IMPLEMENTATION OF INNOVATIVE TEACHING METHODS IN PROJECT «GSS-VET»

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Abstract*:* The paper contains instructions regarding the implementation of innovative teaching methods for vocational education and training on Renewable Energy Sources (RES). The use of innovative teaching methods has the opportunity not only to enhance educational process, but also to empower people, strengthen governance and provoke the effort to achieve the people development goal for the country. The purpose of this paper is to suggest useful innovative teaching methods that can be attempted in imparting knowledge to the learners.

Key words: flipped classroom, innovative teaching methods, ubiquitous learning

1. Introduction

The project Geothermal & Solar Skills Vocational Education and Training (GSS-VET) is an ERASMUS + project, developed up to Key Action 2 "Cooperation for innovation and exchange of good practices" KA2 - Sector Skills Alliances.

Partners of the project are: universities, energy centers, training and scientific institutions, national/international RES associations, chambers of commerce from Bulgaria, Greece, Germany and Spain.

Coordinator of the project is the Technological Educational Institute of Crete. The Bulgarian project partners are: the European Labour Institute, the Chamber of Installation Specialists in Bulgaria, Sofia Energy Centre Ltd., the Technical University of Sofia.

2. Project Aims and Work Packages Methodology

The general objective of the project is to tackle the existing skills gap in continuous training concerning geothermal and solar skills, by creating and implementing a demand driven vocational training for:

- electricians and plumbers working on geothermal and solar installations in the current construction industry to up-grade their skills;
- unemployed workers to get new skills and knowledge in geothermal and solar installations.

The training is in response of the targets set up by the EU Directive 2010/31/EU on the Energy Performance Buildings: all new buildings by 2020 to be nearly zero energy buildings.

GSS-VET plans the following outputs:

- Two EU core curricula for Geothermal and Solar energy systems installers;
- Innovative teaching method;
- Complete training material available online;
- On-line evaluation method;
- Certification of the training;
- Roadmap for the official recognition of the training by 2025;
- Network of VET providers implementing the GSS - VET training in eight EU countries.

As a background, the project Consortium has the task to study and determine the skills needed on the labour market for plumbers and electricians in the geothermal and solar fields and identify the gaps between existing trainings and needed trainings in continuous vocational training.

Eight work packages (WPs) make part of the project Action plan, each of them including specific tasks: WP1 – Project management; WP2 – Final definition of skills and creation of the European curricula for selected trades; WP3 - Development of innovative teaching methods; WP4 - Creation of training contents, qualification standards, and evaluation and recognition method; WP5 – Pilot; WP6 –

Mobilisation of stakeholders; WP7 - Dissemination and awareness rising; WP8 - Evaluation; Quality Management and Sustainability.

3. Innovative Methods of Teaching

The current educational methodology is a teacher-centered system, in which training occurs face-to-face between teacher and students and the lectured information is assimilated via homework. The training information is accessible to everyone, the training system is based on memorizing theory graded by examination, that is why the above pedagogical system is not enough efficient.

Due to the evidences commented above, new pedagogical methodologies, which integrate information and communication technologies (ICTs) have been developed. Those ICTs allow students learning anytime and anywhere [1]. The new methodologies are called "active methodologies", viewed as a constructivist, social-constructivist, and student-centered process whereby students should be active learners in a supportive environment.

Thus, in order to achieve the GSS-VET goals, the following active methodologies were selected: blended learning (BL), flipped learning (FL), ubiquitous learning (UL), work based learning (WBL), problem based learning (PBL) and challenge based learning (CBL).

Below is a short explanation of the above mentioned methodologies:

a) Blended Learning (BL)

According to the Clayton Christensen Institute, blended-learning is "a formal education program in which a student learns, at least in part, through online delivery of instruction and content, with some element of student control over time, place, path and pace, and at least in part in a supervised brick-and-mortar location away from, and the modalities along each student´s learning path within a course or subject are connected to provide an integrated learning experience". In short, it is a combination between in-person classes and e-learning activities that takes the advantages of both face-to-face and online instruction and combines them into a single training-model [2].

b) Flipped Learning (FL)

By definition [3] "flipped learning is a pedagogical approach in which direct instruct-tion moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter". That is, contrary to the traditional educational system, instead of learning theory in class and doing homework, students learn at home, by watching videos posted by the teacher, after that - in class they do exercises and review what the students have learned beforehand. In class are fulfilled face-to-face activities as presentations and team-based discussions.

c) Ubiquitous Learning (UL)

