Polish Education Reform and Resulting Changes in the Process of Chemical Education

Hanna Gulińska

Chemistry in junior high schools covers 130 h in the course of three years; in secondary schools, there are 30 h in the first year, and, providing the students choose to study chemistry, a total of 240 h in classes two and three (*matura* exam). If students decide not to take science, they will unlikely broaden their knowledge of chemistry, biology, or physics again.

The new structure of the education system in Poland has encouraged authors of new handbooks to prepare highly interesting multimedia formats that, as has been proven by extensive research, may positively influence students' interest in a subject and consequently increase students' likelihood of choosing to pursue that subject during subsequent stages of education. It is believed that teachers as well as teaching aids will continue to exert substantial influence on the student's choice.

1 Motivation

Current trends in contemporary education expand general access to information and knowledge but at the same time reveal the necessity to introduce changes in skills as well as the systems of work that need to be implemented. It is universally acknowledged that our society will be increasingly knowledge dependent (Cresson & Flynn, 1997).

In a report prepared for UNESCO, "Learning: The Treasure Within," four pillars of education on which the states are to build their educational systems and programs were presented (Delors, 1999). The pillars include:

- learning to live together, learning to live with others,
- learning to know,
- learning to do, and
- learning to be.

H. Gulińska (✉)
Department of Chemical Education, Adam Mickiewicz University, Poznań, Poland
e-mail: gulinska@amu.edu.pl

M.-H. Chiu et al. (eds.), *Chemistry Education and Sustainability in the Global Age*,
DOI 10.1007/978-94-007-4860-6_2,

A Polish member of the European Parliament, Bronisław Geremek, wrote, "Life-long learning remains in natural opposition to the most painful of exclusions – the exclusion due to ignorance. Changes which occur in information technology and communication, sometimes referred to as the information revolution, strengthen this danger and define the key role of learning in the twenty-first century. As a consequence, all forms of education should be implemented in order to prevent the threats of exclusion and to retain social cohesion."

The above statement as well as the clauses of recent education reform in Poland (2009) encouraged various educational institutions to prepare new learning environments that could shape various key competencies, defined as a combination of:

- knowledge,
- skills, and
- appropriate stances (Gulińska, 2009a, b).

Key competencies are those that people need for:

- self-fulfillment,
- personal development,
- active citizenry,
- social integration, and
- employment.

2 Methodology

An educational project called *E-Academy for the Future* implemented in Poland in 2010 and sponsored by the European Union involves teaching with the aim of achieving seven key competencies:

1. communication in native language,
2. communication in foreign languages,
3. mathematics competencies and basic scientific and technical competencies,
4. IT competencies,
5. ability to learn,
6. social and citizenship competencies, and
7. initiative and entrepreneurship.

"E-Academy for the Future" is going to be implemented within the years 2010–2013. Students from 200 junior high schools in their first year (13–15 years of age) are to participate in the project. The aim is to help these students acquire the above competencies in the course of their school work as well as by means of a project method and e-learning units.

Students will be able to participate in 168 e-learning units either on their own or guided by their teachers. The units will cover such school subjects as chemistry, physics, biology, and geography as well as mathematics, information science, and civil knowledge. Each of the units shall constitute an attractive, multimedia

program containing educational material, tests, and exercises shaping selected skills. The units are designed to make it easy for teachers to include them in the program. The project is an opportunity to make substantial progress in learning technology and to shape key competencies in Polish schools.

Additionally, in the first term of the school year, students who perform poorly on their final test in Class 6 will participate in *School Compensatory Groups* carried out by school teachers in the form of workshops. Their aim is to develop abstract thinking, increase self-esteem, awaken aspirations, and encourage creative problem solving as well as improve the ability to learn.

Students who excel while working with e-learning units will form *Virtual Science Groups* (Virtual School), whose members develop their talents under the supervision of teachers. After the first and the second year of the project implementation, the best virtual school students will participate in 5-day science camps in academic centers across the country.

