



Project Number: 2022-1-HR01-KA220-VET-000086983

Funding Scheme: ERASMUS+ KA220

Activity 3.1. Defining Modalities of Instruction

PROJECT INFORMATION

Programme: Erasmus+

Action type: KA220-VET - Cooperation partnerships in vocational education and training

Project Title: Smart home models in VET

Acronym: Smart VET

Project Number: 2022-1-HR01-KA220-VET-000086983

Start Date: 15/10/2022

End Date: 14/10/2024

Duration: 24 months

National Agency: HR01 Agencija za mobilnost i programe Europske unije (AMPEU)

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Introduction

As a part of the Work package 3 Smart home VET programs several types of activities are to be implemented.

This includes activities:

3.1 Defining modalities of instruction

3.2 Development and accreditation of a short programme of studies on smart home technology

3.3 Smart Home Clubs programme development

3.4 Smart Home Clubs programme piloting and evaluation

3.5 Innovating existing courses with new smart home content

Defined modalities of instructions are to be implemented in developing programs, and instructional materials.

Modalities defined in this document are to be included in the document “Recommendations for developing and implementing courses about Smart Home technology”.

1. Types of modalities

There are many types of modalities available for the development of the different Smart Home programs being developed within this project. Here are only several we considered in development of the programs within the project.

Traditional Face-to-Face activities are always a good choice because it ensures time and space for teachers to keep track of the student's engagement and development of skills. However, student's may be absent for various reasons, some of them may need individualised pace of learning, and there are situations in which it might be difficult and complicated to organize in person work through the entire process.

This can be mitigated with online classes. Online or remote classes are a great alternative to in person lessons because it enables students to work from home if they are not able to attend lesson in school. Especially for the younger groups of students this modality might be challenging because they may need more structure and organization of the learning process than older students. It is also challenging for the teacher to keep track of the student progress and timely identify problems in the learning process.

Hybrid or Blended Learning combines face-to-face and online instruction, allowing more flexibility for students and teachers. It can be implemented in different ways for different groups and programs. Students can attend classes in the laboratory some days and on the others access the learning material and simulations remotely. It also has some organizational difficulties for the younger student groups so it should be carefully planned for them having individual needs in mind, and level of the course age appropriate. Additional benefit of the blended learning model is enabling students to develop social skills, cooperation and sense of community during in person lessons, and supporting their autonomy of study with online activities and individual work. During in person lessons, it is important to allow students to collaborate and develop their own plans for smart home technology implementation by building upon theoretical knowledge they are provided in the lesson and via created resources. It can be beneficial for students with learning difficulties as they are more able to work in their own pace that but still having teachers available to ensure this process. By integrating online learning and practical hands-on activities it is possible to accommodate better individual student needs, and to improve student engagement.

Flipped Classroom is a way for students to work with the material as a preparation for the lesson where they will be using the information for the more practical or collaborative activities. Although this modality is highly beneficial it is also important to assure that students have the means to do the preparational activities on their own (material to read, available devices and internet connection to stream video etc.)

Self-Directed Learning is approach more suitable for the adult learner group, but it can be applied with the gifted or highly motivated students as well. Students are guided through the process, but they are choosing the pace and the level of engagement. It is important to note this way of learning can be completely independent as learner organize their independent projects or use learning platforms.

Gamified Learning uses game elements to engage and motivate students. This modality is highly beneficial for younger students as using games can motivate them and help maintain focus. It can be applied in various ways such as having revised the content with quizzes, adding games as a part of the learning process or organize entire class with a point system.

Project-Based Learning is instructional approach in which learners actively engage with complex, real-world challenges over an extended period. This makes it ideal for implementation where students are expected to design system such as one of a smart home. Students need to research topic, resources, collaborate, evaluate task and results and create something new. It helps them develop problem solving skills which is one of the main thing labour market of 21st century requires.

Workshop concept can also be applied as a short, interactive learning experience focused on collaborative problem-solving. It is typically designed to engage participants actively through discussion, hands-on activities, or project-based tasks. It can be used for elementary school visits because it is time limited opportunity to showcase smart home concept and present VET programs.