It is defined as learning anywhere and anytime, and is based on ubiquitous technology i.e. via any device, connected at any time, in any place and transferring any data format across any network. This methodology is based on the mobile technologies such as laptops, smartphones, tablets and wearable devices. In contrast of the traditional classroom static training, the ubiquitous-learning activities can be completed at any place and any time [4].

d) Work Based Learning (WBL)

It is the case when students are involved in real-life work experience. In order to apply academic and technical skills, and develop knowledge and employability, the work based learning, must blend theory and action. Theory makes sense only through practice, but practice makes sense only through reflection as enhanced by theory. Thus, it is fundamental for VET, as far as it helps in the development of competences and skills, essential aspects in real work-life.

e) Problem Based Learning (PBL)

This is an educational student-centered strategy, in which students learn by solving different real problems. Thus, students are given a problem with the aim at working together in a collaborative scene, form mental models for learning and create learning habits via practice and reflection. Then, decide which one is the best strategy to solve that problem [5].

f) Challenge Based Learning (CBL)

It is a method in which students learn by solving real-world challenges. In that way, students could use every day life´s technology, and, as it is a collaborative method, students have to work together with other students, teachers or experts in order to deepen learnt knowledge. This teaching methodology is divided in three phases. The first phase is the engagement - students move from an abstract idea to a challenge, by formulating essential questions. The second is the investigation - students plan algorithms for the challenge's solutions. The third phase consists on acting, and the solutions obtained are developed, implemented and evaluated. All phases use new technology, videos, audios, presentations etc.

4. Choice of appropriate innovative teaching methodology

The main training methodology to be used in the GSS-VET project is the flipped classroom one. Various studies in flipped classroom in last years showed different fields of studies, including information systems, chemistry, algebra, engineering, technology and mathematics.

Diverse technology tools and/or online platforms have also been used in flipped classroom research. In applying the flipped classroom approach, there are various technology tools such as Wikis and Blogs which can be employed to interact virtually outside the class and used to work collaboratively to solve problems or exchange ideas. These tools allow the users to share text, pictures, and videos with other users during distance learning.

5. Examples of different online platforms used in the flipped classroom practice.

Many authors used a Blog as online platform to share the video lectures. Students had to access and watch one video per week that was available on a Blog. Other platform is a WebQuest to establish students' active learning in a class. Very popular for students in a flipped classroom is to watch video lectures on YouTube and collaborated on Google Docs and Google Hangout.

As alternative options for video creating and hosting can be appointed: TeacherTube - this site is great for schools that have YouTube blocked. No objectionable content here; Screencast.com - this site has a free and a paid version. It integrates very well with Techsmith Products because it is owned by the team at Techsmith; Acclaim - create your own video channel with this nice tool. It has lots of features that make this an excellent choice; Google Drive - a little known feature of google drive is the fact that you can host videos in your google drive. Those videos can then be made public for all to see. There exists Learning Management Systems (LMS), which many teachers find useful to house all of the teaching digital content. More popular LMS are: Edumodo - is known for its easy user interface and is very popular with many schools; VersoApp - a very simple application available on all devices which allows teachers to very easily create objects for students to interact with; Schoology - a full featured LMS which has a great user interface; My Big Campus - made by LightSpeed which makes internet filtering software and hardware. If a school uses their filtering software then it is free for the school or the district; Haiku Learning - a simple to use, yet powerful LMS; Sophia.org - a simple to use platform for hosting and interacting with video content; Moodle - an open source platform which is free but needs a school or a district to host the platform; Black Board - it has been around for a long time and many use this platform; Crazy For Education - the site has crowd sourced videos and builds in interactivity into the whole flipped experience; InfoMentor - an LMS tied to country standards and is popular in Europe; Google Classroom - Google has created a nice LMS like instance that many teachers are using very effectively to flip their classrooms; Camtasia - fairly intuitive for new users. It allows to record screens and adding interactive elements to the video. It is possible to include quizzes throughout a video to test students' comprehension of what they have just seen, and to include links out to any additional materials; Part of the appeal of the flipped classrooms is that all that extra class time

provides more opportunities for collaboration amongst students.

Wikispaces is a great tool for encouraging and enabling that collaboration. It's plenty useful for non-flipped classrooms as well, but can help students collaborate and interact more.

6. Products and Tools Creation

For creating the necessary products and tools in the present work, the following methodological approach is used:

A. Develop the following tools for flipped learning preparation:

- Checklists based on the 4 Pillars: F-L-I-P
- Syllabus templates for Blended Learning course
- Questionnaire for the 5 experts on ICT, Solar and Geothermal systems

B. Distribute the tools to the experts and gather back their assessment and suggestions.

C. Analyse the data using the descriptive analysis, then redesign the syllabus templates into Blended Learning Syllabus based on Flipped Learning Model.