In each school, *Local Project Teams* will prepare, in cooperation with their local communities, interdisciplinary projects that incorporate local environmental, social, and economic issues. The projects will be published on an e-learning platform and thus a *League of Local Project Groups* will be formed. The best projects will be invited to participate in the national overview (Gulińska, 2009c, d).

The following diagram shows how activities are interrelated in the *e-Academy for the Future*:

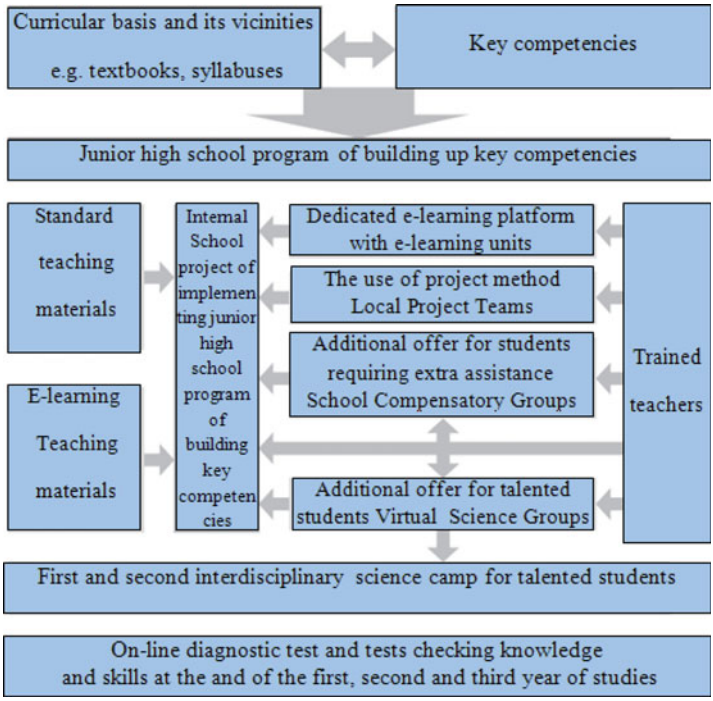


Diagram of *e-Academy for the Future*

While preparing the *e-Academy for the Future* project, it was decided that e-learning methods must not be considered as alternative forms of traditional classes (Gulińska, 2010). Practice has shown that a combination of new (electronic) and traditional teaching methods (*blended learning*) is most effective. In the future, the boundary between the two types of learning may become indiscernible. Therefore, the following has been assumed:

- blended learning will not be just an occasional type of work, but a process carefully planned in time, and
- effective acquisition of key competencies and fulfillment of curricular basis requirements will constitute the results of the applied type of teaching.

Work within the project is done via an e-learning platform "EduPortal," where materials for teachers and students are published. Students can use the e-learning units independently or with their teachers' assistance; they also can communicate with peers participating in the project. Each teacher and student has continuous access to the platform, regardless of time and space.

The basic form of organization of learning is a unit, which is a complete lesson where students acquire not only knowledge but also skills pertaining to at least one competency. Within the e-learning unit, students work with multimedia material and obtain knowledge and skills and use the opportunity to receive feedback and evaluation as well as self-assessment.

Tools for teachers working in the *e-Academy for the Future* involve the following:

- access to the e-learning platform,
- e-learning units prepared by experts and designed for learning key competencies,
- instruction (methodology handbooks) for each e-learning unit,
- an opportunity to model the didactic process by means of e-learning units in various configurations with traditional teaching,
- the potential to quickly modify, update, and expand blended learning, and
- the ability to administer the elements of the learning process as well as monitor students' progress.

