IV. DISTANCE LEARNING OF SCIENCE AND IT

FLIPPED CLASSROOM – CHEMISTRY ON THE EDUCATIONAL PLATFORM COLLEGE OF SCIENCE

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Abstract: *The purpose of this article is providing a short description of flip teaching and presenting flipped classroom strategy used in educational project Śniadeckich College, including materials prepared for the project in the field of chemistry and the educational platform.*

Keywords: flip teaching**,** flipped classroom**,** platform, chemistry

INTRODUCTION

Flip teaching - also known as **flipping the classroom, backwards classroom**, **reverse instruction** and **reverse teaching** – is a form of blended learning in which students work on problem on-line, watching films and animation and then learn with other students in class. This approach allows teachers to spend more time interacting with students instead of lecturing (Barseghian 2011), (Heussner 2013).

Whereas the traditional pattern of teaching has been to assign students to read textbooks and work on problem sets outside school, while listening to lectures and taking test in class. In **reverse teaching** the students first study the topic by themselves, typically using on-line lesson, which can be prepared by the teacher or third parties - an example is the Khan Academy (Toppo 2011). Classroom time is intended for the students to apply the knowledge by solving problems and doing practical work (Pink 2010).

To sum up: the essence of flip teaching is a pre-active organization of data in the process of an independent collection of information, and the search for references in students' current knowledge. Students use their prior knowledge, search their memory for information and experiences that will enable them to understand new

material and give it a meaning. Learners are trying to build a bridge between prior knowledge and material that they are to master (Figure 1).

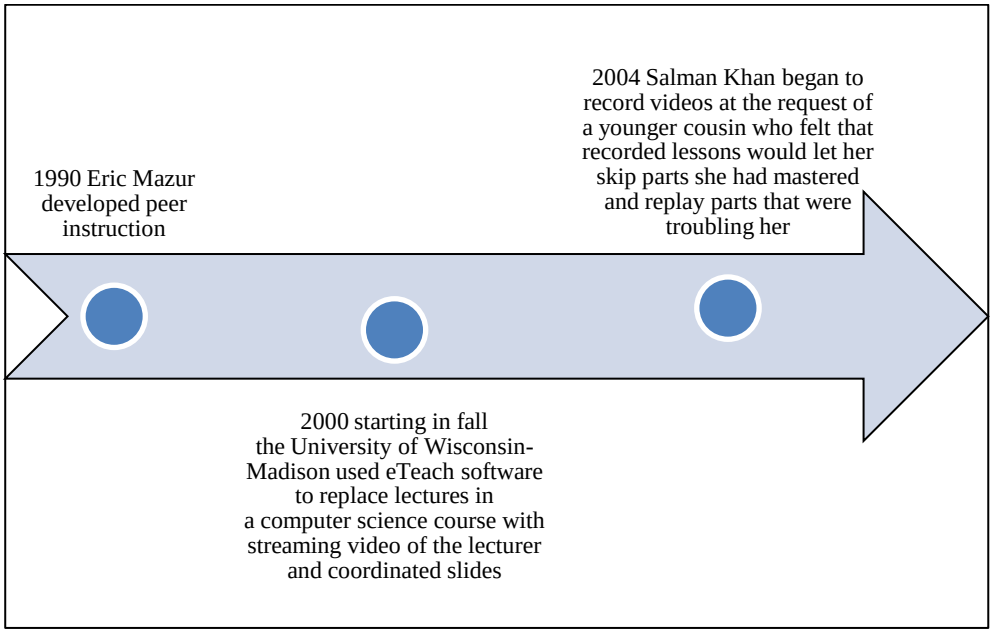


Figure 1. Timeline – The chosen elements of flip teaching

Source: author's materials

Khan's model were originally created for one-to-one tutoring. Khan Academy videos are used as part of some educators flipped teaching strategy.