2. Choice of Blended Learning as a main modality type

For most of the project activities are focused on secondary education students it was important to agree on the modality most suitable for them in the development of the Smart Home Club program. Also important to consider is modality suitable for adult learners in the short- term course on the Smart environments. As elementary school's students are visiting schools for different activities it is important to adapt modality of learning for them as well.

Blended learning as a main modality has been chosen to best accommodate most of the needs in the learning process for these groups with exception of the elementary school students.

In addition to the blended learning in some lessons there will be collaborative work, flipped classroom, workshop, and project-based learning. These modalities are also important to implement to smart home programs as it can help with class dynamics, student engagement and overall success of the program implementation.

Here are some recommendations when choosing modality of instruction:

- Use modalities that match individual student needs, improving engagement and outcomes.
- Select modalities that encourage interaction and hands-on learning.
- Integrate online and blended learning to maximize available tools
- Choose modalities that align with the specific objectives

3. Overview of learning programs and suggested modalities

3.1. Extracurricular activity Smart Home Club

Selected modality for the Smart Home Club is Blended learning model because it enables students to develop social skills, cooperation and sense of community during in person lessons, and supports their autonomy of study with online activities and individual work. Also, this model is more inclusive for students with learning difficulties enabling them to learn in their own pace with resources available online. During in person lessons, it is important to allow students to collaborate and develop their own plans for smart home technology implementation by building upon theoretical knowledge they are provided in the lesson and via created resources. By integrating online learning and practical hands-on activities it is possible to accommodate better individual student needs, and to improve student engagement.

3.1.1. Elementary school student activities and modalities suggested

Elementary school students are often visitors and participate in activities which are used to promote VET studies and new technology in general.

Table 1 - Suggested activities and modalities for elementary school students

Topic	Suggested modality
Introduction to Smart homes	Workshop
Safety procedures and equipment	Lesson
Basics of electrical installation	Lesson for theoretical part, Hands-on activity, laboratory practice, workshop
Basics of programming	Lesson for theoretical part, Hands-on activity, laboratory practice, workshop
Introduction to sensors and actuators	Lesson for theoretical part, Hands-on activity, laboratory practice, workshop
Developing parts of the small-scale smart home model using LittleBits kit or Micro:bit	Project based learning or workshop
Sustainability	Workshop
How to make my home smart home?	Group discussion

Activities can be implemented during elementary school visits, Open days, workshops etc. For younger student groups gamification can be useful to ensure engagement and motivation. It can be implemented through point system for group competitions on some tasks or organizing individual tasks as game, content revision with quizzes.

3.1.2. VET student activities and modalities suggested

Main modality for the VET students is blended with other types partially included to ensure class dynamics. Activities are suggested in the student e-book and combine online and in person activities. E-book can be used independently and as a part of the activity guided by teacher. All these activities can be online and in person, which enables flexibility with blended approach, either having blended individual lesson in several parts or having some lessons in person and some online. Learning materials created can be shared with students to prepare at home for some of the lessons as agreed with their teacher. There is an option to include gamification in the final project by voting on the best designed model or creating point system for engagement.

Table2 - Topics and modalities for the VET students

Topic	Suggested modality
Introduction to Smart homes and smart home technology	Workshop
Networking	Lesson + group discussion
WIFI	Lesson + group discussion
Bluetooth	Lesson + group discussion
Zigbee	Lesson + group discussion
KNX	Lesson + group discussion
DALI	Lesson + group discussion
HUB	Lesson + group discussion
Electrical installation and construction	Lesson+ practical laboratory work
Programming	Lesson+ practical laboratory work
Sustainability and economy of Smart Home implementation	Workshop
Smart home model development	Project based activity

3.2. Smart Environments short-term study programme

The goal is to educate personnel who will know how to: plan, design, implement, maintain, monitor and manage different types of smart environments (such as: smart homes, smart buildings, smart cities, smart factories, etc.). Also, they will know modern technologies and trends in the field of smart environments, as well as the principles of their operation. As students in this course are adult learners, they require more individual approach and self-paced learning. Course is organized in the evenings to accommodate the work schedule of employed students. On-the-job training is carried out at the end of the semester. Teaching is organized in three ways, namely: classically in the premises of the school, as distance learning and by combining these two methods implementing blended learning suggested for all the programs created.