2.1 Structure of an e-Learning Unit

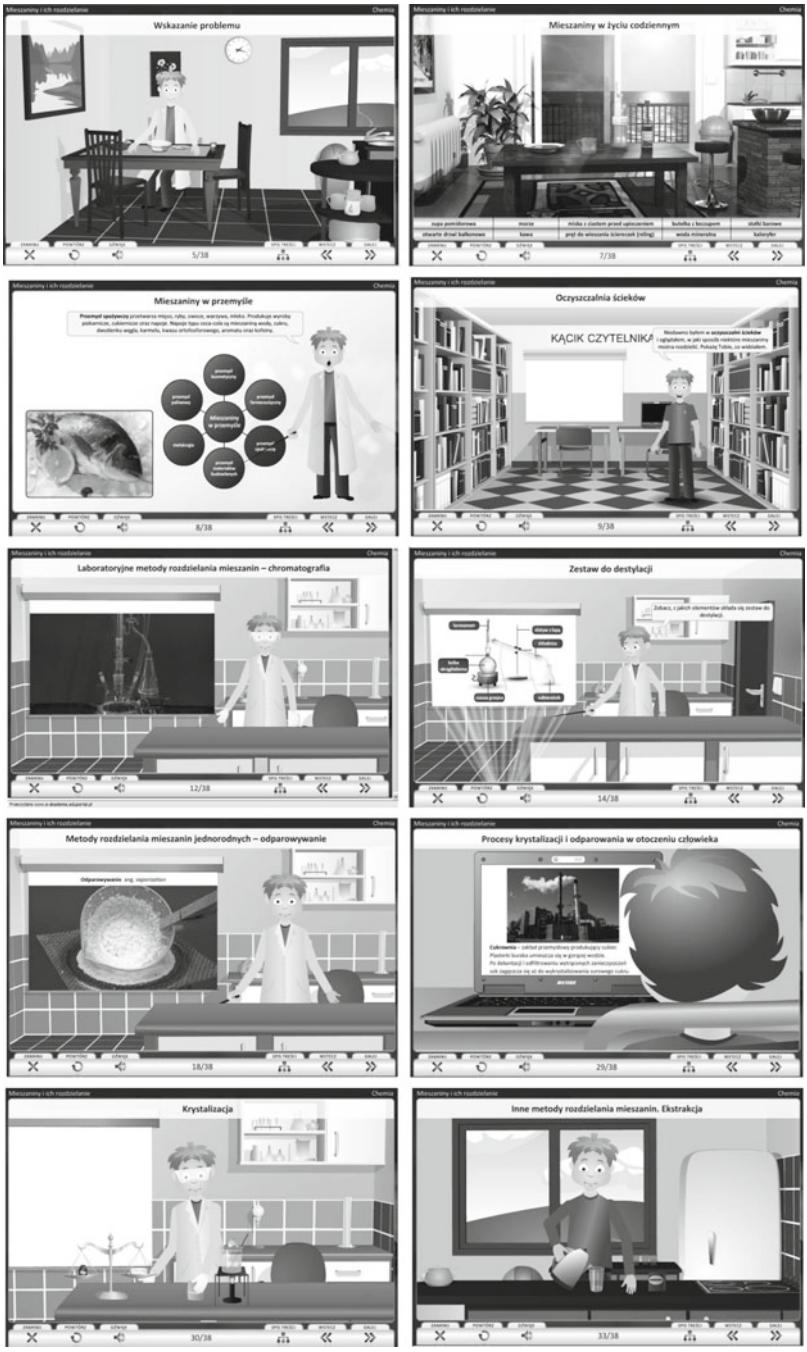
Each e-learning unit teaches a particular competency. For example, for a language competency, the student will learn the most important content (definitions and names) in English. If the competency is initiative and entrepreneurship, then the student's task is to collect materials on a particular subject from the student's immediate environment (their home, their community) and to prepare a report, a poster, or a movie.

INTRODUCTION	Title page and introduction to the contents of the unit.
AIM	Defining the expected results that might be achieved via working with the unit.
RELATIONSHIPS	Essential relationships of the unit with other e-learning units.
MODULE – KNOWLEDGE	The multimedia part of the unit, which makes it possible to acquire the knowledge required to develop at least one competency.
	Practical, interactive use of the skill learned in the context of the newly learned knowledge.
MODULE – EXERCISE	Remembering the acquired knowledge and skills: 1. summary of the most important content of the unit, 2. interactive practice of the new skill.
MODULE – TEST	Feedback and self-check – to what degree was the aim achieved? If it was not achieved, suggest further necessary actions.