Besides mentioned http://www.khanacademy.org/ other materials that can be used while implementing flipped classroom method:

- http://ocw.mit.edu/courses
- http://techtv.mit.edu

FLIP TEACHING GOOD PRACTICE EXAMPLES - *FLIPPED CLASSROOM* AROUND THE WORLD

"Five years ago, in the shadow of Colorado's Pike's Peak, veteran Woodland Park High School chemistry teachers Jonathan Bergmann and Aaron Sams stumbled onto an idea. Struggling to find the time to reteach lessons for absent students, they plunked down $50, bought software that allowed them to record and annotate lessons, and posted them online. Absent students appreciated the opportunity to see what they missed. But, surprisingly, so did students who hadn't missed class. They, too, used the online material, mostly to review and reinforce classroom lessons. And, soon, Bergmann and Sams realized they had the opportunity to radically rethink how they used class time. It's called "the flipped classroom." While there is

no one model, the core idea is to flip the common instructional approach: With teacher-created videos and interactive lessons, instruction that used to occur in class is now accessed at home, in advance of class. Class becomes the place to work through problems, advance concepts, and engage in collaborative learning. Most importantly, all aspects of instruction can be rethought to best maximize the scarcest learning resource—time. Flipped classroom teachers almost universally agree that it's not the instructional videos on their own, but how they are integrated into an overall approach, that makes the difference. In his classes, Bergmann says, students can't just "watch the video and be done with it." He checks their notes and requires each student to come to class with a question (Trucker 2012).

The Flipped Classroom isn't for everyone, but it's been well received by Math and Biology students and their parents at Okanagan Mission Secondary School (OKM) in Kelowna, B.C., and was strongly supported by the OKM principal, Scott Mclean. As teacher Graham Johnson noted in his personal account of his first year using the Flipped Classroom approach to learning, the feedback he has received from students and parents has been "overwhelmingly positive." Carolyn Durley, OKM Biology teacher, says she has had no negative feedback from parents. Both teachers experienced student pushback in the early days of introducing the Flipped Classroom approach, which puts students largely in command of their day-to-day learning. Principal Mclean said he views the Flipped Classroom as "a potential game-changer" because learning takes place before the student enters the classroom, allowing the teacher "to broaden and deepen" the learning. He added that it's the way learning should be for kids because they take control of their learning and they can work at their own pace (Pearson 2012).

FLIPPED CLASSROOM IN POLAND

The inspiration to create a flipped classroom strategy were the largest education fair - Bett Show held in 2008 in London, where a delegation from the National Foundation for Computer Education had the opportunity to participate in the lessons of history at the local high school, conducted with the use of a learning platform. In 2010, the Department Pedeutology Team led by prof. S. Dylak a prepared flipped classroom strategy (Dylak, Duda 2011).

From 2010 until 2013 National Foundation for Computer Education and Adam Mickiewicz University in Poznan implemented project "Śniadeckich College - an innovative science curriculum" co-financed by the European Union under the European Social Fund 'Man - The Best Investment ".

The aim of the project was to develop, test and spread methods of education, which a team of experts described as "a flipped classroom strategy".

The pilot implementation of the strategy was attended by 200 students from the schools: St. Mary Magdalene High School in Poznan and Juliusz Słowacki High School in Grodzisk Wielkopolski.

EDUCATIONAL PLATFORM – COLLEGE OF SCIENCE

College of Science educational platform was created for the implementation of innovative science curriculum within the Śniadeckich College project as a tool for digital approach to learning. It is available at http://platforma.wiedzatech.eu/. Educational platform for students and teachers support the learning process using flip learning in the first years of secondary school (Figure 2).

According to the concept of flip learning platform the College of Science supports teachers' and students' work to facilitate advance preparation for the lesson under teacher's lead.

Figure 2. College of Science Platform – start website (Information about the project, 'Do you know?'– strategy 'For whom?', 'Hello', choice of the subject: math, physics, chemistry, biology, geography)

Source: Platform

Platform's graphic design has been developed in accordance with the trends for the web and mobile solutions using the tiled navigation and info graphs for quick retrieval of content.

The scientific content available on the platform was developed by a team consisting of employees of A. Mickiewicz University in Poznan, teachers and high school students participating in the project. These are educational materials for students and teachers, for 75 topics from five subjects in the field of science: biology, geography, physics, chemistry, and mathematics (Figure 3).

