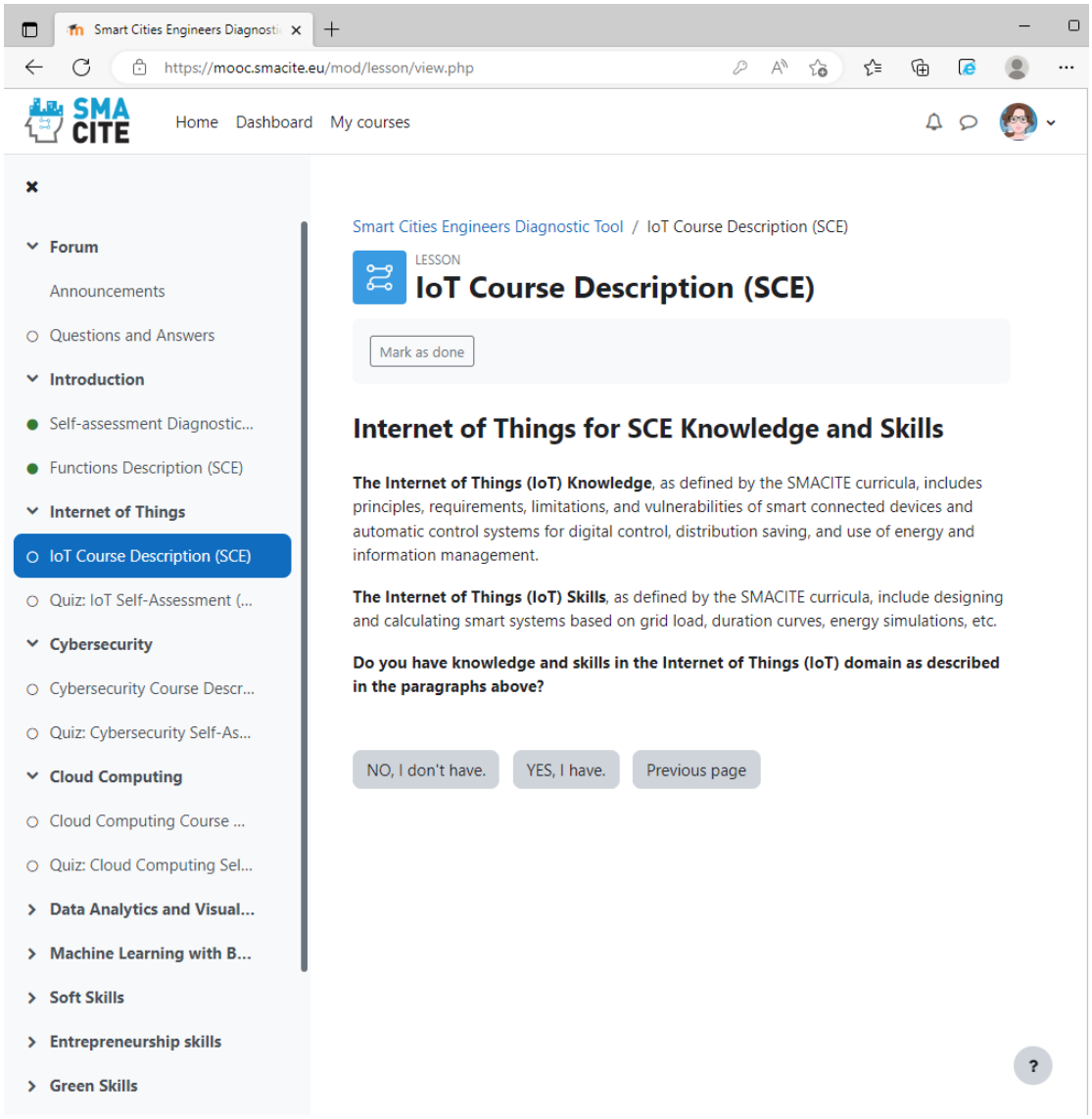

Figure 3 Internet of Things for Smart Citeis Engineer knowledge and skills genral description

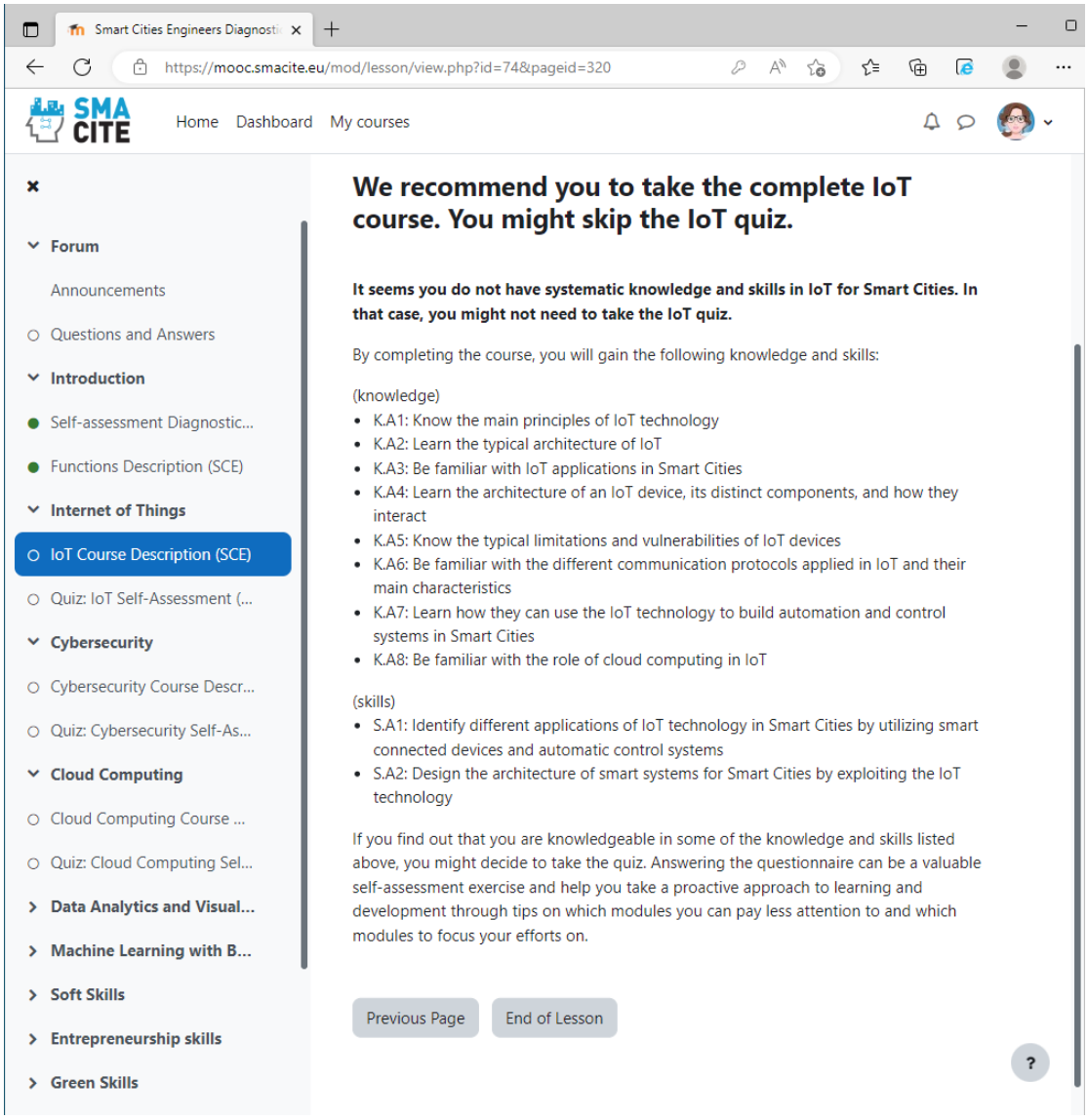

Figure 3 Internet of Things for Smart Cities Engineer knowledge and skills detailed description.

If the learner declares no knowledge and skills in IoT, the system recommends taking the complete course and skipping the Quiz.

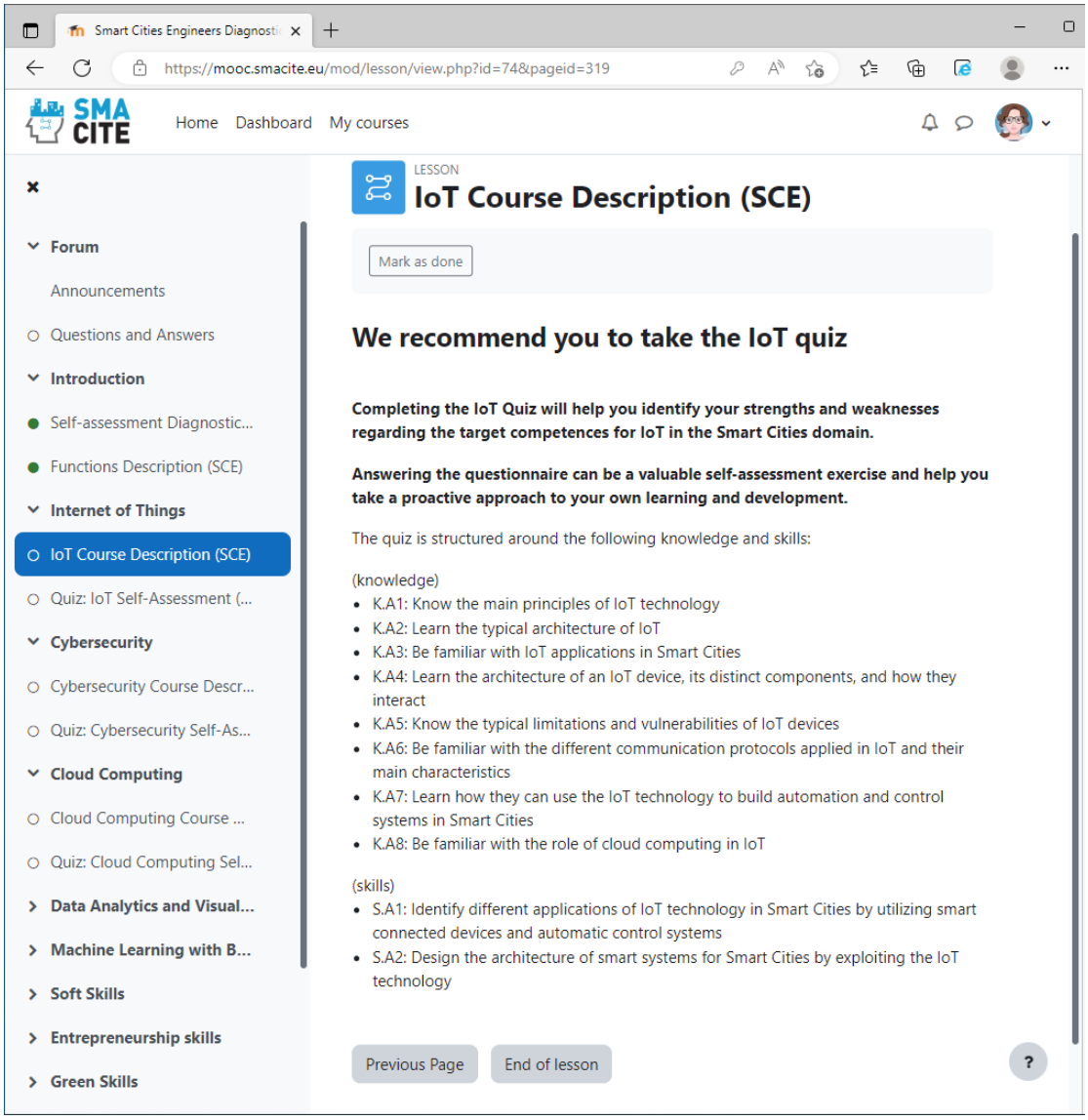

Figure 3 Internet of Things for Smart Citeis Engineer knowledge and skills detailed description.

