

Anna Baprowska, Małgorzata Nodzyńska

The Impact of Long-Term Education Projects on the Students' Conceptual Knowledge

Introduction

Practical laboratory science teaching is one of the most effective teaching methods (Stohr-Hunt, 1996: 101–109; van den Berg, 2013: 74–92). This also applies to other methods during which students can be active and express their own opinions (Bilek et al., 2018: 779–799; Freeman et al., 2014: 23; Janštová and Rusek, 2015: 28–33; Kopek-Putała and Nodzyńska, 2015: 95–101). Mostly, however, students do not have such opportunities in formal education. The school practices reproductive thinking, while in everyday life the road from problem to solution is much longer and requires a greater selection of information, dealing with uncertainty and a multitude of possible solutions. In everyday life, it is important to be able to produce various solutions or to search for unusual ways to solve a problem. The weakness of students in Poland is the ability to assess the results of experiments and formulate conclusions. Often, they are also unable to use their theoretical knowledge to solve tasks (they playback messages, but they cannot use them to e.g. analyze the presented situations). It can, therefore, be concluded that they do not lack knowledge – only other competences. Therefore, it can be concluded that instead of the system of knowledge, skills, attitudes, and competencies preferred for years, attitudes and competencies come to the fore, which is associated with new educational needs.

Aim of the research

The long-term educational project was implemented in junior high school in 2016–2018. The assumption of the project was to equalize educational opportunities for children from rural areas. During the classes, students developed selected key competencies:

1. ability to recognize the main features of a scientific study,
2. draw conclusions and conduct observations,
3. ability to organize your own learning,
4. effective own time management,
5. problem-solving,
6. obtaining, processing, evaluating, and assimilating new information.

They also practiced the application of new knowledge and skills in everyday life situations, including the ability to plan projects and lead them to achieve their goals, manage educational projects. And social skills such as group work.

The aim of the study was to examine the impact of a long-term educational project on the increase of students' conceptual knowledge.

Description of project activities

The long-term educational project concerned chemistry classes. The criterion for choosing students for the project was the voluntary principle. Two groups were created out of people willing to participate in the project: one for talented students and the other for students with learning difficulties. Students who received at least a grade – good (4) in chemistry in the first grade of junior high school, were assigned to the advanced group. Students who received lower grades were assigned to the equalization group. (A six-point scale is used in Poland, where “6” is the highest mark and “1” is the lowest). The same teacher ran classes in all groups. 30 hours per year were allocated to chemistry classes for one group – a total of 60 hours for each of 2 groups. Groups could not have more than 12 people. In class, students also prepared the final product “Chronicle of chemistry experiences”, which contained exercise instructions, presentations, and videos. After the project was completed, the school community has presented the results of the students' work. Students also took part in inter-school competitions: “Colorful Chemistry” and “Chemistry and Physics in the kitchen”.

Research results

In order to examine the impact of the long-term educational project on the increase of students' conceptual knowledge, a pre-test was carried out in the first class of the project, followed by the same test after the first year of the project and then after the second. Evaluation surveys were also carried out. Tests for both groups were similar but adapted to the level of difficulty. Both groups also completed an evaluation questionnaire whose results will be discussed in another article. The test for group 1 (with learning difficulties) included 24 tasks. One-third of these tasks were directed at practical skills, related to the ability to observe, draw conclusions from conducted experiments, and knowledge about the characteristic reactions of selected substances, how to detect given substances. Other tasks checked students' conceptual knowledge. These were multiple-choice, true-false, and open tasks.

Table 1. Results of group No. 1 (students with learning difficulties)

	Pre-test	test after the first year of the project	test after the second year of the project	School grade in chemistry before project	school grade after the first year of the project	school grades in chemistry at the end of the project
Student 1	6%	10%	35%	2	2	2
Student 2	13%	28%	44%	2	3	3

Student 3	21%	25%	62%	2	3	4
Student 4	17%	25%	59%	3	2	3
Student 5	22%	55%	70%	3	4	4
Student 6	15%	20%	35%	2	2	3
Student 7	22%	25%	40%	2	3	3
Student 8	25%	25%	45%	2	3	3
Student 9	45%	65%	85%	3	4	5
Student 10	18%	20%	78%	3	3	4
Student 11	29%	35%	75%	3	3	4
Student 12	17%	35%	65%	2	3	3
Summary	21%	31%	58%	2.4	2.9	3.4

The test for group 2 (talented students) contained 20 questions, half of which were problem questions, while the rest concerned the students' conceptual knowledge. These were open questions, multiple-choice questions as well as computational tasks and reaction equations.

Table 2. Results of group No. 2 (talented students).

	Pre-test	test after the first year of the project	test after the second year of the project	School grade in chemistry before project	school grade after the first year of the project	school grades in chemistry at the end of the project
Student 1	45%	75%	95%	4	5	5
Student 2	25%	35%	62%	4	4	5
Student 3	65%	85%	100%	5	5	6
Student 4	35%	75%	89%	5	5	5
Student 5	56%	85%	95%	5	5	6
Student 6	40%	55%	65%	4	4	4
Student 7	35%	55%	85%	4	4	5
Student 8	55%	85%	95%	5	5	6
Student 9	55%	85%	100%	4	6	6
Student 10	48%	65%	90%	4	5	6
Summary	46%	70%	88%	4.4	4.8	5.4

The results of the obtained research confirm that the participation of students in a long-term project significantly influenced the increase of their key competencies and positively affected the level of their knowledge and skills in chemistry. On average, in the group of weaker students the percentage of correct answers, increased three times and in the group of able students twice. However, comparing the increase in knowledge in both examined groups, we cannot forget about the initial results of the group of talented students that were definitely higher than the results obtained

by weak students (21%–46%). In both examined groups of students a significant increase in knowledge (understood here as knowledge, skills and attitudes) was noted. However, analyzing the increase in knowledge in each year of the project, we can see that in the group of weaker students, in most cases, in the first year of education the increase was much smaller than in the second year. This trend was not observed in the group of talented students (see Figures 1 and 2).