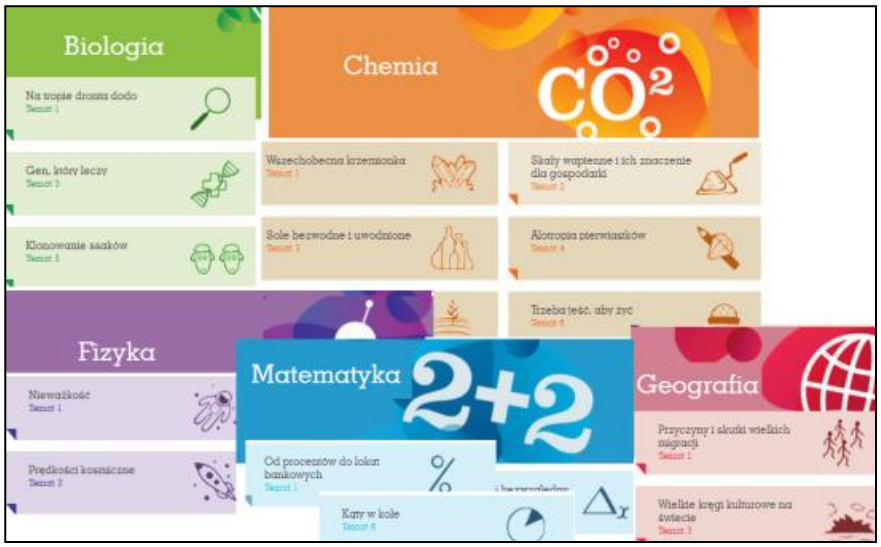


Figure 3. College of Science platform – subject materials (Topics' examples: Biology: 'Gene, which cures', Chemistry: 'You have to eat to live', Physics: 'Zero gravity', Geography: 'The reasons and outcomes of great migrations', Math: 'From a percent to bank deposits')

Source: author's materials

The materials include almost all of the curriculum that is taught in the first grade of high school. Each topic on the platform is divided into four stages (Figure 4):

ACTIVATION

The essence of working at this stage is to activate student's prior knowledge of the topic.

PROCESSING

At this stage, the students solve specific tasks related to a topic based on a variety of teaching materials. Before moving to systematization step students take a screening test.

SYSTEMATIZATION

This step is carried out in the presence of the teacher, at this stage students organize the information obtained in the previous stages.

EVALUATION

This stage is designed to shape students' belief that the answers to the questions always create new questions and that the knowledge is never final (Dylak 2012).

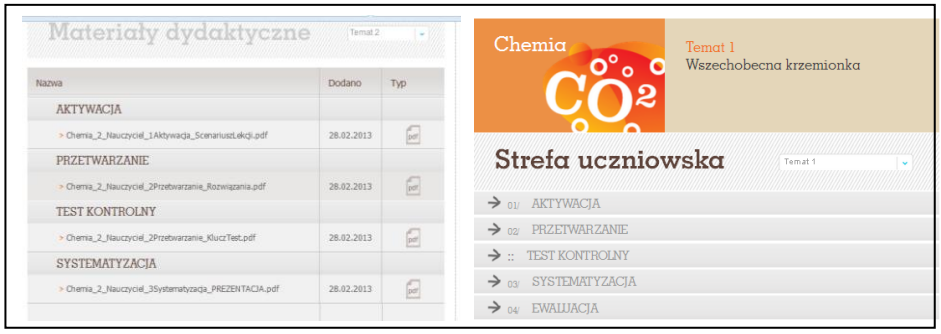


Figure 4. College of Science platform – didactic materials
(On the left teacher's view: Activation, Processing, Test, Systematization; on the right student's view: Activation, Processing, Test, Systematization, Evaluation)

Source: Platform

Chemistry materials prepared in accordance with the methodological rules include **15 thematic modules, which comprise of:**