2.2 Unit Separating Mixtures – KNOWLEDGE

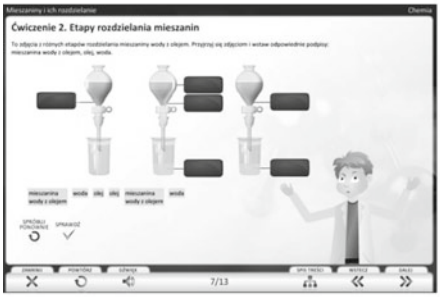
The content in this unit pertains to an issue that is discussed in relation to other subjects and everyday life. The unit begins with a scene where an avatar is faced with a difficult situation and needs to find a solution to this problem. The student

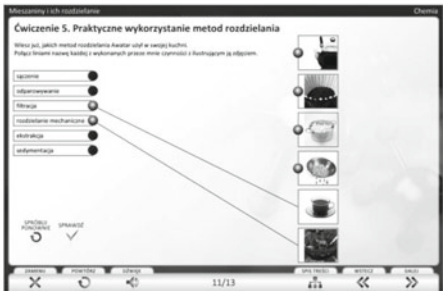
watches interesting films and, together with the avatar, carries out simple chemistry experiments. Discovering new formation is intertwined with several short exercises. The lesson is crowned with a graphically interesting summary.



2.3 Unit Separating Mixtures – EXERCISE

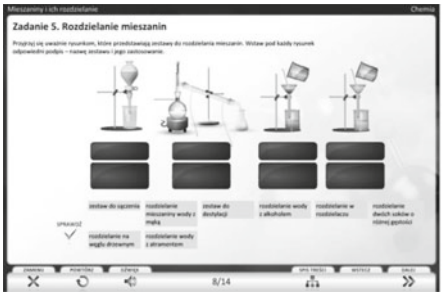
This part of the unit reviews all of the new information and provides practice for new skills. All tasks are done with the avatar's supervision; he is a friend and a guide. Students receive feedback on their work and, when they do not know an answer, they are given some prompts. There are various types of tasks that might involve making models, writing down chemical equations, building laboratory apparatuses, and carrying out simple experiments. The tasks are not evaluated and the student does not receive any points.

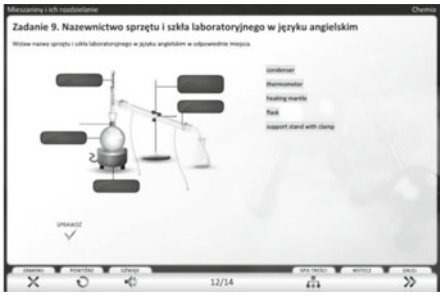




2.4 Unit Separating Mixtures – TEST

The tasks in the test make it possible for students to do a self-check of their knowledge and skills. The assignments are graphically interesting and of varied character (e.g., drag & drop, matching, filling the gaps, building laboratory kits, designing experiments, drawing conclusions from the experiments). The student is continuously accompanied by the avatar, whose role is now slightly different; the student does not receive any prompts, just a bit of encouragement. The only feedback the student receives is whether or not an answer is correct. Each test can be taken as many times as students need until they decide that their answers are satisfactory. Finally, results are registered on the platform and sent to the teachers as well as to a central database. Students must solve all 21 tests in each of the 7 subjects.





3 Findings and Discussion

Each of the e-learning units might be used:

- during the lesson process (in the classroom or in the computer room),
- at home (when working on *EduPortal*),
- as part of students' activity outside of school (project method),
- as part of homework (independent work with e-learning units), and
- as an integral part of classes by means of project work method.

The above is definitely not an easy task for teachers who might not be familiar with working on e-learning platforms (Gulińska & Bartoszewicz, 2008). Therefore, *within the project, several teacher trainings are to be carried out to teach them how to use "EduPortal" and to carry out classes with the use of e-learning units.* The teachers will create virtual classes, with some assistance from school IT teachers, and they will monitor students' progress and achievements.