If the learner declares no knowledge and skills in IoT, the system recommends taking the Quiz.

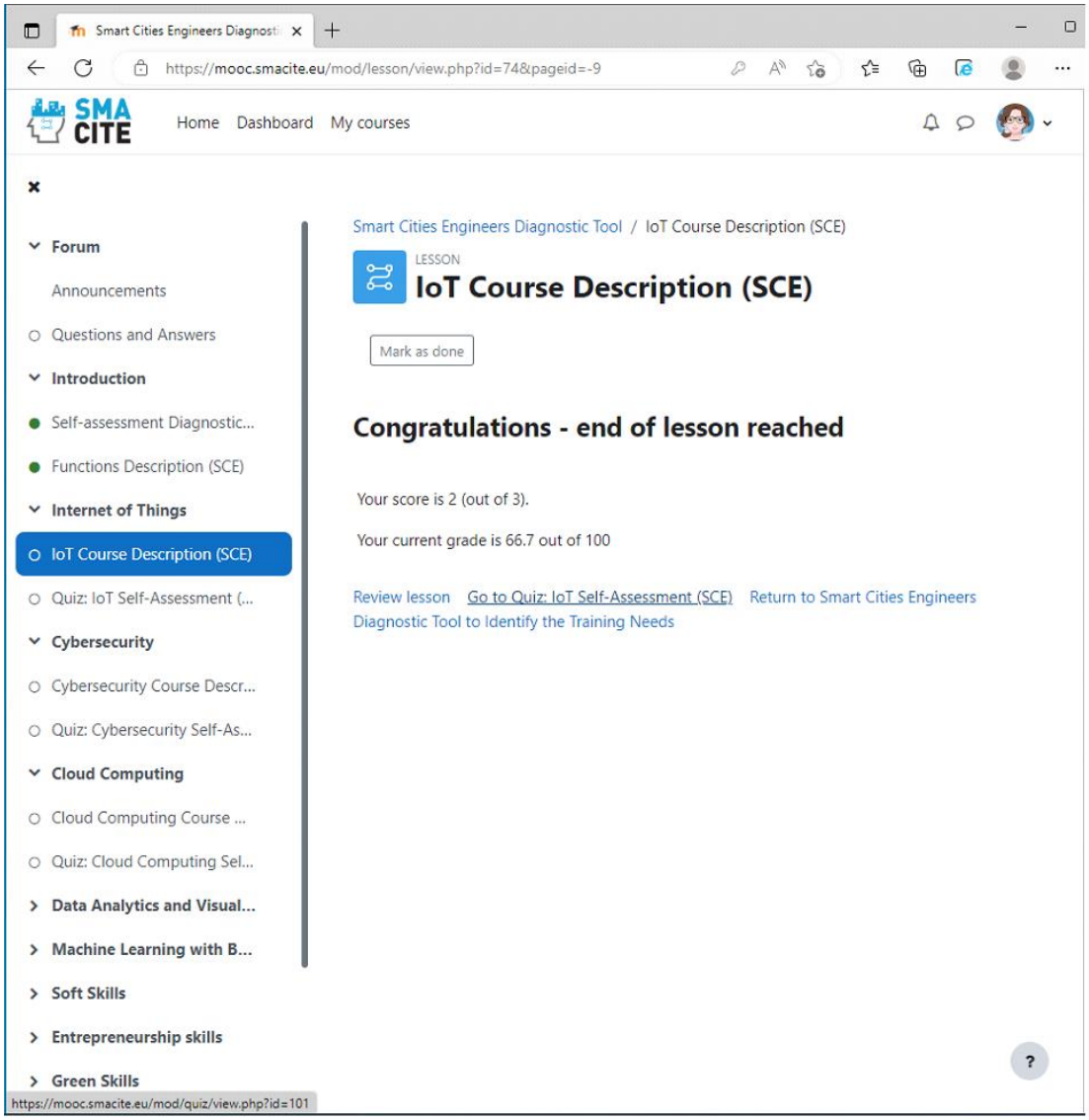

Figure 12 End of lesson with redirection to the Quiz

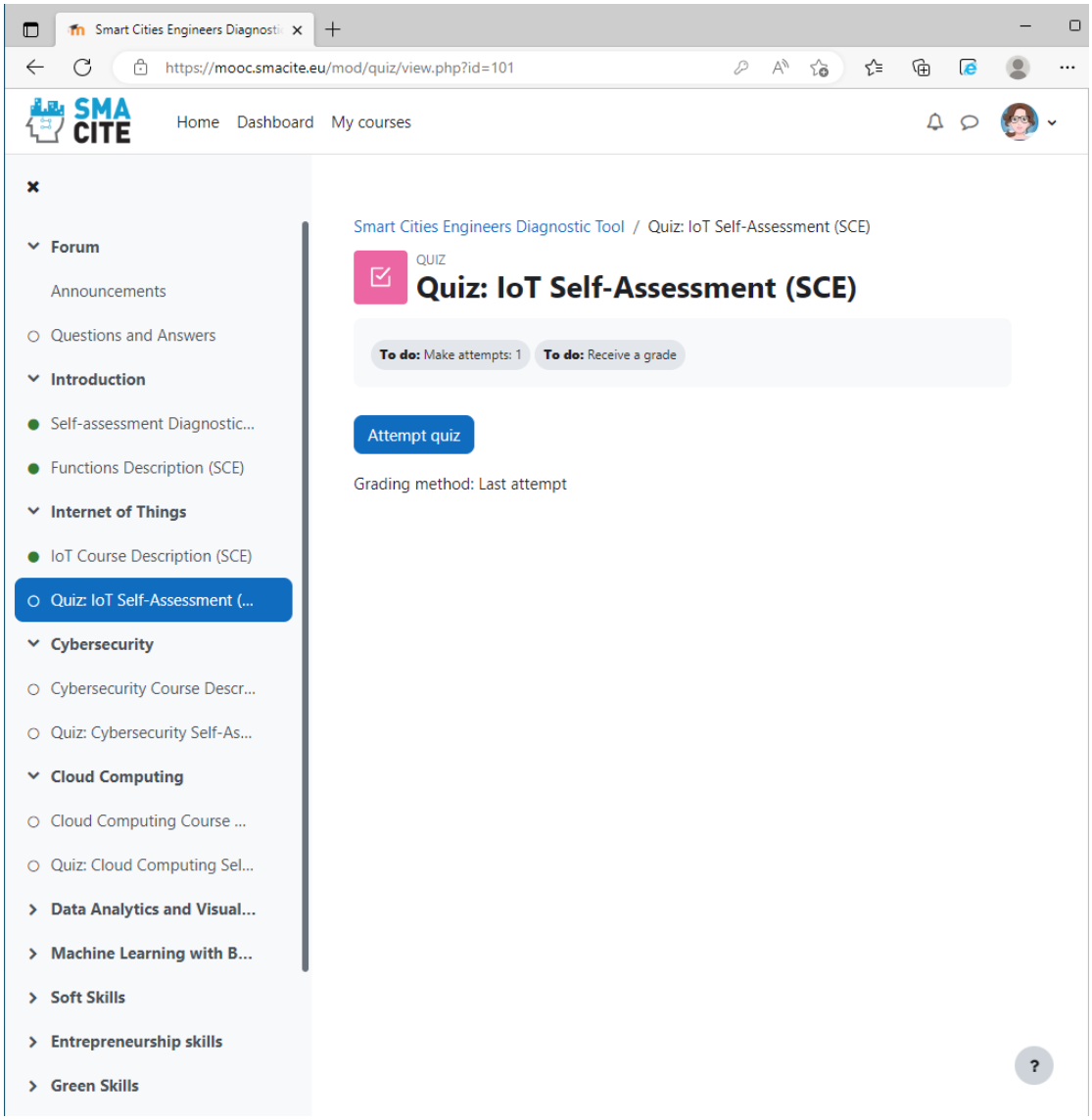

Figure 13 Quiz Entry Screen

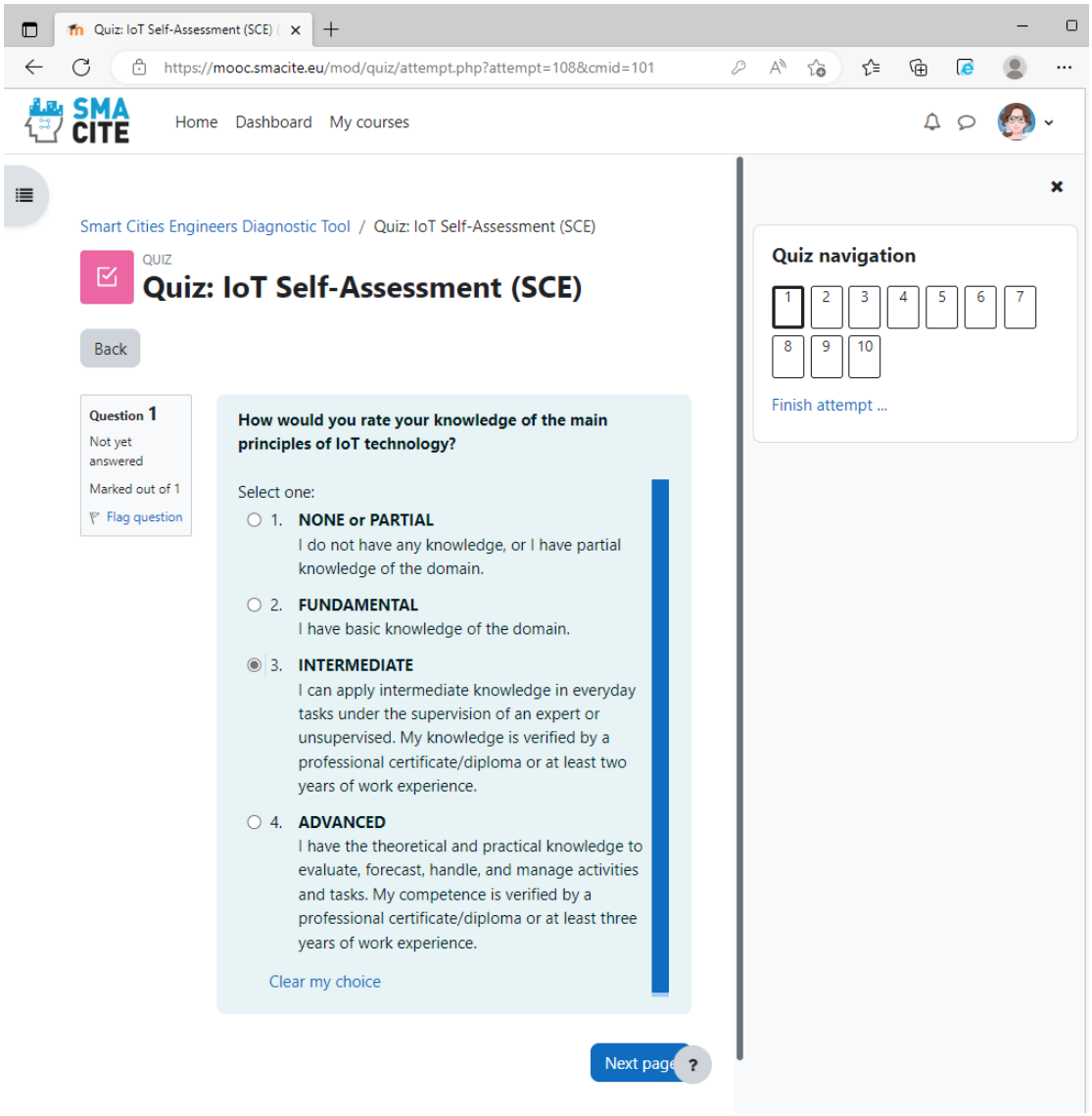

Figure 14 Quiz question 1

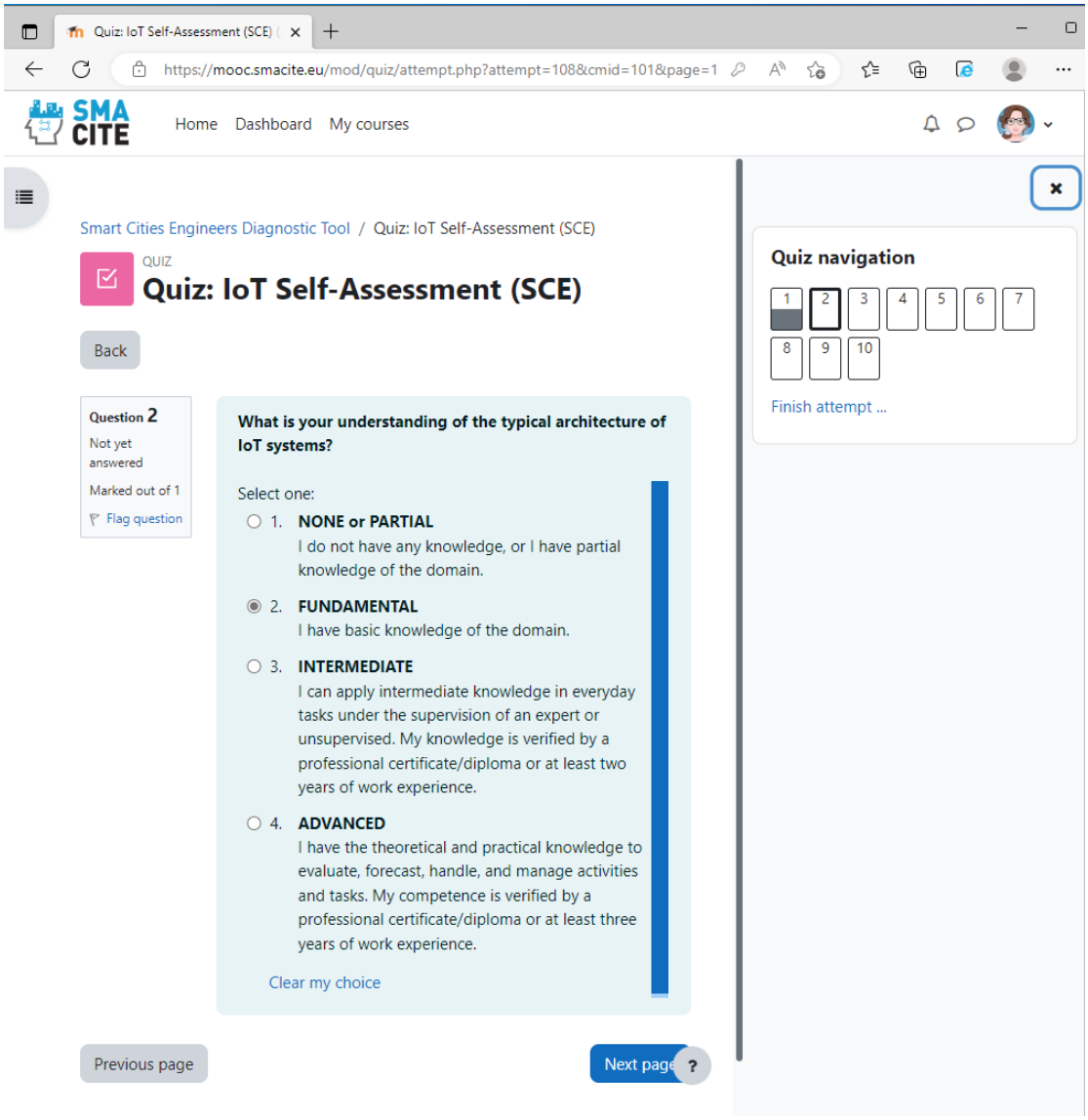

Figure 15 Quiz question 2

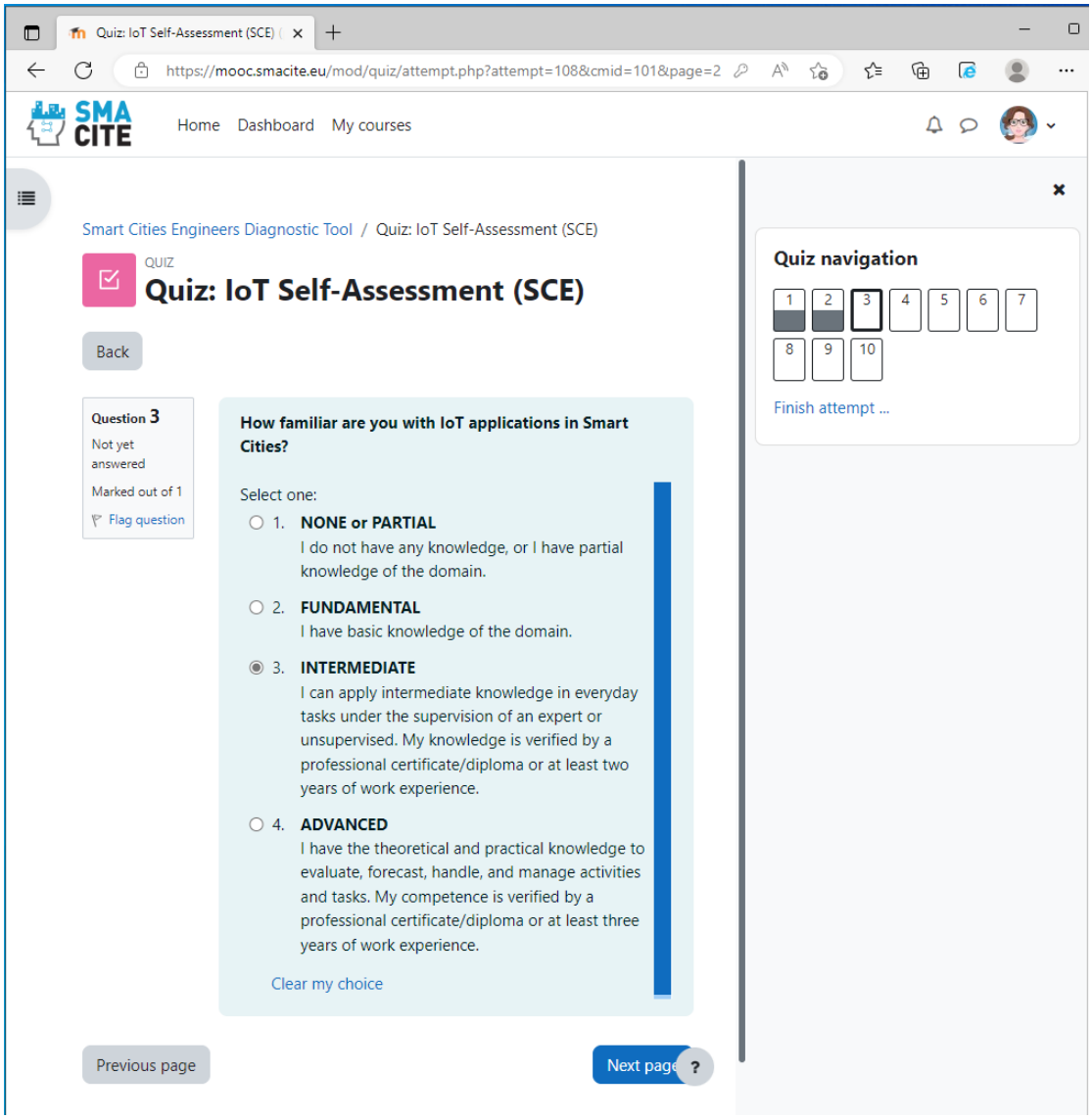

Figure 16 Quiz question 3

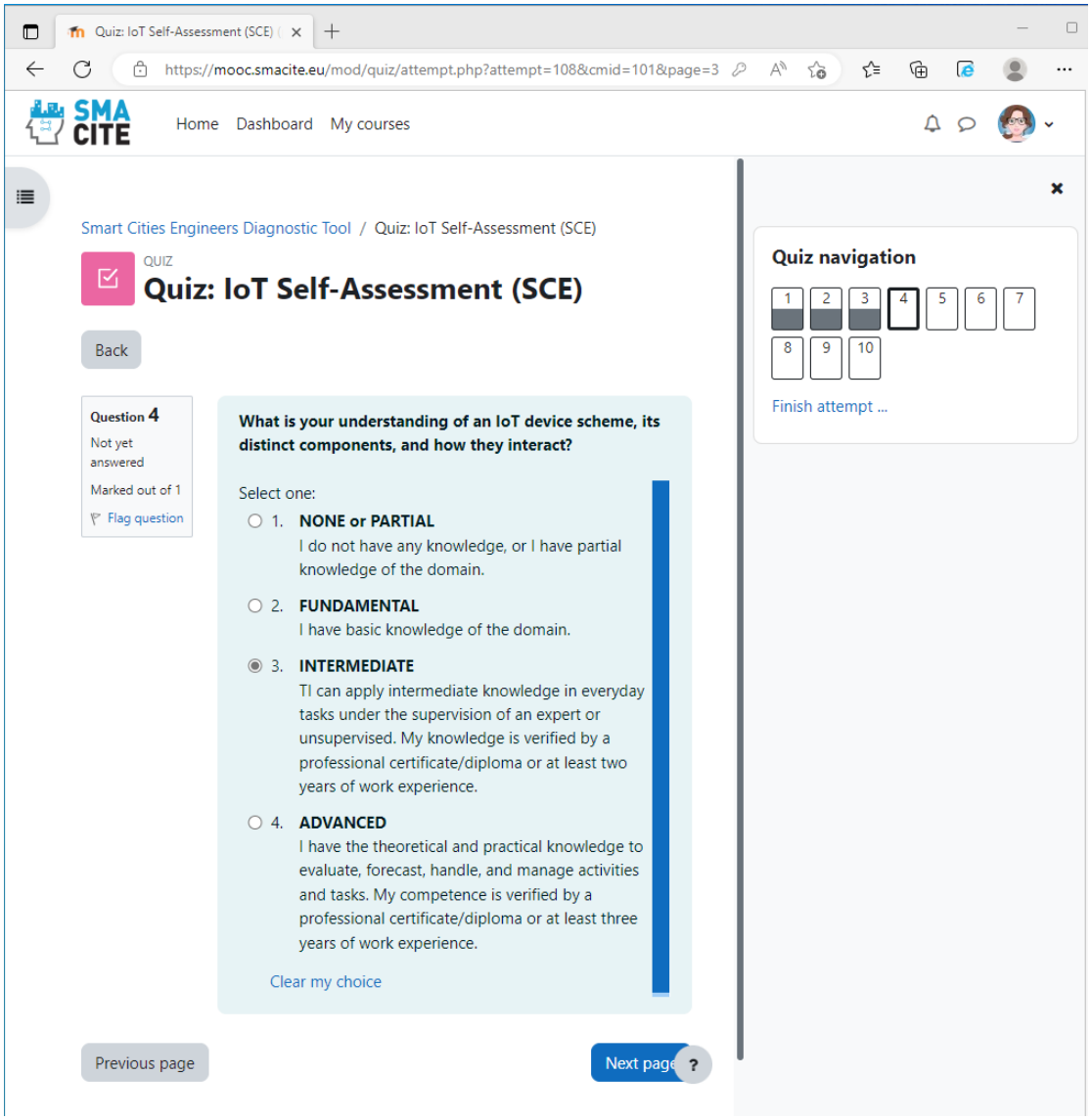

Figure 17 Quiz question 4

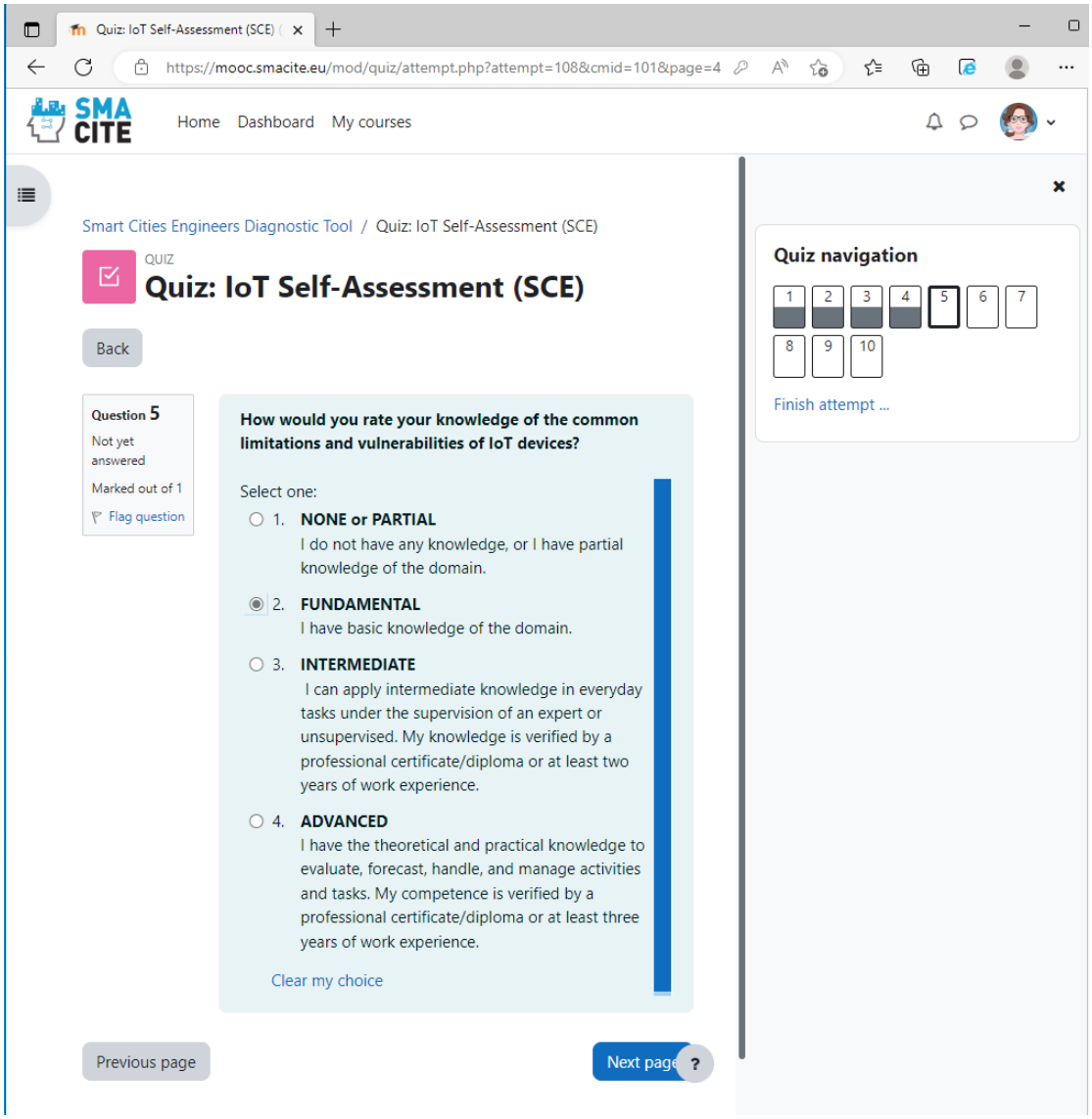

Figure 18 Quiz question 5

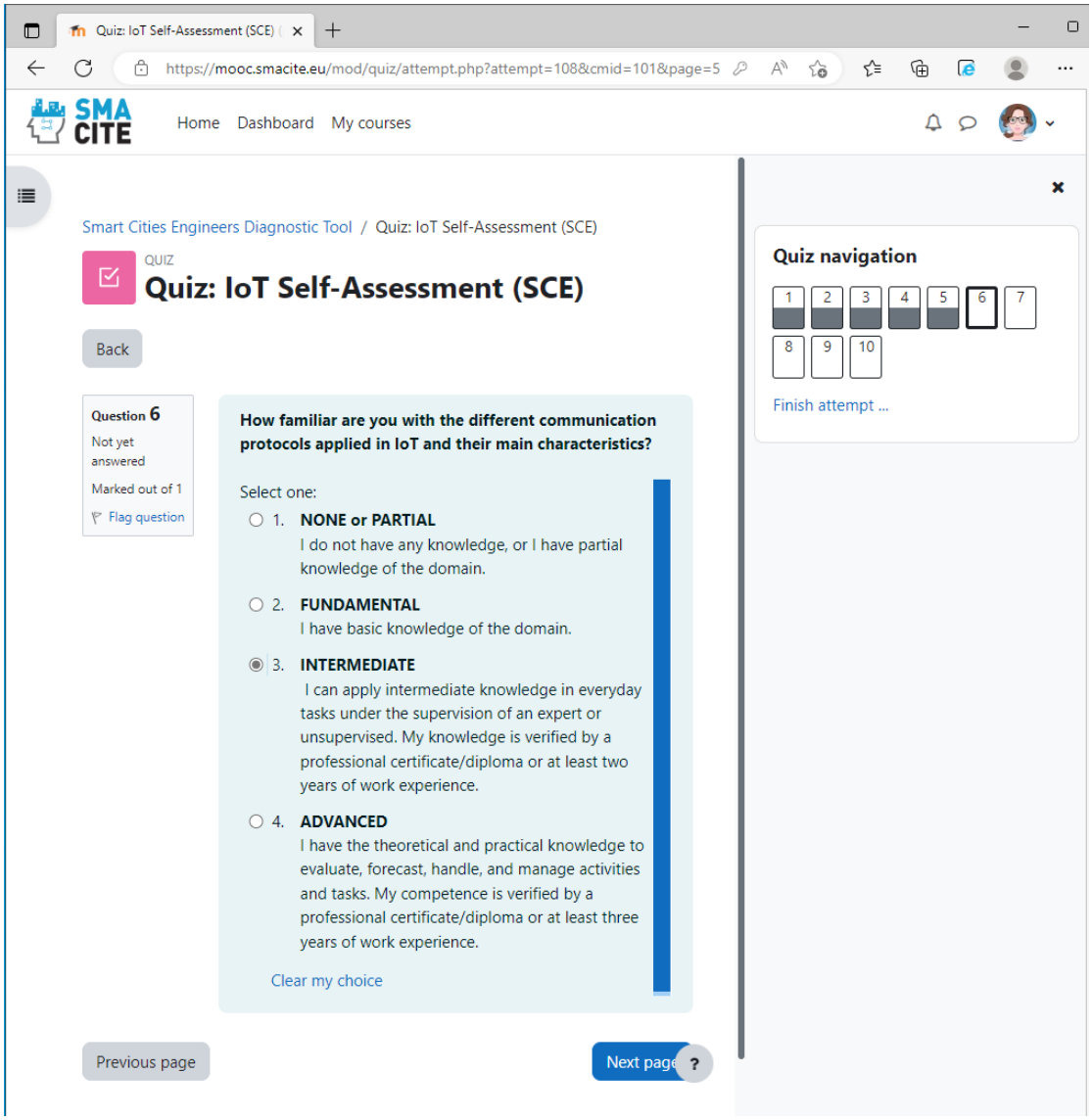

Figure 19 Quiz question 6

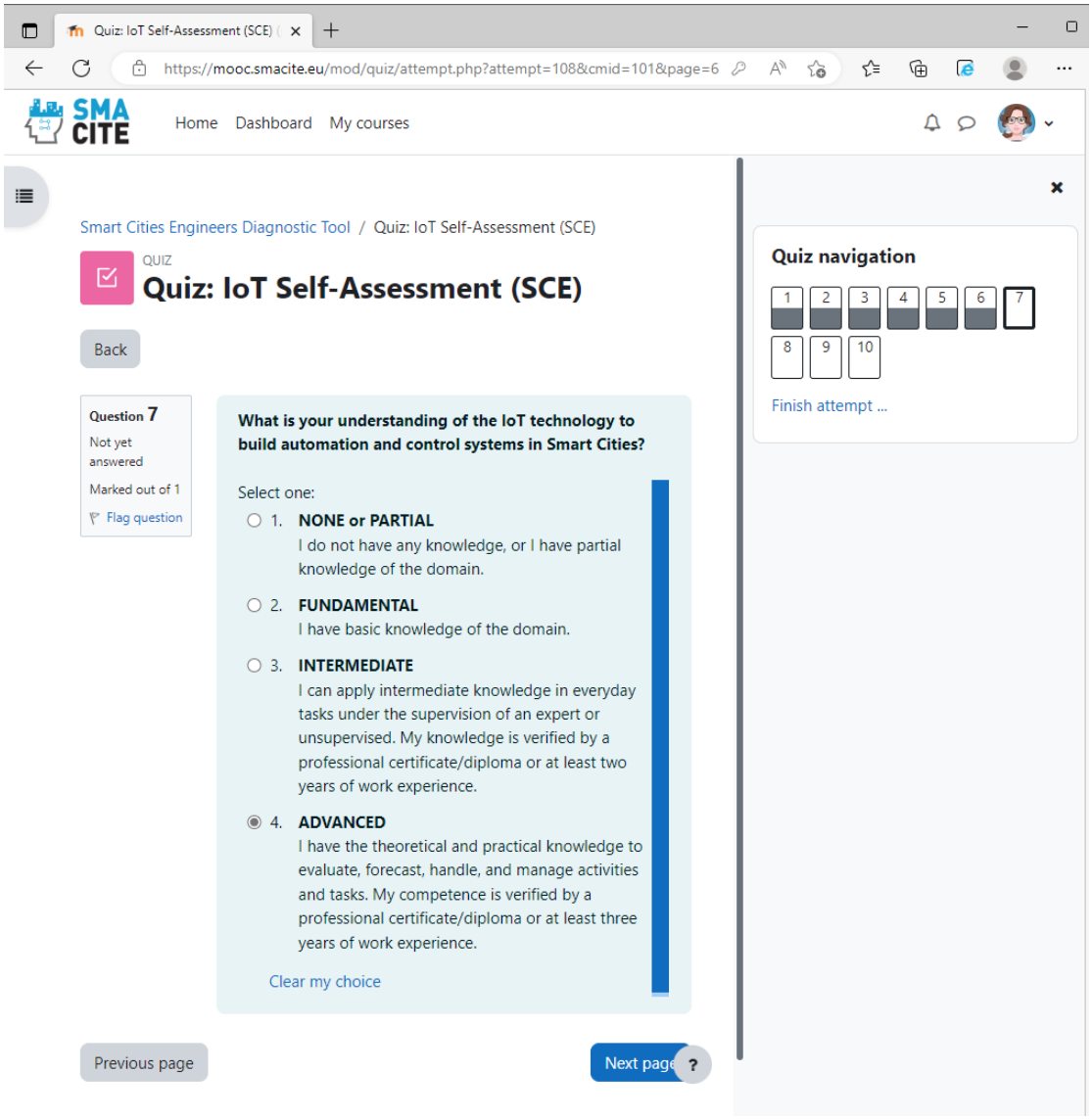

Figure 20 Quiz question 7

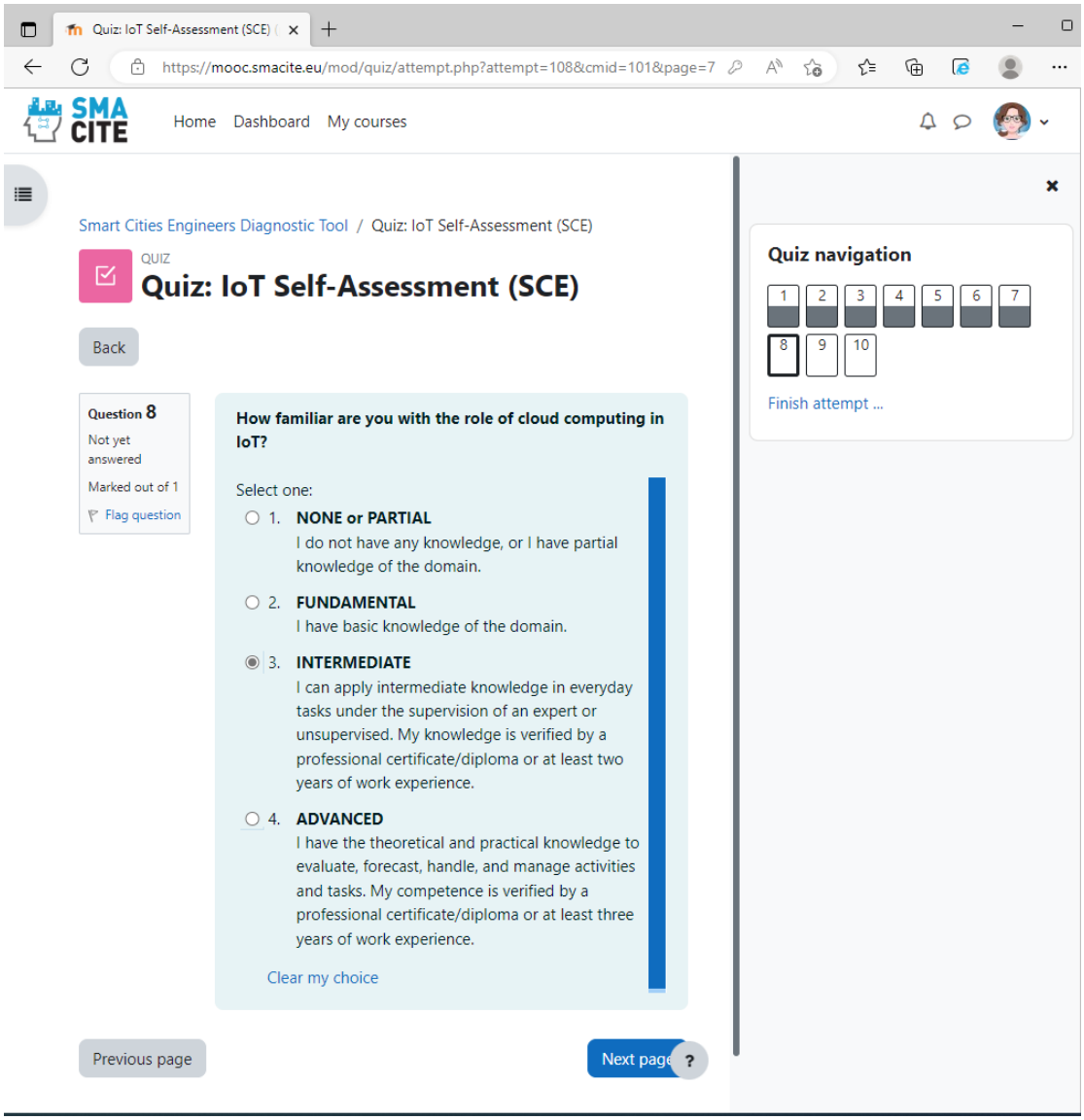

Figure 21 Quiz question 8

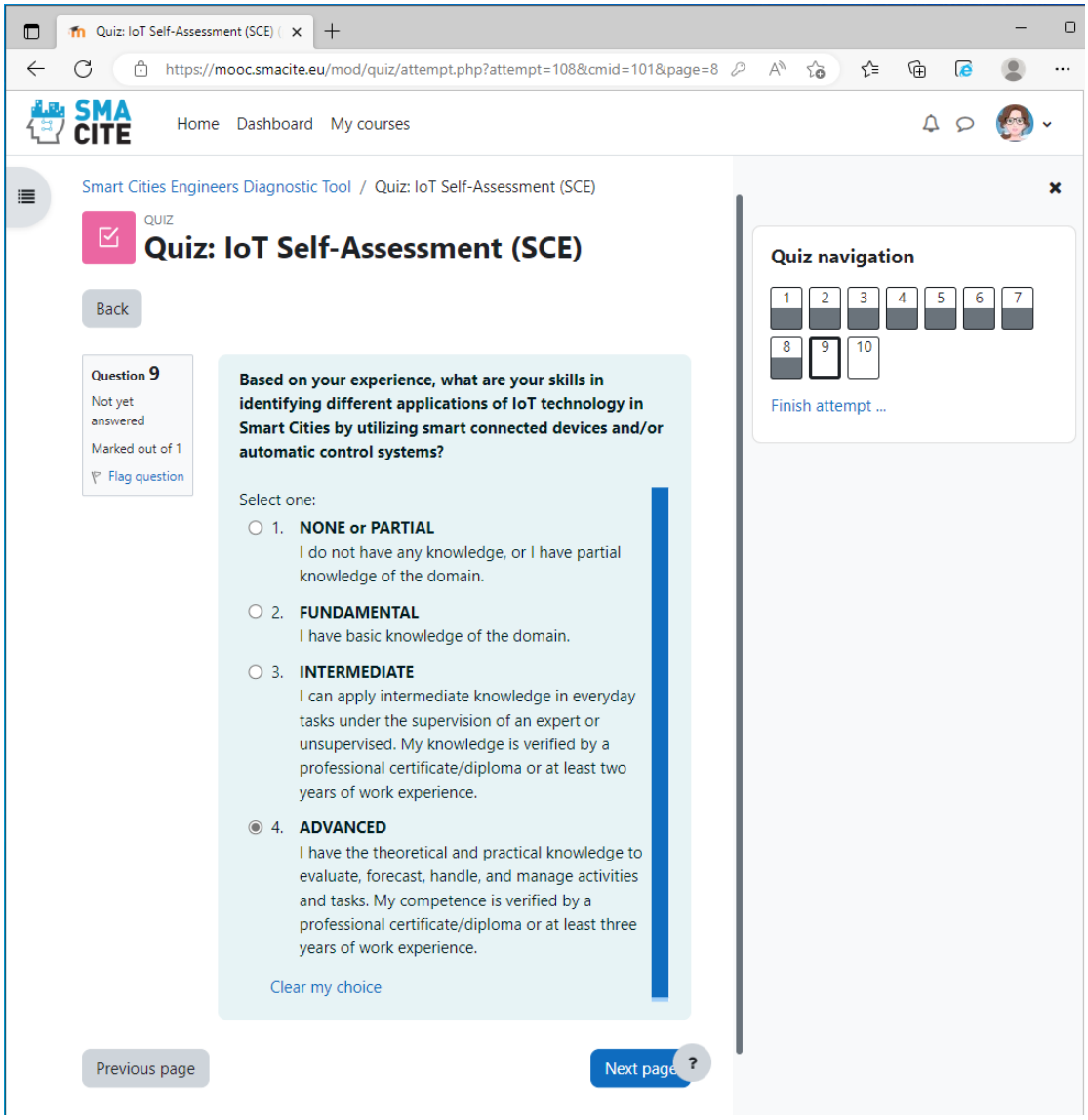

Figure 22 Quiz question 9

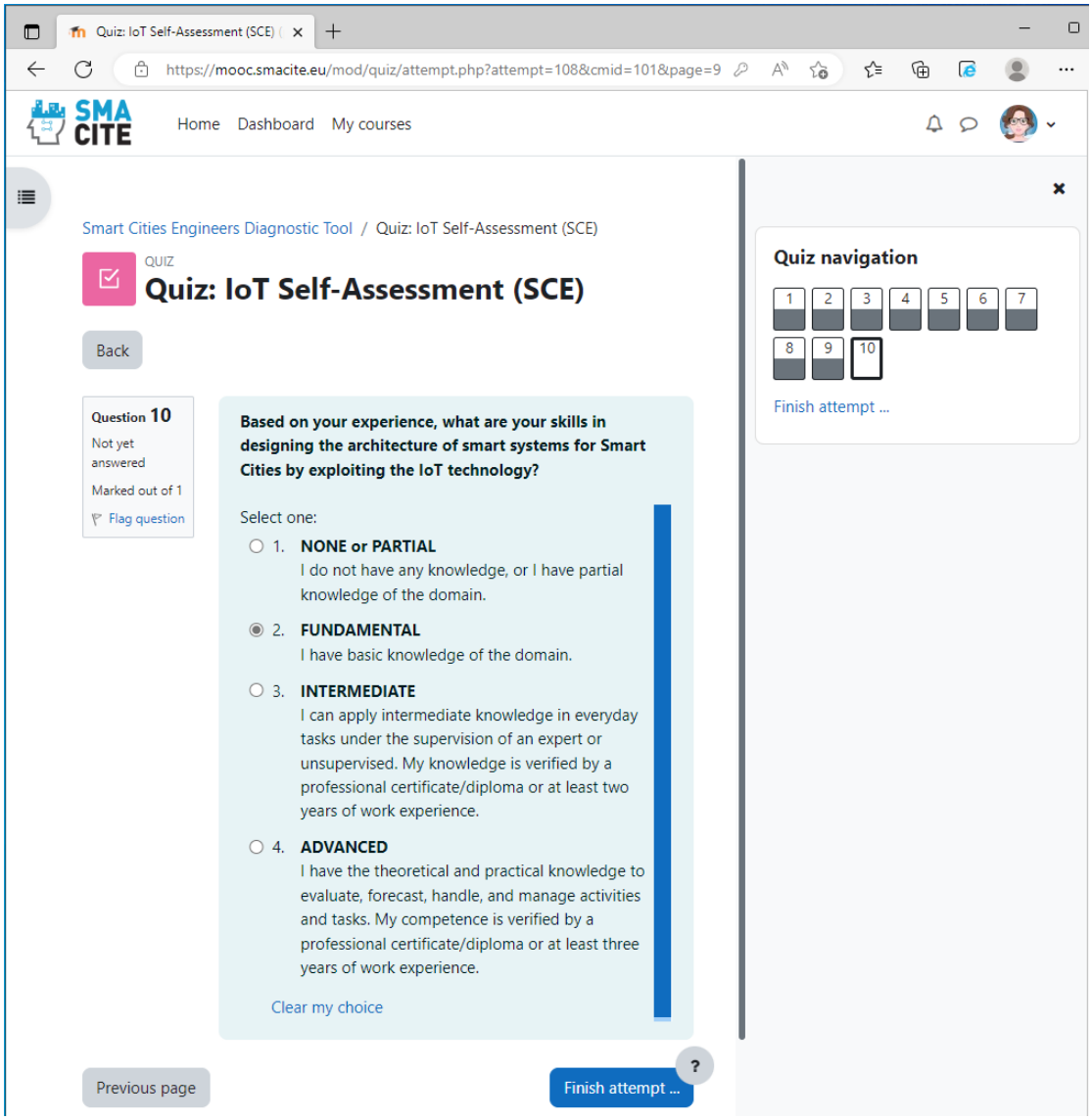

Figure 23 Quiz question 10

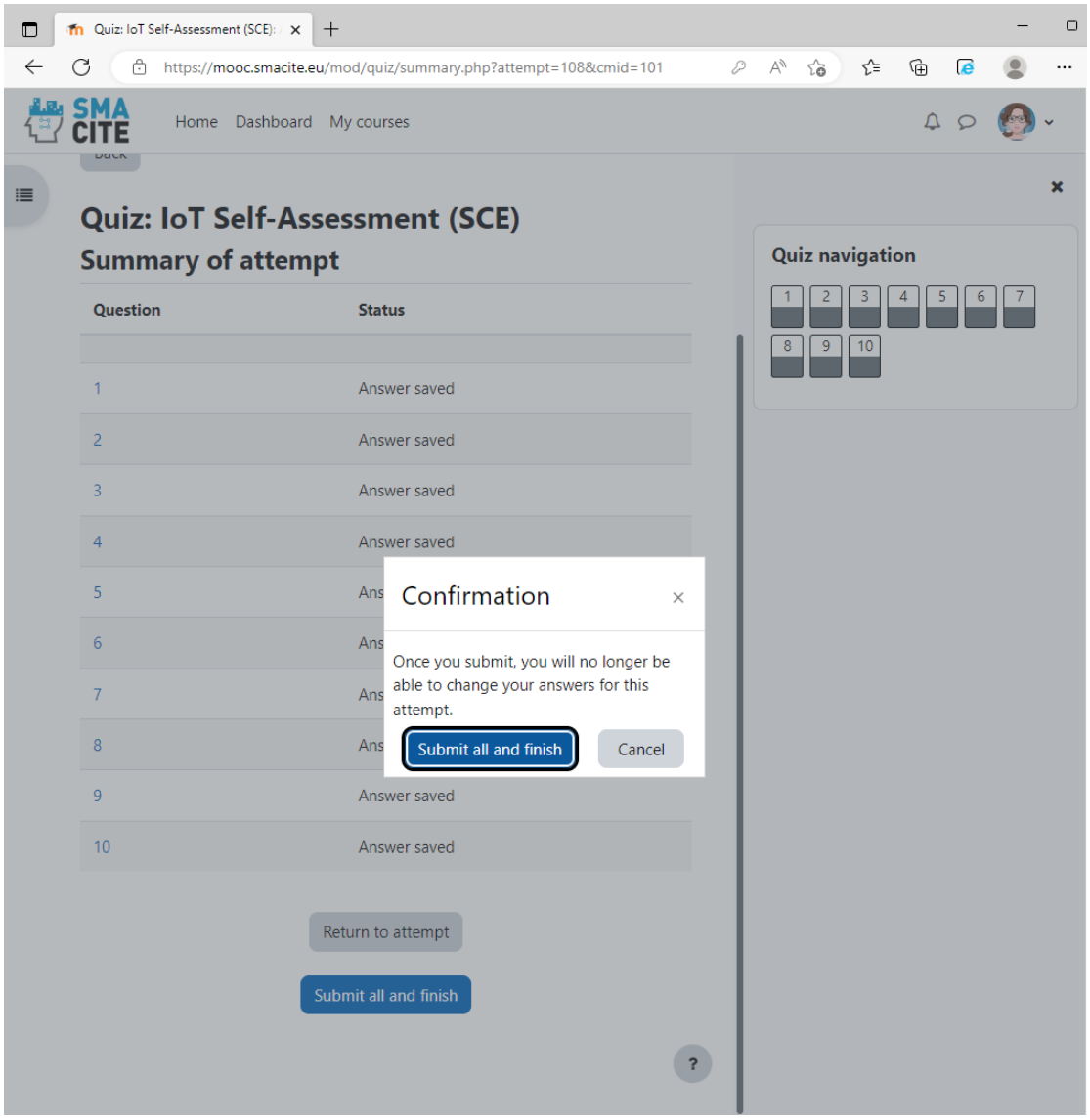

Figure 24 Quiz submission

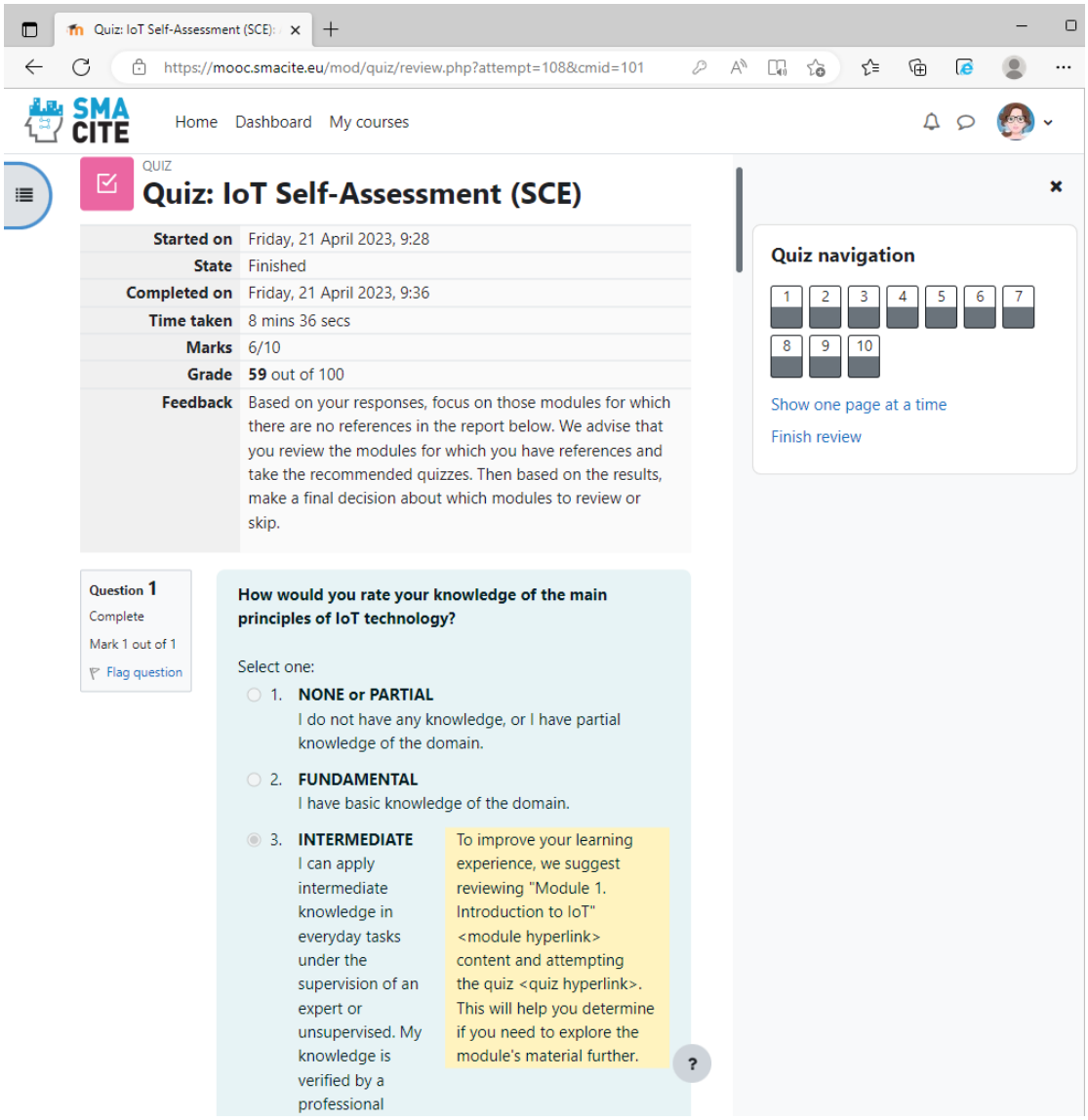

Figure 25 Quiz report with detailed results and recommendations on course and modules levels