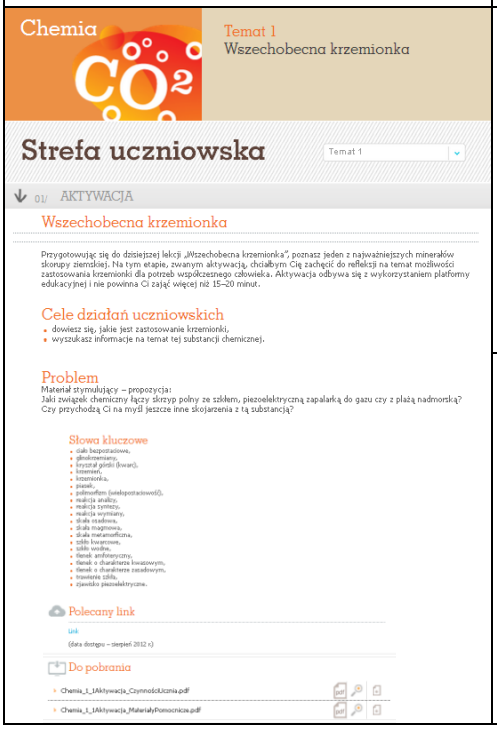
- ✓ chemistry lesson scenarios
  - developed in accordance with the rules and provisions of flip teaching and education reform, to be implemented in the first grade of high school,
- ✓ materials for students
  - including descriptions of chemical experiments which are performed by students at home,
- ✓ methodological materials for teachers
  - including the solution of tasks and methods of their assessment (Gulińska, Bartoszewicz Makles, Mischke 2011)

Table 1.

Activation – materials from student's and teacher's profile

On the platform, in the folder ACTIVATION – materials for the student	On the platform, in the folder ACTIVATION – materials for the teacher
On the platform in the catalog AIMS of student's activities ✓ PROBLEM - a description of the problem situation activating the student to begin work on the subject ✓ KEYWORDS ✓ STUDENT'S ACTIVITIES Tasks and questions divided into mandatory and extra. ✓ MATERIALS	✓ lesson scenario with methodology comments indicating the appropriate section of the curriculum and recommended literature.

✓ Links to sample content on the Internet.



EXAMPLE: STAGE I – ACTIVATION

Stimulating material – the proposal:

Imagine visiting the ruins of a medieval castle in Ogrodzieniec, lying in the Kraków-Częstochowa Upland, you came upon information:

(photo's author: Andrzej Makles)

"Tourist! – We announce a contest about limestone.

First place – two-week trip to the U.S., where we will explore the longest cave in the world, Kentucky, which with its 563 km of corridors which are at least three times larger than any other known cave on Earth.

Second place – week stay in Turkey, combined with a visit to Pamukkale, meaning "Cotton Castle". This object is on the list of World Heritage Sites.

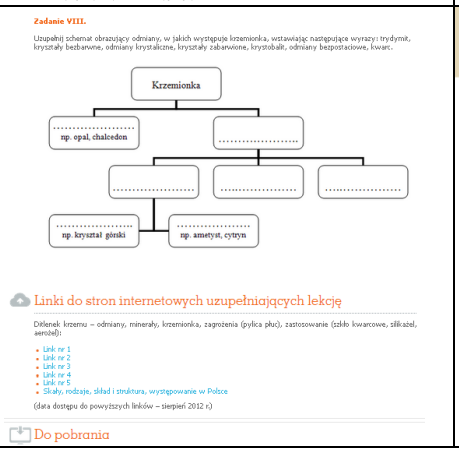
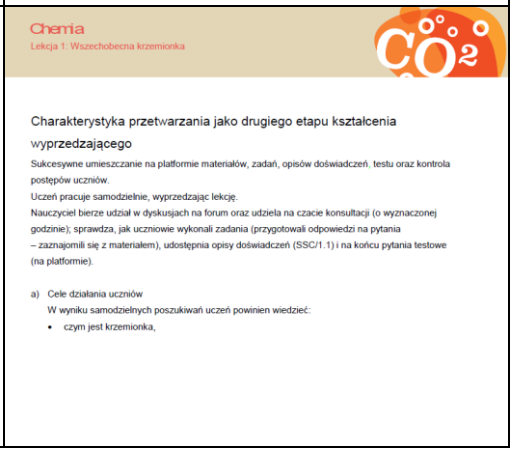
Rules of the contest - a solution the following tasks are required to achieve success. "

In the student's eye:

An interesting way to present geography information during the chemistry class and to awake our desire to broaden our knowledge about the limestone.

Table 2.