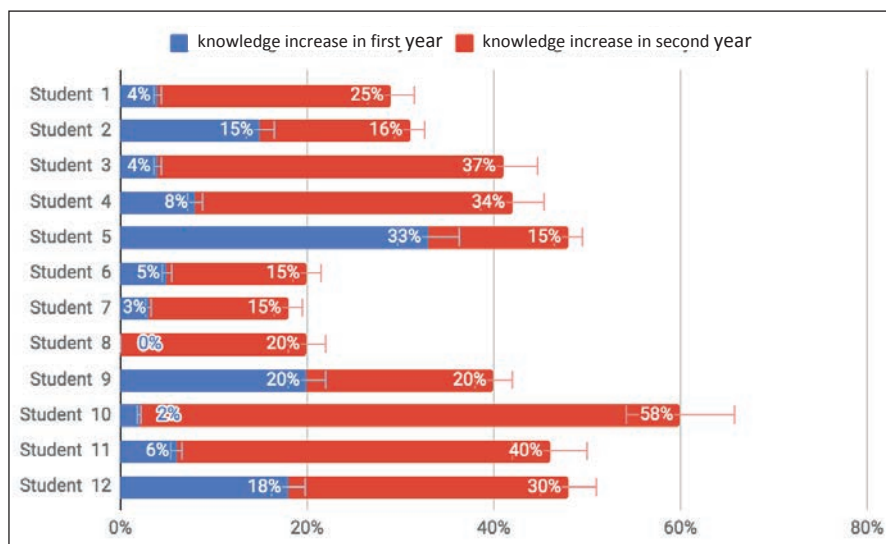


Fig. 1. Increase of knowledge in weaker students in the first and second years of the experiment, source: Baprowska 2019.

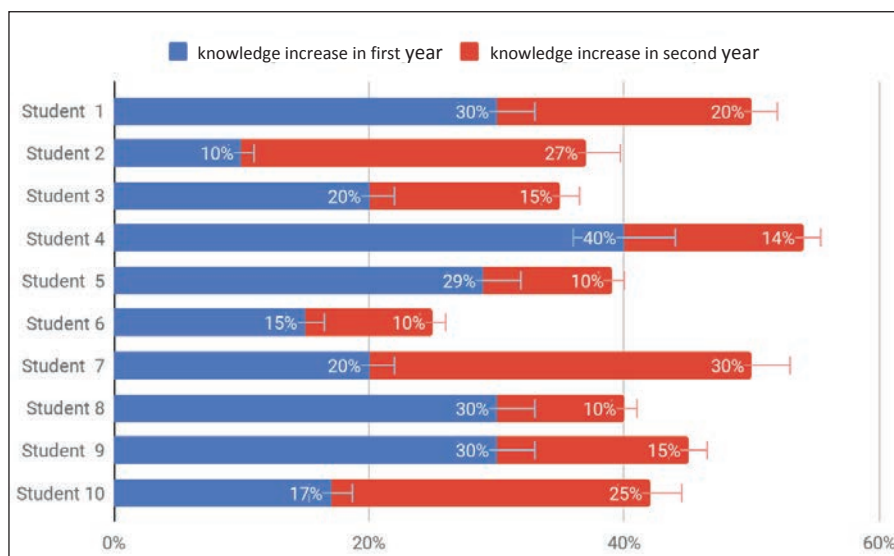


Fig. 2. Increase in knowledge of talented students in the first and second years of the experiment, source: Baprowska 2019.

Conclusion

Participation in the two-year project significantly affected both groups of students researched. In the group of talented students, we notice a two-fold increase of points in the test and in the group of weaker students a three-fold increase of points. The final results of the weaker students came close to the results of talented students – it can, therefore, be concluded that the project evened out differences between students. A significant difference can be seen in the increase in knowledge in both groups studied. In the weak students in the first year of work in the project, the increase in knowledge was small, only the second year of work brought the expected results. Therefore, it can be concluded that only long-term projects have an impact on the permanent improvement of competences – especially for weaker students.

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Abstract

The article describes research on the impact of long-term education projects on the increase in students' knowledge (understood as information, skills, attitudes). Two groups of students participated in the project which lasted two years: talented students interested in chemistry and students having problems with this subject. The results obtained show that there was a significant increase in knowledge in both groups. The detailed differences between the two groups are described in the article.

Keywords: project-based education, conceptual knowledge, chemistry

mgr Anna Baprowska

Department of Chemistry, Faculty of Science, University of Hradec Kralove, Czech Republic

e-mail: a.baprowska@gmail.com

ORCID: 0000-0002-1299-2997

dr hab. Małgorzata Nodzyńska, prof. UP

Department of Biology and Chemistry Education, Institute of Biology
Pedagogical University of Krakow, Poland

e-mail: malgorzata.nodzyska@up.krakow.pl

ORCID: 0000-0002-8606-5846