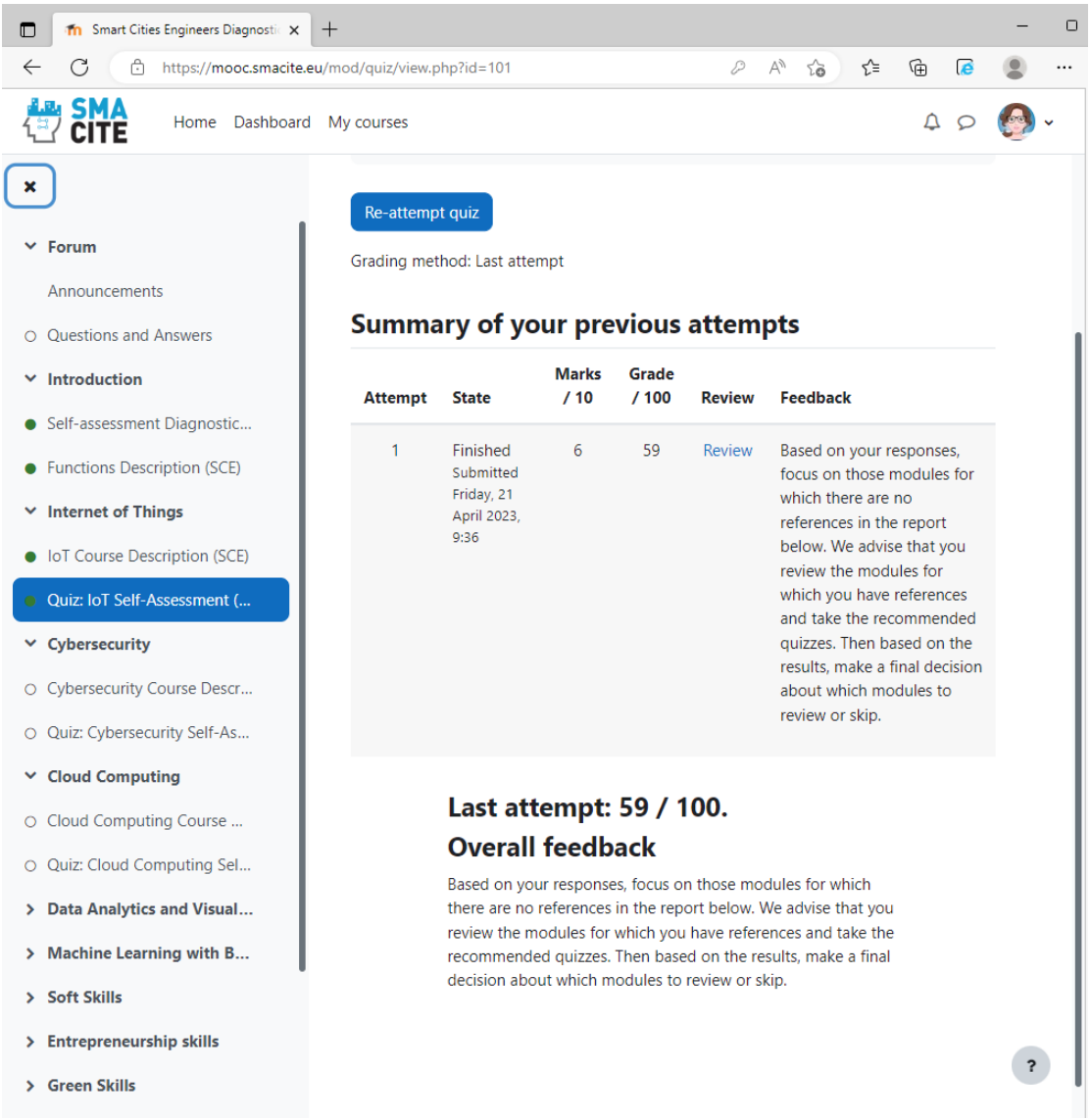

Figure 26 Quiz list of attempts with summary results and general recommendation on course level

Annex 2 Diagnostic Web Tool Structure for Internet of Things Course for Smart Cities Engineers

The Annex illustrates the web-based tool by presenting direct export for Internet of Things course. The remaining courses Cybersecurity, Cloud computing, Data analytics and visualization, Machine Learning and Big Data for engineers and Internet of Things, Cybersecurity, Cloud computing, Data analytics and visualization, Machine Learning and Big Data for engineers have the same structure. All the content of those courses is presented in D2.1, D2.2, and D4.1

Smart Cities Engineer Profile Introduction Pages

Self-assessment Diagnostic Tool (SCE)

Personalization is key to engaging learners in the training and learning process. This diagnostic tool was developed to help you, individual learners, identify your training needs based on your previous knowledge, skills, and competences. The diagnostic tool is structured around the knowledge and skills defined in the SMACITE **"Smart Cities Engineer" (SCE)** job profile.

