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THE CHALLENGE OF LABORATORY WORK CONSTRAINTS IMPOSED BY COVID 19

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Abstract: In the conditions of restrictions imposed by COVID-19 in the 2019-2020 school year, an alternative to the laboratory classes at school could be the home science experiments. The home experiment is a simple self-conducted experiment that students perform at home without the immediate guidance of the teacher in the course of the experiment.

This article presents a model for performing home experiments of interdisciplinary nature in the conditions of distance e-learning. The experiments were in the school subject Biology and health education in regular classes with students from 9th grade in SPGE "John Atanasoff", Sofia.

Students perform experimental tasks at home independently, using the available equipment. One of the advantages of this type of experiment is that when setting tasks, the teacher does not need to take into account the different speed at which students perform them. This allows all students to be given the same task. A special value of this type of activity is that it motivates students and increases their interest in the studied subjects.

INTRODUCTION

The restrictions imposed by COVID-19 put the education systems around the world in a situation of mass transition to distance learning. According to UNESCO, the pandemic is causing unprecedented disruptions in the education system. Over 67.6% of students from more than 140 countries do not attend school due the pandemic situation (COVID-19 Impact on Education).

Distance learning in a digital environment is a new type of learning. Bulgarian educational system was not prepared to work in an electronic environment. Most teachers overcame the problems according to their skills and used personal electronic resources.

Fortunately, the publishers have provided free access to their electronic resources. So, they helped the Bulgarian teachers and students. The combined efforts of all participants in the educational process: head masters, teachers, parents, students made possible the successful implementation of e-distance learning in many Bulgarian schools.

This has made some traditional teaching methods inapplicable. Teachers must have the necessary knowledge and skills for this type of training to ensure an effective learning process. Enrichment with new principles, methods and forms of education was needed (Yotovska et al., 2020).

However, the methodology of teaching and learning did not change drastically during this period.

Bulgarian teachers acquired new skills and digital competencies for learning in an electronic environment. The teachers adapted to work in an electronic environment but new challenges have emerged - how to implement laboratory classes (Asenova, Yotovska, 2014). There are two opportunities for teaching and learning at a distance in practice-oriented classes: virtual laboratories (for which there are good practices in university education in the training of teachers and future teachers) and practical activities in a home environment - home experiment (Asenova et al., 2014; Yotovska et al, 2018).

According Mostenanenko, the experiment is "a form of scientific experience, it is a systematic and repeatedly reproducible observation of the object, its individual sides and connections with other objects which manifest themselves in the process of deliberate, strictly controlled by the observer effects of the studied object" (Mostenanenko, M V. Philosophy and methods of scientific knowledge, Lenizdat, 1972).

In the natural sciences the terms experience and experiment are unambiguous, therefore they can be taken as synonyms. The experiment is a general scientific method of knowledge and it is one of the main research methods. Each experiment is a reproduction of a phenomenon under specific conditions in order to be studied. The experiment is one of the sources of experience and empirical data which leads to results, enriching its creator with new knowledge and skills and upgrading his worldview (Lazarova Sn., The experiment as a means for increasing the activity of students in acquaintance with the natural environment).

MATERIALS AND METHODS

In the restrictions imposed by COVID-19 in the 2019-2020 school year an alternative to laboratory classes could be a home experiment. The home experiment is a simple stand-alone experiment that students test without direct instruction of the teacher in the course of the experiment.

This article presents a model of conducting home experiments of interdisciplinary nature in the conditions of e-distance learning. The experiments were conducted in the classes of biology and chemistry with students from 8th and 9th grade of HVSE "John Atanasov" - Sofia.

Students perform experimental tasks at home independently using the available equipment. One of the advantages of this type of experiment is that: when setting the task, it is not necessary the teacher to reports the different students' speed to complete their experiments. This can allow one-time assignments to be given to all students. The special value of this type of activity is that it motivates students and increases their interest in learning subjects.

Activity

The themes of the home experiments are:
Lactic-acid fermentation (BIOLOGY)
Determination of water hardness (CHEMISTRY)
Placing an egg in a bottle (CHEMISTRY)

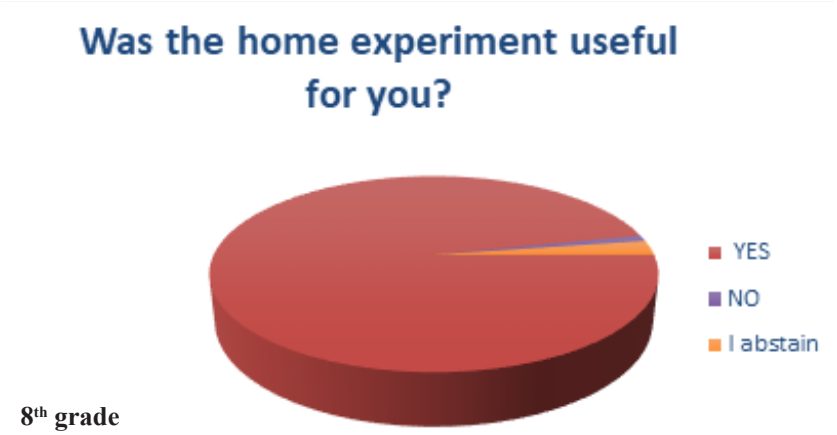
Students receive a worksheet with the necessary methods and materials and the course of the experiment (Supplementary material 1). Students perform homework experiments, document the result and send their artifacts to the teacher within a certain period (Supplementary material 2).

After conducting the home experiments a survey was conducted – a questionnaire.