Processing – materials from student's and teacher's profile

On the platform, in the folder PROCESSING – materials for the student	On the platform, in the folder PROCESSING – materials for the teacher
✓ AIMS of student's activities ✓ Lesson's CONTENT – texts with images ✓ STUDENT'S ACTIVITIES Tasks and questions divided into mandatory and extra. ✓ MOVIE refering to the lesson's topic ✓ Links to sample content on the Internet. *APPENDIX – additional materials*	✓ Examples of tasks with their solutions
	
	

Additional materials essentials at this stage:

✓ Chemistry in a small scale laboratory set

In the student's eye:

Majority of us at this stage of the work before the lesson liked the most. Experiments are always exciting for us. And by the way it turned out as many reagents is available around us.

In the practician's eye:

An experiment in the chemistry teaching is a very important and valuable tool for working with students: among others, it increases interest in the subject and involves different types of student's activity (Figure 5).

An example of the task on the educational platform

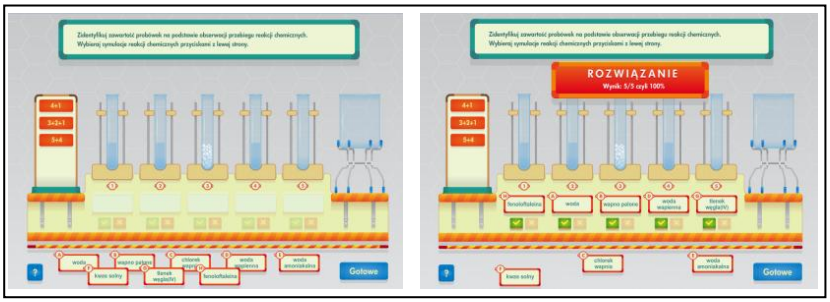


Figure 5. College of Science platform – interactive task
(Buttons i.e. 1+2 allow to simulate conducting an experiment. Student's task is to indentify substances needed and putting their names under test tubes)

Source: Platform

In the student's eye:

Without any problems we were able to identify the tubes 3, 4 and 5 But we were confused because of the information about the red-colored mixture of 1+4.

We would arrive at a solution easier if given data mentioned the raspberry color.

– film available on the platform

– e-portfolio

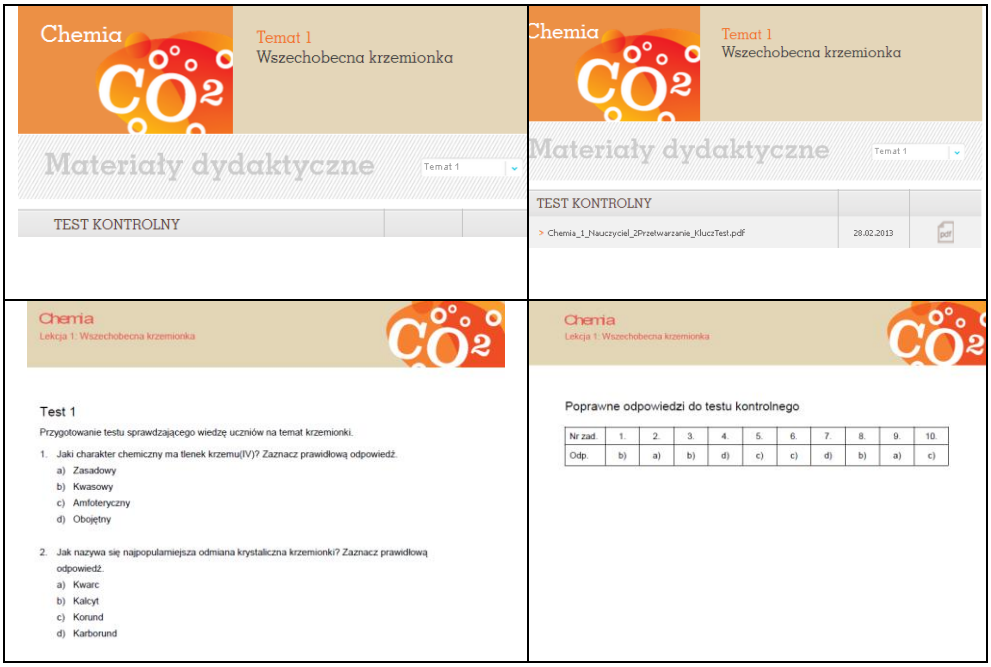
In the practician's eye:

Students as a result of independent research, sometimes after the consultation with the teacher or discussion between students, created their e-portfolio sites on the platform. Teacher while checking student's work have the ability to edit the text in order to correct mistakes, highlighting them in a different color.