At the first session, which took place in August 2010, participating teachers received laptop computers for personal use; the schools participating in the project

received SmartBoards. During the training sessions the teachers learned how to use the resources published on *EduPortal*, how to prepare tests and homework, how to publish them on the platform, and how to work with interactive boards.

Detailed information and instructions are also to be found in the Guidebook published on *EduPortal*. The guidebook contains instructions for each unit, lesson scenarios and open tasks that encourage teachers to use activating forms of work with their students. If teachers encounter difficulties, they can receive assistance from their school's IT teacher.

The tasks to be accomplished by teachers working with the unit:

- study and analyze the methodological materials for the unit,
- review the tasks to be performed by students in the unit, role-playing,
- analyze how the unit might be the source of knowledge and motivation to develop key competencies for particular groups of students,
- analyze and decide how and when the unit might be used in teaching, and
- build the unit into the process of teaching particular key competencies.

4 Conclusions and Implications

It is assumed that in the project, the teacher of a given class will also be the class e-teacher, that is, that they will teach regular classes as well as those carried out in the computer room using the e-learning units. The teacher will do the experiments suggested by the avatar and use the interactive board. They must also use the platform for checking student progress in their independent work with e-learning units, and they will use the platform for discussion with the students. Some other tasks will be performed on the platform as well. This method of work will make it possible for the teachers across the country to share their experiences within the *e-Academy for the Future* project as well as to share their skills in using technology for teaching (Gulińska & Bartoszewicz, 2010).

It will not be possible to know whether the project is a success or a failure until it has been underway for at 3 years. Nonetheless, the project is enormous; it involves

many schools and students; and we assume that it will help schools to creatively and attractively implement the requirements of the new curricular basis. What is most important, however, is that the project prepares the next generation to live and work in the new world that we all face.

References

Cresson, E., & Flynn, P. (1997). *The White Paper on education and training. Teaching and learning – Towards the learning society*. Luxemburg: European Communities, The Office for Official Publications of the European Office for Official Publications of the European Luxemburg.

Delors, J. (1999). Edukacja – jest w niej ukryty skarb. In UNESCO (Ed.), *Education and the economy in changing society*. Paris: OECD.

Gulińska, H. (2009a). Interesting chemistry – A multimedia task collection. In A. Méndez-Vilas, A. Solano Martín, J. A. Mesa González, & J. Mesa González (Eds.), *Research, Reflections and Innovations in Integrating ICT in Education* (pp. 397–403). Badajoz: FORMATEX.

Gulińska, H. (2009b). Multimedial handbooks of chemistry, a multimedia task collection. In A. Burewicz (Ed.), *ICT in chemical education* (pp. 31–38). Poznań: Sowa.

Gulińska, H. (2009c). Using new technologies in teaching chemistry. In M. Gupta-Bhowon et al. (Eds.), *Chemistry education in the ICT age* (pp. 131–144). Dordrecht: Springer.

Gulińska, H. (2009d). Games as integral parts of a traditional handbook, research. In M. Bilek (Ed.), *Theory and practice in chemistry didactics XIX: 1st part* (pp. 484–491). Hradec Králové: University of Hradec Kralove.

Gulińska, H. (2010). Modern computer games as elements of teaching chemistry in Polish junior high schools. *Journal of Science Education, 11*, 4–7.

Gulińska, H., & Bartoszewicz, M. (2008). Natural science in the joint program of chemistry and natural science. *Journal of Science Education, 9*, 21–25.

Gulińska, H., & Bartoszewicz, M. (2010). The effects of using the share point platform in teaching science students and teachers. In M. Valencic Zuljan (Ed.), *Facilitating effective student learning through teacher research and innovation* (pp. 175–191). Ljubljana: University of Ljubljana.

http://www.springer.com/978-94-007-4859-0

Chemistry Education and Sustainability in the Global Age

Chiu, M.-H.; Tuan, H.-L.; Wu, H.-K.; Lin, J.-W.; Chou, C.-C. (Eds.)

2013, XII, 352 p., Hardcover
ISBN: 978-94-007-4859-0