This tool is organized by training topics, corresponding to the courses in the SMACITE curriculum. Each topic consists of two sections.

The first one, organized a lesson named "course description", aims to help you, as a learner, to understand the Smart Cities Engineer job profile. You will gain an insight into the specific knowledge and skills required to work in Smart Cities, through the lens of each different topic.

The second one will invite you to take a quiz to assess your own knowledge and skills in that particular domain. The questions are designed to help you identify your strengths and weaknesses regarding the target competences for Smart Cities Engineers.

Taking the quiz can be a valuable exercise in introspection and can help you take a proactive approach to your own learning and development. It can also be a valuable resource for identifying career paths and job opportunities in Smart Cities. Last but not least, based on your knowledge and skills self-evaluation, the tool will provide you with recommendations on what modules from the course you might consider skipping or reviewing.

Please note that the tool is designed for your information only. In the end of the day, you are the one to decide which modules and courses to take, regardless of the recommendation given by the tool.

Functions Description (SCE)

As a Smart Cities Engineer, you will have functions as follows:

- Design, plan, and develop technical and engineering specifications and solutions for projects from infrastructure, optimising materials and integrating specifications and resource allocation within time constraints.
- Oversee the project on a daily basis. Responsible for high-quality results within objectives and constraints, ensuring effective use of resources. Responsible for risk and issue management, communication and stakeholder management.
- Design, plan, manage and maintain cloud-based systems. Responsible for developing, implementing and debugging cloud applications and handling the migration of applications to cloud.
- Advise and implement solutions to control access to data and programs and ensure the protection of processes. Responsible for the protection and security of systems and networks and design, plan and execute the system's security architecture, with models and security policies and procedures.
