Anca COLIBABA
Gr.T.Popa University of Medicine and Pharmacy Iasi, EuroEd Romania
Irina GHEORGHIU
Albert Ludwigs University Freiburg, Germany
Anais COLIBABA
Trinity College Dublin, Ireland

E-CLASSES PROJECT: PRACTICAL APPLICATION OF SCIENCE THROUGH FLIPPED CLASSES

Case Study

Keywords
Flipped learning,
Science,
E-classes,
Education

JEL Classification
X00

Abstract

The article is based on the Erasmus+ project E-Classes (Ref. no.: 2017-1-RO01-KA202-037344), which addresses a few educational needs at the European level: the need to raise students' interest in scientific issues and develop innovative and ICT based teaching approaches to make science learning more attractive and interactive. The article focuses on a new form of learning, flipped learning, which helps teachers to modify their teaching methods and adapt their teaching contents in a more complete, attractive, motivational, and economic way. The article relies on the transdisciplinary use of this method with science and technological school subjects in the VET sector. It introduces the main objectives, outputs and benefits of the project and gives insights into the efforts made to elaborate, train and experiment the flipped classroom pedagogic model by improving VET teachers and students e-competences and by involving companies in the educational process through multimedia enriched apprenticeship simulations, which aim at enhancing youth employability.

INTRODUCTION

The Education and Training Monitor 2016, a yearly evaluation of education and training systems across Europe published by the European Commission notifies that the EU faces serious challenges in education as 22 % of 15-year-olds underachieve in scientific school subjects despite the unprecedented development of technology and science (European Commission, 2016).]. More than two out of five 15 year-olds do not have adequate levels in reading, mathematics and science to equip them for adult life. The rapid technological progress has brought about dramatic changes in our society and economy and as a result more demands for schools. Thus, there is significant incongruity between what schools offer and what the labour market needs, which is visible in skill mismatches between what employers demand and what employees offer and the high unemployment rates among young people. In order for schools to address these needs in society new strategies are required: investment in infrastructure (e.g. broadband, digital devices), training courses for teachers, and development and implementation of high quality educational resources. No matter how debatable the use of technology in schools is there is common accord that technology, when used correctly, can help students learn better, more efficiently and creatively by accessing wider and more up-to-date knowledge. However, the efforts to equip schools with modern technology do not meet these needs: less than half of the existing students are in highly digitally equipped schools and only 20-25% of them are taught by technologically confident teachers. Between 50% and 80% of students never use digital textbooks, exercise software or learning games (European Commission, 2012). The European E-Classes project aims at raising up to the new educational challenges in Europe and enables teachers and trainers to develop their professional, IT and pedagogical competences through their access to open educational resources (OER).
The publishing language is English, French or Romanian.

THE E-CLASSES PROJECT

The E-Classes project aims at helping VET teachers to revise and strengthen their professional skills so that they can improve young people's performance, particularly those at risk of early school leaving and with low basic skills. To this end the project develops a methodology especially focused on the use of ICT in school. In line with the Communication of the European Commission (SWD (2012) 371 final) "Rethinking Education:

Investing in skills for better socio-economic outcomes", the E-Classes project aims to scale up the use of ICT-supported learning and access to high quality OER by developing effective tools for teachers and trainers to manage creative classes (European Commission, 2012). The E-Classes project develops tools enabling teachers and trainers to evaluate, transfer and validate E-Classes training at local, regional, national and European level based on a multi-level partnership. The project relies not only on teachers' commitment but also on students' involvement in their learning process and creation of materials, which facilitates their future integration into the world of work after graduation. Other key members of the above mentioned partnership are companies whose contribution to young people's induction in the world of work is essential. The fruit of this threefold collaboration among teachers, students and companies is the development of educational materials which enhance various competences: workplace skills, problem-solving, teamwork, foreign languages, IT and multimedia, communication and cultural competences, etc.
The main objectives of the project are:
- to strengthen the e-skills and the adoption of practices of collaborative learning for teachers of science and technological school subjects;
- to adopt an approach based on learning outcomes suitable for low skilled learners and with risk of dropout;
- to assimilate a culture sensitive to the value of non-formal and informal learning, providing alternatives for learners less interested in the academic world, as well as at-risk groups;
- to produce tools which stimulate creativity and innovation by creating and managing multimedia educational resources;
- to stimulate students' active and creative role in the learning process through the use of ICT and OER;
- to collaborate with companies in order to create relevant educational products on job orientation and integration for students;
- to offer training and exchange of experiences for both teachers and students at EU level.
The E-Classes project through its purposes and activities addresses the following target groups:
Direct target groups: VET teachers, VET students, VET schools, Companies.
Indirect target groups: Schools (in general), Teachers and students (in general), Parents, Educational and training centers/ NGOs in the field of education, Teachers associations, Students/ Youth associations, Educational public authorities (Teacher Training Centers), Public at large.