Table 3.

Test – materials from student's and teacher's profile.

On the platform, in the folder TEST – materials for the student	On the platform, in the folder TEST – materials for the teacher
✓ TEST with 10 questions	✓ TEST with the solution



In the student's eye:

Most of us complained about the large number of tasks that needed to be solved before taking the test. Fortunately, some of these tasks were not difficult.

In the practician's eye:

To effectively discuss the results of the test is teacher should prepare a table presenting the effects of students' work.

Table 4.

Systematization – materials from student's and teacher's profile

On the platform, in the folder SYSTEMATIZATION – materials for the student	On the platform, in the folder SYSTEMATIZATION – materials for the teacher
✓ AIMS of student's activities ✓ HOMEWORK	✓ Systematizating presentation corresponding to the test

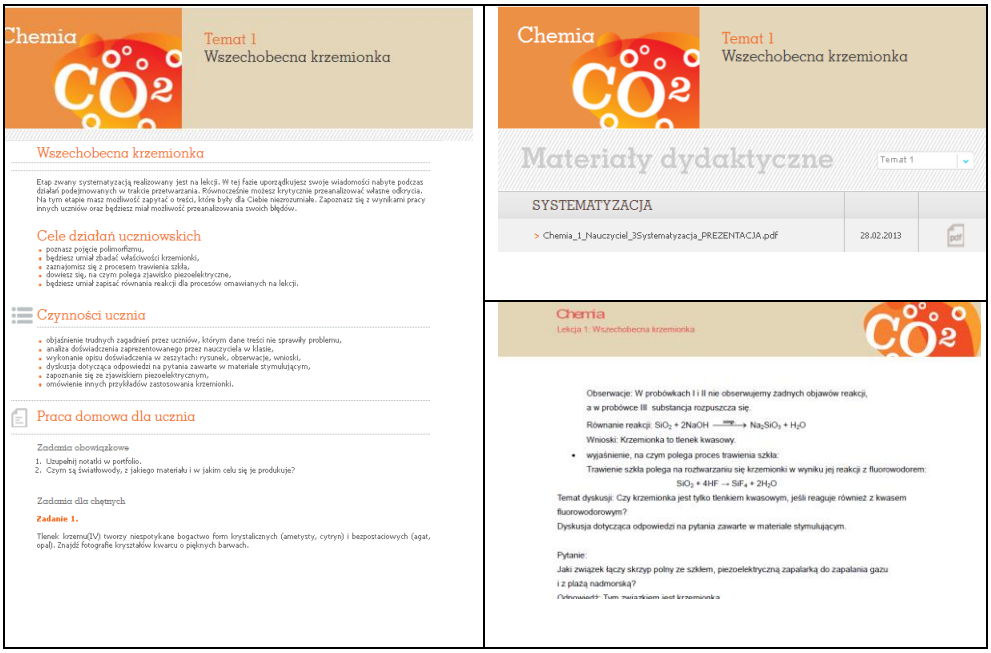


Table 5.

Evaluation – materials from student's and teacher's profile

On the platform, in the folder EVALUATION – materials for the student	On the platform, in the folder EVALUATION – materials for the teacher
✓ EVALUATION QUESTIONNAIRE - OPEN OR CLOSED QUESTIONS PREPARED FOR THE ATTENTION OF STUDENTS AND TEACHERS	✓ There is no folder EVALUATION for teachers.
	

By accessing the platform, students after login, have the ability to solve problems on the basis of available teaching materials and the process of preparation for lesson is monitored and controlled by the teacher (Figure 6).

Figure 6. College of Science platform – Login

Source: Platform

All materials collected during the search student can save in My notebook (figure 7.), which is a module for collecting notes (text, files, web sites) for later use.