Table 3 – List of courses

No.	Course title	Field	Semester	Number of classes	ECTS
1	Electrical installations and lighting	Technical and technological field	1	3+2 (weekly)	6
2	Process automation	Technical and technological field	1	3+2	6
3	Smart environments	Technical and technological field	1	3+2	6
4	Smart homes	Technical and technological field	1	3+2	6
5	Professional practice	Technical and technological field	1	60 (in total)	6
Active teaching classes in total				(12+8) x 15 = 300 + 60 = 360	
Total ECTS					30

Official website page where the programme is presented to potential participants: <https://vtsns.edu.rs/kratki-program-studija-pametna-okruzenja/>

3.3. Smart Home technician – specific VET module

Proposed vocational technician module that can be implemented in technician programs as a specialization module. It is also proposed to be blended course, however this may vary depending on regulations in the individual country. Duration is aligned with ECVET credit system. Specific vocational education modules are planned for 30 Credit Points, which is 750 hours. This course is for the students to be smart home installers and is suitable for the students who wish to get sufficient knowledge in the sphere of smart home systems installation.

Course objectives:

- To study the basics of designing and constructing the "Smart Home" system;
- To master the principles of calculation and the technology for collecting and configuring the "Smart Home" system.

Learning outcomes:

- Students can read and follow installation, architectural and project documentation;
- Students can use documentation keys, scales and revision numbers;
- Students can follow electrical and constructional health and safety procedures and policies for human safety and accident prevention;
- Students know the principles of safe isolation & accessory replacement;
- Students can connect and configure various network connected devices (e.g. typical domestic routers, network switches and wireless access points), securing a network using physical and cryptographic means;
- Students can install and test typical access control hardware;
- Students can install, configure, troubleshoot, maintain audio, video, and home entertainment systems;
- Students can install, configure and test communication devices;
- Students can use applicable test equipment to check compliance with agreed specifications;
- Students can make modifications to existing construction (e.g. drilling, channeling, cable running, choosing and using appropriate anchoring devices),
- Students can troubleshoot basic systems to rectify simple faults.

Table 4 – List of modules in Smart home technician specialization module

Knowledge Area	In-Class Instruction	Independent Work	Practical Work	Total Hours/Credit Points
Module 1: Introduction, overview of Smart Home systems, standards, and regulations.	21	4	0	25 / 1
Module 2: Information transfer protocols, network topology, and VPN connections	29	17	28	74 / 3
Module 3: Automatic control systems and equipment for the implementation of the Smart Home project	63	23	63	149 / 6
Module 4: Development of a Smart Home project based on an apartment or a detached house	38	23	88	149 / 6
Module 5: Creating a Smart Home prototype and setting up a Smart Home	19	38	191	248 / 10
Module 6: Economic and marketing analysis of the use of the Smart Home system	40	15	43	98 / 4
Total	210	120	413	750 / 30

Conclusion

For elementary school students it is important to stress safety procedures, basic concepts, demonstration exercises and comprehensive project ideas. This can be achieved with hands on approach and active learning methods enhanced with gamification. Content should be adapted to their level of knowledge and skills. VET students have more experience with this type of technology therefore, some of the content can be completely up to them enabling blended modality implementation and project based activities. Topics can be altered having in mind school's resources, student's vocation and age group, experience and knowledge and also motivation to learn new skills.

Higher education students or adult learners can benefit from the short course designed for them to acquire skills and knowledge needed and to apply it directly in the vocational practice. Their course is adapted to the needs of the labour market and individual needs of the student as they are often employed or have some other obligations during the day. Technician program is something to be considered in the future as in individual countries Smart Home technology and courses developed about it is recognized as an important topic to introduce future technicians to. Modality proposed is blended, however it can be adapted to individual country legislation if such option is not available in regular VET programs. Blended modality may be included by accommodating workhours for individual work that can be completed remotely through learning platform of choice. Project based activities are recommended as they promote student autonomy and real-life solutions.

Resources and References

Smart home technician program, 2023

Smart Environments short-term study programme, 2024

Smart Home Club extracurricular activity - lessons plan 2024

Learning styles and teaching methods

<https://www.europeanproceedings.com/article/10.15405/epsbs.2020.12.02.6>