THE PROJECT METHODOLOGY

The project methodology is the flipped teaching approach. Woodland Park High School chemistry teachers Jonathan Bergmann and Aaron Sams were the first to initiate the flipped teaching approach; they recorded some lectures and sent them online to students who missed their classes to watch and study them at home. However, Jonathan Bergmann and Aaron Sams repeatedly stated that there could not be one person credited as the inventor of the method and there are also different ways of implementing this approach (Bergmann &Sams, 2012).

The flipped classroom approach is in line with the advance of technology and students' rising interest in ICT. It is based on reversing the traditional stages of a class, that is, outside activities (often video lectures) precede class activities - exercises, projects, or discussions (Lage et al., 2000). The teachers will have to prepare the video students watch at home very carefully as the video is a key element in introducing the topic, concepts and main ideas of the issue under discussion (Khan, 2011). This will definitely take teachers some time considering the role the video has in stirring students' interest in the topic and preparing them for the lesson. However, it is worth doing as it will turn the class into a busy workshop where interested students will work together to find out answers to the questions raised by the video (Berrett, D., 2012). The method brings about dramatic changes in the teacher's role: the teacher is no longer the "sage on the stage" but the "guide on the side"; he guides students in their search for knowledge acting as their coach and advisor (King, A. 1993).

The SWOT analysis of the flipped methodology as applied to project countries has helped project partners identify and examine the internal and external factors that can have an impact on the viability of implementing a flipped class experiment in the project countries.

STRENGTHS

Flipped classroom methodology allows students to learn when and where and for as long as they want and at their own pace;
A flipped classroom encourages students to reflect about the topic taught and to think about questions to ask their peers or the teacher in class;
A flipped classroom relies on the shift from a teacher-centred to a student-centred learning environment, having the student engaged in active learning strategies;
A flipped classroom considers individual student's needs, by customizing materials and using strategies to appeal to students' interests;

A flipped classroom relies on increased student-teacher interaction, which results in increased student motivation and participation in classes;
Flipped classes encourage students to work on their analytical and critical thinking skills; students use their higher forms of cognitive skills (application, analysis, synthesis, and evaluation);
A flipped classroom encourages students to take responsibility for their own learning;
Having available video recordings of the lessons students can review them as often they need;
A flipped classroom improves student attitudes towards learning;
Absence of the student or the teacher is no longer a problem as everything was previously prepared and recorded; Teachers that teach the same course can prepare and share their materials with all the students.

WEAKNESSES

This methodology depends on students' participation; trust in students is vital: if the students do not watch the video at home, many of the gains of this methodology are lost;
This methodology may add a lot of workload and stress to those teachers who do not have the required IT skills;
Preparing the materials may also require a lot of time;
Some teachers may feel they lose control of the class as students are encouraged to be more critical about what is taught in class;
Teacher multitasking role;
The need for instant feedback mechanism;
Students will spend a lot of time in front of the computer;
Evaluation done by computers is not complete as computers cannot evaluate essays.

OPPORTUNITIES

Flipped methodologies encourage teachers to use a wide range of methods and give vent to their imagination when designing their lessons;
The methodology allows both teachers and students to enrich their knowledge. The teacher is a coach and an advisor who guides the student to explore the topics, share their findings with peers and examine and analyse new content with a view to integrating it into the context;
Teaching becomes challenging and motivating: attracting students' attention and interest is important as teacher's authority is based on students participation in and outside class;
Flipped methodologies encourage the school to improve its technology and equipment as

technology plays a key role in the flipped methodology.

THREATS

Teachers may lose opportunities in their profession if they do not have the required skills in IT;

The method may require a lot of time and work, which may be perceived as a threat to teachers' personal life;

Not all students may feel comfortable with this method; students who still depend on teachers' permanent encouragement and guidance may feel lost and confused;

There are a few changes which may trigger a few threats: students will use textbooks but also online materials which may result in editorials losing sales; teachers become tutors and the class turns into a meeting point for discussions; this may lead to an increase in the number of tutoring facilities and online courses.

CURRENT AND FURTHER DEVELOPMENTS: PROJECT OUTPUTS

The SWOT analysis has reinforced our confidence in the success of implementing the flipped methodology in our countries. The partnership has gone on to recruit the teachers and students who will participate in the flipped classroom experiment. These teachers and students have been familiarized with the method and its stages, at which point the first project output, the Guidelines on flipped classroom methodology, has proved to be an invaluable tool.