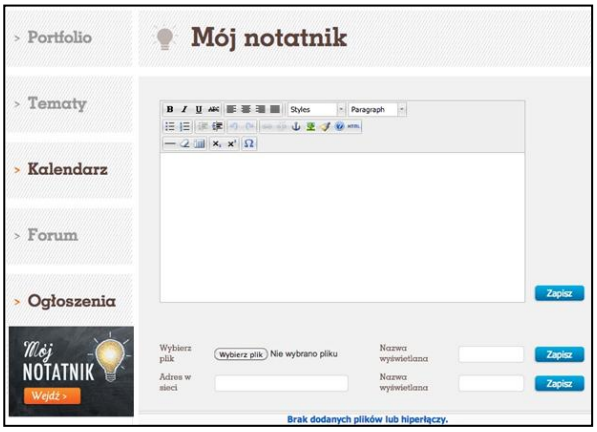


Figure 7. College of Science platform – My notebook

Source: Platform

The platform allows to organize work's calendars for students and teachers (Figure 8). Calendar module presents lessons available in a given school year divided into stages: ACTIVIZATION, PROCESSING, TEST, SYSTEMATIZATION, EVALUATION.

Figure 8. College of Science platform- calendar

Source: Platform

The teacher has the ability to edit the dates of stages, change their length, to see details of the subject in the calendar. Students work in accordance with the described methodology and place their work place in the portfolio (Figure 9).

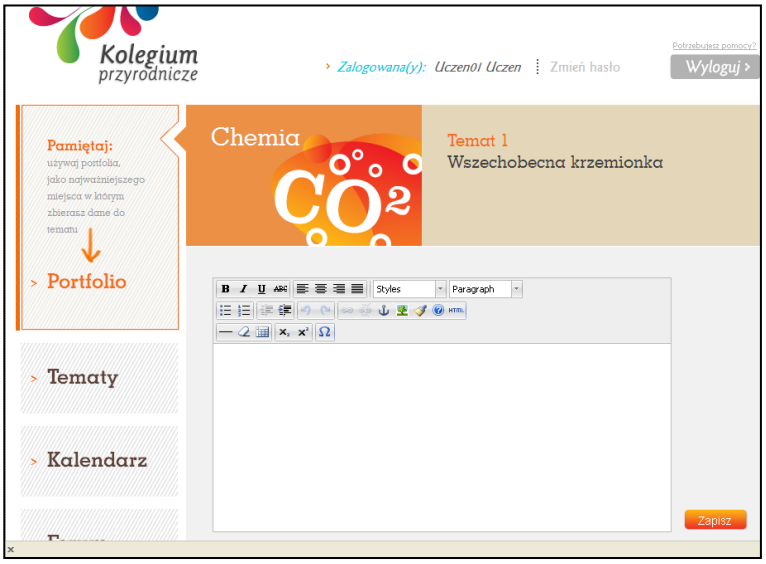


Figure 9. College of Science platform – Portfolio

Source: Platform

The teacher obtains the ability to monitor, organize and support the work of the students and he or she can publish his or her own teaching materials on the platform. The platform also allows the verification of the achievements of the students and their reporting. It has functionalities such as class notice board or discussion forums which is moderated by the teacher (Figure 10). All users defined in the system are able to upload materials which visible to everyone.

