



Air Subject as a Part of the Whole-school Project High School Students

Irena Chlebounová¹

Abstract

At the Archbishop's High School in Prague, the school council draws attention to school problems. From these suggestions, a problem-solving one-week project emerged in 2017. It aimed at the school environment and proposals for its improvements. Thirty teams of students of all ages focused on eight chosen areas: purity, safety, light, noise, air, concentration, nutrition, and movement. Three groups dealt with the Subject Air. The result of their efforts was a joint presentation they defended before the jury. The following issues were identified as urgent: ventilation during breaks, restoration of existing ventilation shafts, removal of old carpets and renewal of parquet flooring. In the final reflection, we used questionnaires, interviews and open questions to find out what the students thought about the project. They appreciated collaboration between different grades, measuring with sensors and interesting suggestions for improving school. They complained about the length of the project, the misuse of time, the disagreements in the final presentation, the absence of part of the students, the demandingness of working with literature and the propagation of esoteric delusions (Feng-Shui). It turned out that if their proposals are not implemented, it has a very demotivating effect on students.

Keywords: Whole-school project, Project-Based Learning

1. Introduction

As Petty [1] mentions, few teaching methods enable teacher to develop such a wide range of skills as project lessons, and few give him more opportunity to waste a lot of time with poorly managed activities. Problems with project-based learning related to teachers' mistakes were investigated by Pouchová [2].

Application of a project-based learning have been found to increase STEM learning, such as higher level instructional feedback, higher-level questioning strategies, integration of subject areas, student discussion, and self-assessment [3]. In contrast to traditional teaching where the teacher passes information and controls pupil's understanding, in project-based learning, pupils can come to a self-knowledge through meaningful experiments.

Experimental learning develops the student's autonomy. By experiential learning, the students are faced with unknown situations and tasks in a real context" [4]. In order for this method of teaching, it is necessary to implement principles mentioned in a number of publications [5]. It is the connection school with practice, interdisciplinarity, self-reflection, usable results and development of soft skills.

The students think that the curricula should introduce changes designed to make connections between science and research and between the scientific knowledge and everyday life [6].

This paper shows way the eight-year high school students (11 to 18 years) were guided by the project-based learning to solve problems with school environment. Their responses revealed benefits of the project as well as some mistakes that led to student's negative evaluation of it. The conclusions can improve the design of other projects.

2. Methodology

The project Air took place 14 days in January 2017 as a part of the whole-school project Pila [7]. Its aim was to map the school environment in 8 areas (purity, safety, light, noise, air, concentration, nutrition, movement). About 16 students from the 1st to the 8th grade formed each of 30 groups. Three groups worked on the subject Air. Students shared their roles in the team. This contribution mainly shows the qualitative part of the research.

¹ Faculty of Natural Sciences at Charles University, Czech Republic



2.1 The Role of the Teachers

Teachers supervised the teams, familiarized themselves with the methods of measurement and the resources of informations. They kept their role as a guide. They provided action research based on their observations, interviews, and reflective questionnaires. Questionnaires were made up of claims (four point Likert scale) and the open questions. See Table 1. It shows that group 51 appreciated help of a chemistry teacher and the tools she had prepared.

2.2 The Open Questions for three Groups of Subject Air

1. Why did you choose this topic?
2. What is the strongest site of the project?
3. What is the weakest part of the project?
4. What does the project teach us?
5. What are your suggestions for improvement?
6. How was meaningful the project Pila?
7. How was meaningful the subject Air?

Table 1. Reflection questionnaire, answers of 12 students (team 51), scale: 1 = totally agree, 2 = rather agree, 3 = rather disagree, 4 = totally disagree. Ambiguous answers not included. Source author.

Claim	Number of answers Yes	Number of answers No
I am happy with the outcome of teamwork	10 (3x 1, 7x 2)	2 (1x 3, 1x 4)
The meaning and assignment of my role was clear to me	8 (3x 1, 5x 2)	2 (2x 3, 0x 4)
Teachers helped us effectively	11 (8x 1, 3x 2)	0
We had all the tools we need	11 (8x 1, 3x 2)	0
We had a well-organized teamwork	8 (1x 1, 7x 2)	2 (2x 3, 0x 4)

3. Results and discussion

3.1 The Program of the Three Groups Workings on the Subject Air

The first day, a lecture was held by an expert organising "Healthy Air in Schools" designed by Passive House Center [8]. Under the project, the school received a handbook and a set of 8 measuring sensors. They were located in places that differed significantly from one another and the monitored values of humidity, temperature, pressure, carbon dioxide and noise were recorded throughout whole week.