- Collect and interpret rich data sources, manage large amounts of data, merge sources, ensure consistency and create visualizations to aid in understanding data using mathematical models and communicate insights and findings to team and, if required, to non-experts and recommend ways to apply data.
- Design, integration and acceptance testing of automation systems integrating connected devices and smart appliances within residential facilities. Work with key stakeholders to ensure the desired project outcome including wire design, layout, appearance and component programming.

IoT Course Description (SCE) Lesson

Internet of Things for SCE Course Description

The course deals with Internet of Things (IoT) technology. It presents the main principles and limitations of IoT technology, as well as the IoT architecture. Emphasis is placed on the architecture and different components of IoT devices, the communication technologies employed by the IoT, the use of IoT technology for developing automatic control systems, and the integration between IoT and cloud computing.

The course learning objectives are:

- Make the students familiar with the fundamentals of IoT technology, including the different hardware and software components, the IoT architecture and the data flow and messaging protocols
- Discuss IoT applications in Smart Citie
- Describe the architecture, different components and vulnerabilities of IoT devices
- Present the different communication protocols available for IoT
- Explain how IoT technology can be exploited to design automatic control systems for Smart Cities
- Explain the interconnection between the IoT and the cloud

The course consists of the following modules:

- Introduction to IoT
- IoT Devices
- IoT Communications
- IoT for automation and control
- IoT Cloud
- Revision

Do you want to try answering several IoT related questions?

These questions would help you to understand better the scope and level of detail of the IoT curricula.

Note: You'll have 2 attempts available to answer sample questions. After that, even if you chose "Yes, let me try to answer a few questions", you'll be directed to the next page of the lesson".

Description/Jump

Yes, let me try to answer a few questions.

No, let me go to the next page.