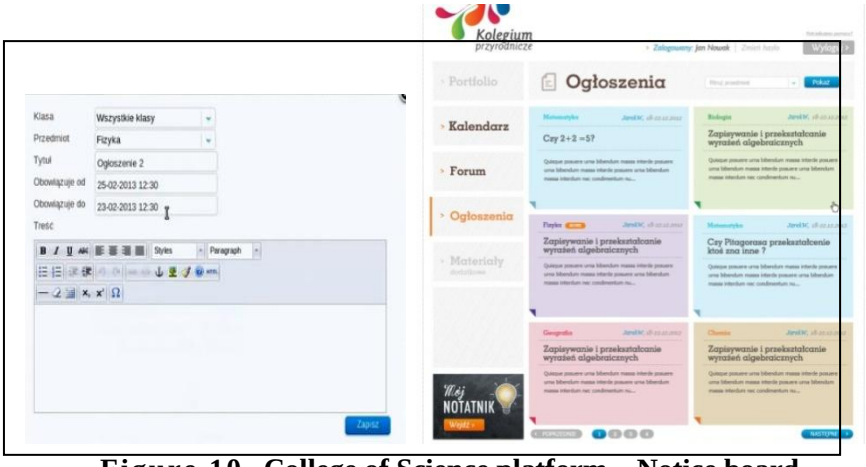


Figure 10. College of Science platform – Notice board

Source: Platform

CONCLUSION

Teaching chemistry took place before the traditional lesson. Students using the platform prepared for classes according to the teacher's instructions, allowed them to discuss the topic in schools in a problem and multi-contextual way.

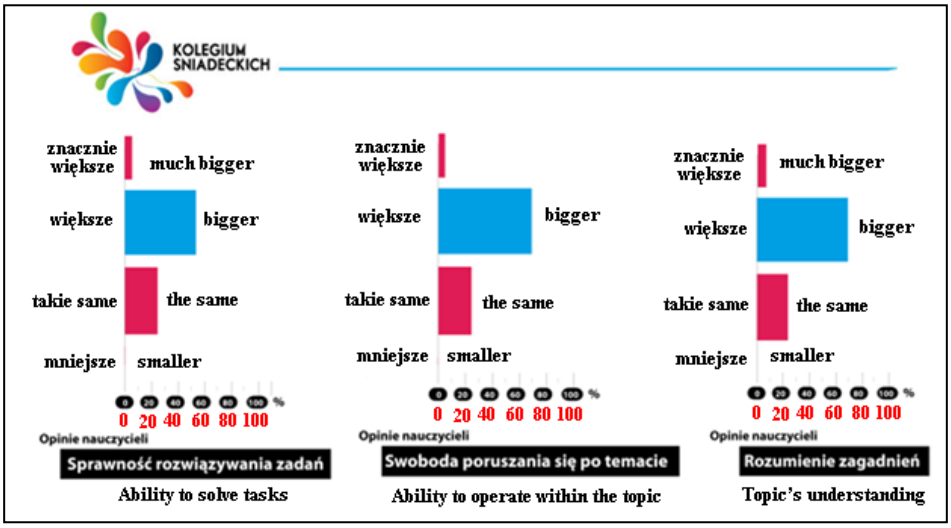


Figure 11. Results of teachers' surveys

Source: Platform

Learning through educational platform may occur at any time and in any place, allowing for the development of the student, not only in terms of the class-lesson system, but also enables to develop the interest in the subject beyond the typical school area. Collected during the pilot implementation of the data and the opinions of teachers who were involved in the project, show that students working using flipped classroom strategy were more efficient at problem solving and understanding of the discussed issues (Figure 11).

REFERENCES

Barseghian, T., 2011: *Three Trends That Define the Future of Teaching and Learning*, MindShift, KQED available at http://blogs.kqed.org/mindshift/2011/02/three-trends-that-define-the-future-of-teaching-and-learning, (accessed on 1 August 2013)

Dylak, S., Duda, L., 2011: *The implementation strategy of Collegium Sniadeckich*, Poznan

Dylak, S., 2013: Methods of training in flip teaching strategy, collective work, a text book co-funded by the European Union under the European Social Fund, Poznan ISBN 83-918407-6-X

Gulinska, H., Bartoszewicz, M., Makles, G., Mischke, K., 2011: *Scenarios for Chemistry classes in line with flip teaching – Collegium Śniadeckich,* Department of Chemical Education, Poznan

Heussner, K. M., 2013: *Clay Christensen takes closer look at how online learning will disrupt K-12 education* available at http://gigaom.com/2013/05/23/clay-christensen-takes-closer-look-at-how-online-learning-will-disrupt-k-12-education, (accessed on 1 August 2013)

Kolegium Śniadeckich: *About the Project, 2012,* available at www.kolegiumsniadeckich.pl and www.ofek.pl. (Accessed on 10 February 2013)

Pink, G., 2010: *Think Tank: Flip-thinking - the new buzz word sweeping the US,* The Daily Telegraph

Toppo, G., 2011: *Flipped' classrooms take advantage of technology*, USA TODAY