The Guidelines on flipped classroom methodology
Advise teachers how to create and use the new approach during science and technology classes. It is a very practical document that describes how teachers can design a flipped lesson. It presents an operative view of implementing the flipped methodology in traditional teaching, thus personalizing the lesson according to the time and the technological resources available.

The implementation of a flipped classroom is supported by the use of didactic contents and videos. The guidelines concentrate on eight thematic areas of five transdisciplinary school subjects.

Flipped classes multimedia lessons
Each partner country will set up a working group of teachers (from the ones trained within the project) who will act as a network of promoters and creators of Flipped classes multimedia lessons for science and technological disciplines. The lessons will

focus on short videos. Specialists in the field recommend recordings of about five to seven minutes each because if they are longer students may lose attention (Bergmann and Sams, 2012); they are of the opinion that students may watch the video longer if there is somebody talking in the corner of the screen or even longer if this person is their own teacher. The teachers prepare their lessons first by creating video lectures with explanations and embedded exercises. In making the videos the teachers will be helped by specialists from companies, who will contribute with concrete applications of the abstract scientific concepts and theories. These videos are sent to students before their class, so they can watch them at home, at their own pace and as often as needed until they get a clear idea of the subject. While watching, students' motivation increases, as they have to do online quizzes and activities that check their comprehension of the ideas as well as their learning progress. Later on, students meet in class with their peers and teachers and they will clarify those concepts which were not clearly understood at home and will have enough time in class to do more exercises, projects or to take part in open discussions.

Videos on job orientation and integration
Schools and companies will work together to support students' learning process by making12 videos per country illustrating main skills an employee needs to do the required job in the company.

Virtual E-Classes Learning Environment The aim of this action is to involve partners in discussions with teachers and students in order to collaborate in the creation of the framework of the content of the E-Classes. These are so called digital learning platforms that represent an educational series of products designed to work in the real and virtual space. These environments offer plenty of opportunities for teachers' professional training. The platforms are designed to function as instructional environments and provide digital curriculum tools for planning, organizing the educational content or tracking and evaluating students' progress. These platforms are based on the theory of social constructivism. They offer opportunities for differentiated teaching and learning at one´s pace, supporting cooperative learning and the application of interdisciplinary methods.

Benefits
The teacher is no longer the only authority leading and controlling the class; a teacher enjoys a multitude of roles - a mentor, an advisor, a coach - while students have turned into active learners who are active participants in their learning process by

watching the video and doing the embedded tasks, applying their knowledge or actively discussing with their peers. Students take full benefit of collaborative learning which develops their oral communication, self-management, self-esteem and sense of responsibility.

Prepare your manuscript using Microsoft Word. All files should be submitted as a Word document (docx).

The manuscript should contain the title page, abstract, text, references, tables, and figures. Do not submit tables and figures in separate files. Appendices are the only exception to this requirement.

CONCLUSIONS

Through the use of modern technologies the flipped methodology is definitely a method which enables teachers to reach their students. A flipped class changes a teacher's traditional role and empowers students to think critically, do research and then share their knowledge with their peers in a collaborative way in an attempt to co-create new knowledge. Through the use of the flipped methodology students engage in authentic learning experiences at their pace under the teacher's guidance. Students work in groups; misunderstandings are corrected on the spot by their peers or the teacher who circulates from one group to another.

The E-Classes project is taking advantage of state-of-the-art technology, which enhances learning and motivates students profiting from their addiction to it. Learning becomes more personalised with classes customised for all students.

REFERENCES

Journal article

[1] Berrett, D. (2012, February 19). How 'flipping' the classroom can improve the traditional lecture. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/article/How-Flipping-the-Classroom/130857/

[2] European Comission. (2016). Education and Training Monitor. Retrieved from http://ec.europa.eu/education/sites/education/files/monitor2016_en.pdf

[3] European Comission. (2012).Rethinking Education:Investing in skills for better socio-economic outcomes.Retrieved from www.cedefop.europa.eu/files/com669_en.pdf

[4] Khan, S. (2011). Let's use video to reinvent education. Speech presented at TED2011. Retrieved from http://www.ted.com/talks/salman_khan_let_s_use_video_to_reinvent_education.html

[5] King, A. (1993). From sage on the stage to guide on the side. *College Teaching, 41(1),* 30-35. Retrieved from http://www.edweek.org/ew/articles/2012/10/03/06khan_ep.h32.html

[6] Lage, M.J., Platt, G.J., and Treglia, M.. Inverting the classroom: A gateway to creating an inclusive learning environment. The Journal of Economic Education, 31(1):30–43, 2000.

Book

[1] Bergmann, J., &Sams, A. (2012). *Flip your classroom: reach every student in every class every day.* Washington, DC: International Society for Technology in Education.