Cluster 1

Q1 Internet of Things

What is IoT? (single choice)			*MC*
		Default mark:	1
		Shuffle the choices?	Yes
		Number the choices?	A
		Penalty for each incorrect try:	33.3
		ID number:	
#	**Answers**	**Feedback**	**Grade**
A.	Network of physical objects embedded with sensors	That's right :) Bravo!	*100*
B.	Network of virtual objects	That's not a correct answer. You can try again.	*0*
C.	Network of objects in the ring structure	That's not a correct answer. You can try again.	*0*
D.	Network of sensors	That's not a correct answer. You can try again.	*0*
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

Q2 Internet of Things

What is the component of an IoT system that executes a program? (single choice)			*MC*
		Default mark:	1
		Shuffle the choices?	Yes
		Number the choices?	A
		Penalty for each incorrect try:	33.3
		ID number:	
#	**Answers**	**Feedback**	**Grade**
A.	A sensor	That's not a correct answer. You can try again.	*0*
B.	An actuator	That's not a correct answer. You can try again.	*0*
C.	A digital to analog converter	That's not a correct answer. You can try again.	*0*
D.	A microcontroller	That's right :) Bravo!	*100*
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

End of cluster 1

Cluster 2

Q3 Internet of Things

Which of the following are low-power wide-area network technologies used in IoT? (choose two answers)			*MA*
		Default mark:	2
		Shuffle the choices?	Yes
		Number the choices?	A
		Penalty for each incorrect try:	33.3
		ID number:	
#	**Answers**	**Feedback**	**Grade**
A.	Ethernet	That's not a correct answer. You can try again.	*0*
B.	LoRa	That's right :) Bravo!	*50*
C.	Sigfox	That's right :) Bravo!	*50*
D.	IEEE 802.11	That's not a correct answer. You can try again.	*0*
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

Q4 Internet of Things

Which of the following is a common use case for edge computing in IoT systems? (single choice)			*MC*
		Default mark:	1
		Shuffle the choices?	Yes
		Number the choices?	A
		Show the number of correct responses once the question has finished:	Yes
		Penalty for each incorrect try:	33.3
		ID number:	
#	**Answers**	**Feedback**	**Grade**
A.	Remote device management and monitoring	That's not a correct answer. You can try again.	*0*
B.	Real-time data processing and analysis	That's right :) Bravo!	*100*
C.	Cloud-based data storage and retrieval	That's not a correct answer. You can try again.	*0*
D.	Long-term trend analysis and forecasting	That's not a correct answer. You can try again.	*0*
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	For any partially correct response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

End of cluster 2

Cluster 3

Q5 Internet of Things

What is an actuator? (single choice)			*MC*
		Default mark:	1
		Shuffle the choices?	Yes
		Number the choices?	A
		Show the number of correct responses once the question has finished:	Yes
		Penalty for each incorrect try:	33.3
		ID number:	
#	**Answers**	**Feedback**	**Grade**
A.	A sensing device that collects industrial data	That's not a correct answer. You can try again.	*0*
B.	A device that acts as a IoT controller	That's not a correct answer. You can try again.	*0*
C.	A component of a IoT device that acts as the gateway between the sensors and the cloud	That's not a correct answer. You can try again.	*0*
D.	A component of a machine that is responsible for moving and controlling a mechanism or system	That's right :) Bravo!	*100*
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	For any partially correct response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

Q6 Internet of Things

Which of the following is false about IoT devices? (single choice)			*MC*
		Default mark:	1
		Shuffle the choices?	Yes
		Number the choices?	A
		Show the number of correct responses once the question has finished:	Yes
		Penalty for each incorrect try:	33.3
		ID number:	
#	**Answers**	**Feedback**	**Grade**
A.	IoT devices are completely safe	That's right :) Bravo!	*100*
B.	IoT devices use the internet for collecting and sharing data	That's not a correct answer. You can try again.	*0*
C.	IoT devices need microcontrollers	That's not a correct answer. You can try again.	*0*
D.	IoT devices use wireless technology	That's not a correct answer. You can try again.	*0*
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	For any partially correct response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

End of cluster 3

Internet of Things for SCE Knowledge and Skills

The Internet of Things (IoT) Knowledge, as defined by the SMACITE curricula, includes principles, requirements, limitations, and vulnerabilities of smart connected devices and automatic control systems for digital control, distribution saving, and use of energy and information management.

The Internet of Things (IoT) Skills, as defined by the SMACITE curricula, include designing and calculating smart systems based on grid load, duration curves, energy simulations, etc. LE

Do you have knowledge and skills in the Internet of Things (IoT) domain as described in the paragraphs above?

Description/Jump

NO, I don't have.

YES, I have.

Previous page

We recommend you to take the IoT quiz

Completing the IoT Quiz will help you identify your strengths and weaknesses regarding the target competences for IoT in the Smart Cities domain.

Answering the questionnaire can be a valuable self-assessment exercise and help you take a proactive approach to your own learning and development.

The quiz is structured around the following knowledge and skills:

(knowledge)

- K.A1: Know the main principles of IoT technology
- K.A2: Learn the typical architecture of IoT
- K.A3: Be familiar with IoT applications in Smart Cities
- K.A4: Learn the architecture of an IoT device, its distinct components, and how they interact
- K.A5: Know the typical limitations and vulnerabilities of IoT devices
- K.A6: Be familiar with the different communication protocols applied in IoT and their main characteristics
- K.A7: Learn how they can use the IoT technology to build automation and control systems in Smart Cities
- K.A8: Be familiar with the role of cloud computing in IoT

(skills)

- S.A1: Identify different applications of IoT technology in Smart Cities by utilising smart connected devices and automatic control systems
- S.A2: Design the architecture of smart systems for Smart Cities by exploiting the IoT technology

LE

Description/Jump

Previous Page

End of lesson

We recommend you to take the complete IoT course. You might skip the IoT quiz.

It seems you do not have systematic knowledge and skills in IoT for Smart Cities. In that case, you might not need to take the IoT quiz.

By completing the course, you will gain the following knowledge and skills:

(knowledge)

- K.A1: Know the main principles of IoT technology
- K.A2: Learn the typical architecture of IoT
- K.A3: Be familiar with IoT applications in Smart Cities
- K.A4: Learn the architecture of an IoT device, its distinct components, and how they interact
- K.A5: Know the typical limitations and vulnerabilities of IoT devices
- K.A6: Be familiar with the different communication protocols applied in IoT and their main characteristics
- K.A7: Learn how they can use the IoT technology to build automation and control systems in Smart Cities
- K.A8: Be familiar with the role of cloud computing in IoT

(skills)

- S.A1: Identify different applications of IoT technology in Smart Cities by utilising smart connected devices and automatic control systems
- S.A2: Design the architecture of smart systems for Smart Cities by exploiting the IoT technology

If you find out that you are knowledgeable in some of the knowledge and skills listed above, you might decide to take the quiz. Answering the questionnaire can be a valuable self-assessment exercise and help you take a proactive approach to learning and development through tips on which modules you can pay less attention to and which modules to focus your efforts on.

LE

Description/Jump

Previous Page

End of Lesson

Annex 3 Self-assessment Quiz Questions IoT

top/Diagnostic Tool (DT)
top/Diagnostic Tool (DT)/IoT Engineer DT
IoT_KA1: Know the main principles of IoT technology

How would you rate your knowledge of the main principles of IoT technology?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA1
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 1. Introduction to IoT" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to explore the module's material further.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 1. Introduction to IoT" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA2: Learn the typical architecture of IoT

What is your understanding of the typical architecture of IoT systems?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA2
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		10
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 1. Introduction to IoT" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to explore the module's material further.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 1. Introduction to IoT" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA3: Be familiar with IoT application in Smart Cities

How familiar are you with IoT applications in Smart Cities?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA3
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 1. Introduction to IoT" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to explore the module's material further.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 1. Introduction to IoT" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA4: Learn the architecture of an IoT device, its distinct components and how they interact

What is your understanding of an IoT device scheme, its distinct components, and how they interact?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA4
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE TI can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 2. IoT Devices" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to further explore the module's material.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 2. IoT Devices" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA5: Know the common limitations and vulnerabilities of IoT devices

How would you rate your knowledge of the common limitations and vulnerabilities of IoT devices?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA5
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		10
B	FUNDAMENTAL I have basic knowledge of the domain.		33.3
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest "Module 2. IoT Devices" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to explore the module's material further.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 2. IoT Devices" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA6: Be familiar with the different communication protocols applied in IoT and their main characteristics

How familiar are you with the different communication protocols applied in IoT and their main characteristics?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA6
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 3. IoT Communications" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to further explore the module's material.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 3. IoT Communications" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA7: Learn how they can use the IoT technology to build automation and control systems in Smart Cities

What is your understanding of the IoT technology to build automation and control systems in Smart Cities?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA7
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		10
B	FUNDAMENTAL I have basic knowledge of the domain.		33.3
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 4. IoT for automation and control" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to further explore the module's material.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "4 IoT for automation and control" <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_KA8: Be familiar with the role of cloud computing in IoT

How familiar are you with the role of cloud computing in IoT?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_KA8
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 5. IoT Cloud" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to further explore the module's material.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 5. IoT Cloud" <module hyperlink>. If you are not sure, you might take the quiz after the module to evaluate your proficiency in the topic. Based on your performance on the quiz <quiz hyperlink>, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_SA1: Identify different applications of IoT technology in Smart Cities by utilising smart connected devices and/or automatic control systems

Based on your experience, what are your skills in identifying different applications of IoT technology in Smart Cities by utilising smart connected devices and/or automatic control systems?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_SA1
#	Answers	Feedback	Grade
A	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
B	FUNDAMENTAL I have basic knowledge of the domain.		10
C	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 1. Introduction to IoT" <module hyperlink> and "Module 2 IoT Devices" content and attempting the quizzes <quiz hyperlink>, <quiz hyperlink>. This will help you determine if you need to further explore the module's material.	66.6
D	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 1. Introduction to IoT" <module hyperlink> and "Module 2 IoT Devices" <module hyperlink>. If you are not sure, you might take the quizzes <quiz hyperlink>, <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

IoT_SA2: Design the architecture of smart systems for Smart Cities by exploiting the IoT technology

Based on your experience, what are your skills in designing the architecture of smart systems for Smart Cities by exploiting the IoT technology?			MC
Default mark:			1
Shuffle the choices?			No
Number the choices?			1
Penalty for each incorrect try:			0
ID number:			IoT_SA2
#	Answers	Feedback	Grade
	NONE or PARTIAL I do not have any knowledge, or I have partial knowledge of the domain.		0
	FUNDAMENTAL I have basic knowledge of the domain.		10
	INTERMEDIATE I can apply intermediate knowledge in everyday tasks under the supervision of an expert or unsupervised. My knowledge is verified by a professional certificate/diploma or at least two years of work experience.	To improve your learning experience, we suggest reviewing "Module 1. Introduction to IoT" <module hyperlink> content and attempting the quiz <quiz hyperlink>. This will help you determine if you need to further explore the module's material.	66.6
	ADVANCED I have the theoretical and practical knowledge to evaluate, forecast, handle, and manage activities and tasks. My competence is verified by a professional certificate/diploma or at least three years of work experience.	You might skip "Module 1. Introduction to IoT " <module hyperlink>. If you are not sure, you might take the quiz <quiz hyperlink> after the module to evaluate your proficiency in the topic. Based on your performance on the quiz, you can make an informed decision about whether to review the module's content in greater detail or skip it altogether.	100
	General feedback:		
	For any correct response:		
	For any incorrect response:		
	Hint 1:		
	Show the number of correct responses (Hint 1):	No	
	Clear incorrect responses (Hint 1):	No	
	Tags:		
Allows the selection of a single or multiple responses from a pre-defined list. (MC/MA)			

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