D. Prepare all the materials and resources. Run the course for 8 weeks using the redesigned Blended Learning Syllabus.

E. Create the questionnaires for the students' opinions on the redesigned Blended Learning course based on Flipped Learning Model.

F. Distribute the questionnaires to the students and collect the data back.

7. Organizing the model of Inverted Class

The organization of an Inverted class model keeps the following basic rules:

- Each training video is accompanied by clear learning objectives and step-by-step instruction.
- Accompany each training video with a task or ask the students themselves to make some questions to the video lecture.
- Invite students to write notes or small notes on the video they watched.
- In preparatory stage the teacher creates a site, where he places all the necessary materials for the lessons.
- The training objectives are set.
- In home preparation stage students are given homework - a link to the site for self-preparation, where the materials for the lesson are posted.
- The course of the lesson - students work in groups. The lesson plan is published in advance on the website. Groups are formed by the teacher based on the results of the preliminary survey, which students complete at home.
- Reflection of the lesson.

8. Preparation of the flipped classroom methodology

In order to prepare flipped classroom methodology, the teacher needs to design a system of teaching tasks (the content of classroom classes) that meet the educational objectives. Then compose a playlist of videos from necessary theory. If the course is not authoritative, then the necessary lecture database could be from open educational resources. It will not be superfluous relate the playlist of lectures to the corresponding sections of the paper textbook. In preparing this course it is most important to provide all students with all the materials and the exact schedule of classes at the beginning of the course. Thus, the essence of the methodology of flipped learning can be reduced to three main components:

A. Preparation (selection or creation) by the teacher of the virtual educational environment: video lessons, presentations, other materials and assignments to them, as well as the choice of electronic service for feedback to students.

B. Organization of the educational process. The teacher defines a key competencies on the topic, the forms of working with students in the class and preparation of tasks for the work of students in the classroom. At the same time, the students solve additional tasks.

C. Current and final assessment of knowledge and competencies of students. The teacher can choose together with the students several forms of performing the final work, for example, as a test or a project.

The central element of the "flipped class" methodology is not the video lectures themselves, but the active social interaction of the teacher and students that develops around video lectures in the classroom, virtual environment and social networks. The essence

of the methodology is not simply to redistribute the hours of study and the burden of the students, but to motivate students more towards independent activity, to give them tools and knowledge for further self-development, in other words to turn to their own experience. Thus, it can distinguish several main components that need to be taken into account when preparing the teacher for a course in the "flipped learning" model:

1. The volume of the necessary knowledge. It is better to divide this knowledge into two groups: the first group will include the knowledge to be transferred directly supported of video lectures by the teacher. In the second group, the students will receive in the course of their independent practice.

2. Identify the types of practical work that will be carried out in lessons collectively by the teacher and students, as individual and group work and homework.

3. Determine what materials in the form of abstracts, presentations, and design work should be developed by students during the course.

4. Prepare (create or find) video lectures and assignments to them, auxiliary materials (algorithms, templates, posters) to be used by the trainees, performing their work.

5. To apply a flexible system for assessing the work of students, specific criteria for marking. Moreover, they should be accessible to trainees as much as possible so that they have an opportunity to independently evaluate their activities. Assessments should not punish the student, but show him opportunities for further improvement.

6. Establish the types and ways of communication with students and receive their feedback. Identify a work system the teacher will be able to give special attention to each student.

9. Conclusion

Flipped Learning and Ubiquitous Learning are new pedagogical approaches, which are being increasingly implemented in schools, universities, even in businesses. They transform the traditional education system into an active learning method, switching from the traditional classroom´s teacher-centered model to a student-centered model.

The presented paper proves that many challenges exist in the flipped classroom approach. Many authors reported that there was no evidence that flipped learning had improved students' grades. They mentioned some limitations in it and required future research into such areas as achievement scores, technology, and how pedagogy must be integrated. On the other hand many students had difficulty in adapting in the flipped classroom due to the new approach. Most of the part-time students also mentioned that the course was very voluminous and they missed enough time to watch the video lesson outside the class. The Flipped Learning Management showed that The Office of General Education and Innovative Electronic Learning realized on the importance of learning model development to conform the identity and vision of the university that envisions graduate as competent ones based on the standard of The National Higher Education (TQF).

Acknowledgement

This paper is in the frame of the project Geothermal & Solar Skills Vocational Education and Training (GSS-VET) which is an ERASMUS+ project.

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