3.1.1 The Group 51

Evaluating the measurement results was done by Group 51, supervised by a chemistry teacher. In addition to the above mentioned sensors, the group used as well oxygen and carbon dioxide Vernier sensors [9]. The values in the school were compared to the values measured in front of the school in the center of Prague and in the Prokop's Valley (a protected landscape area). Group representatives found the old school ventilation system, which is currently not used. They cleared the clogged shaft leading to the chemistry classroom. The measured values then showed that this classroom has the best air values from all the compared rooms. It is a large classroom without carpets or hangings. It has the largest number of green plants and it is regularly ventilated. After studying the articles about air conditioning, principles of proper ventilation, the effects of plants on health, the coordinator organized brainstorming. The proposals for improvements were divided according to the financial requirements. As costless were marked regular ventilation in classrooms and occasional throughout whole building, care about plants, regular deaeration of the heating system, lower temperature setting in the central heating and regular cleaning. As expensive were marked the replacement of draught-prone windows, installation of air filters and air conditioning.



3.1.2 The Group 52

Students in Group 52, led by the teacher of art, photographed the school interior and thought about how our school might look to stand on the Feng-Shui principles [10]. They created a model of the school according to these principles (Figure 1). They also visited Czech television and made a report on the air condition in our school (Figure 2).



Fig. 1 The Feng-Shui model of the classroom done by group 52



Fig. 2 The Group 52 makes a report on air quality in TV

3.1.3 The Group 53

Group 53, led by a language teacher, read German-written articles on air quality at schools and created a survey "What damages the air". They counted the number of plants, carpets and curtains in classrooms and described their influence on the quality of air. They dealt with the possibility of removing the window sills from the classroom so that the air could circulate better.



3.2 The Evaluation of Project by the Three Groups

Problems occurred when creating a joint presentation of three groups. Students disagreed what is important. Most of them condemned Feng-Shui as unscientific and refused to put this to a joint presentation. Group 52 felt that they were doing something unnecessary and dangerous from the point of view of the catholic faith.

"Experiential learning develops critical thinking, intrinsic motivation, creativity and originality of students, desire to learn and skills of independent work and also skills of teamwork." [4] This has also been shown in our project. Students have identified the problematic aspects of the project and appreciate the benefits (most often mentioned teamwork, soft skills and practical impact of their findings). See Table 2

Table 2 Answers of 31 students from the three groups of the Subject Air to open questions about the meaningfulness of the project. Source author.

The positively rated benefits of the project	The negatively rated features of the project
They learned to present and discuss	Feng Shui (devoted to unknowing delusions)
They worked on a topic important to health	Uncompromising creation of the final presentation
The teamwork in the small groups went well	Badly organised big joint group
Each group focused on something else	The use of time would be better
They have devised good suggestions to solve the problem	Time was too demanding, sometimes it was boring (Not enough work for everybody for all the time)
They were creative, actively involved	The impossibility to realize some proposals
Effective search for information	Production of a model that ends in a trash
They liked the content of the work and the practicality	Caricature of Scientific Research (Too difficult to be done properly)
They had enough measuring aids, measuring was interesting and useful	The topic was too deep for younger students and reading of scientific articles was too difficult

4. Conclusions

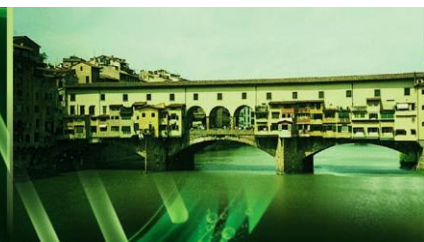
It turned out that a group of more than thirty students cannot co-operate effectively. In such a large group, only the loudest students will succeed. The others are disappointed that their views are not taken seriously. On the contrary, groups of 10 -16 students of different ages cooperated well. They showed a lot of creativity and enjoyed new activities, new experiences and also new friends.

For many, the measurement was quite interesting. As a very demanding it appeared evaluation of data. One reason was the absence of the oldest students. They stayed at home. The second tough part of work seemed to studying articles. Students are not used to read complicated texts. While practicing research tasks, teachers should count on and teach pupils how to work effectively with demanding scientific texts.

This project developed the ability to solve the problems of real life. Many of the investigated changes are planning to be done - removing old carpets, restoring parquet floors. Regular ventilation was introduced between classes in classrooms immediately. Students need to see practical change if they had investigated them. They do not like to do useless work. All groups were responsibly thinking about school environment problems and suggested a number of interesting solutions. All final presentations can be found on the school websites. [11]

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