RESULTS AND DISCUSSION

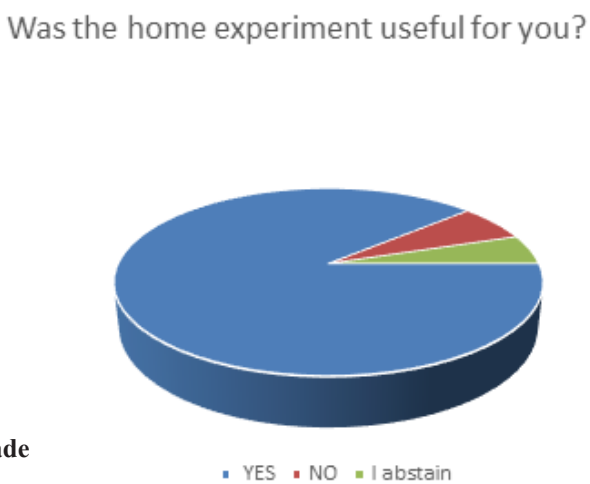
I78 students from 9th grade took part in the home experiment in biology project and 208 students from 8th grade took part in the chemistry experiment.

The first question from the survey is related to the evaluation of the usefulness of the Supplementary material of this teaching method (Was the home experiment useful for you?) (Fig .1).



8th grade

1.Was the home experiment useful for you?
201 students answered **YES**
2 students answered **NO**
5 students answered **I ABSTAIN**

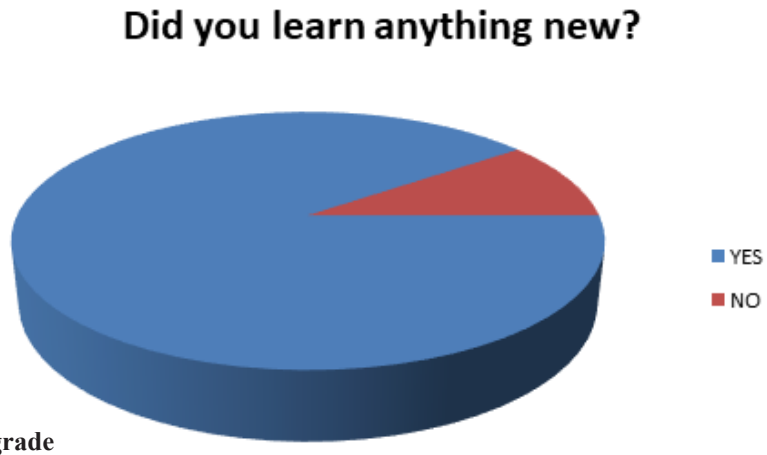


9th grade

1.Was the home experiment useful for you?
69 students answered **YES**
5 students answered **NO**
4 students answered **I ABSTAIN**

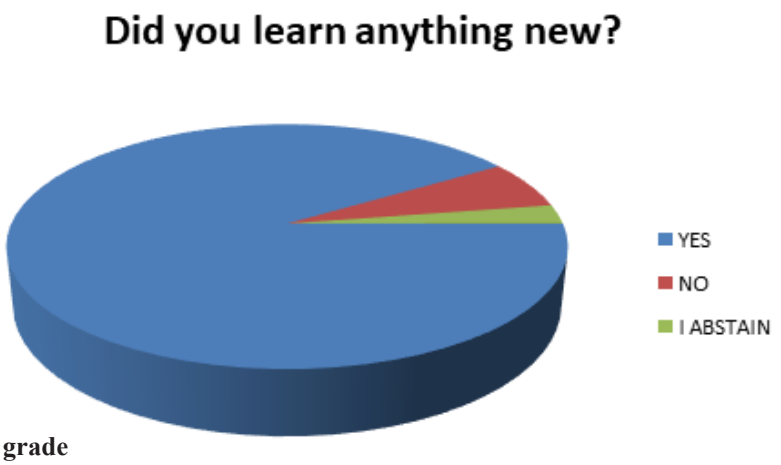
Fig. 1. Answers to a question from the survey:
Was the home experiment useful for you?

The next two questions from the survey are about whether students have learned something new - knowledge or skill. The second question: (Did you learn anything new during the home experiment?) (Fig. 2) and the third question: (Have you mastered a new skill during the home experiment?) (Fig. 3).



8th grade

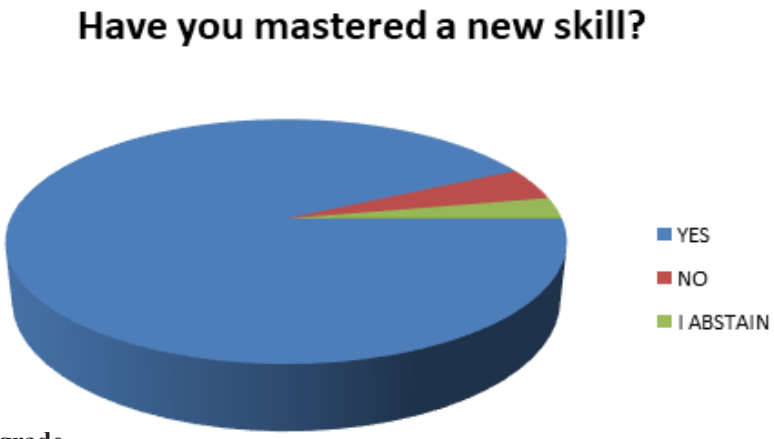
2. Did you learn anything new?
   187 students answered **YES**
   21 students answered **NO**



9th grade

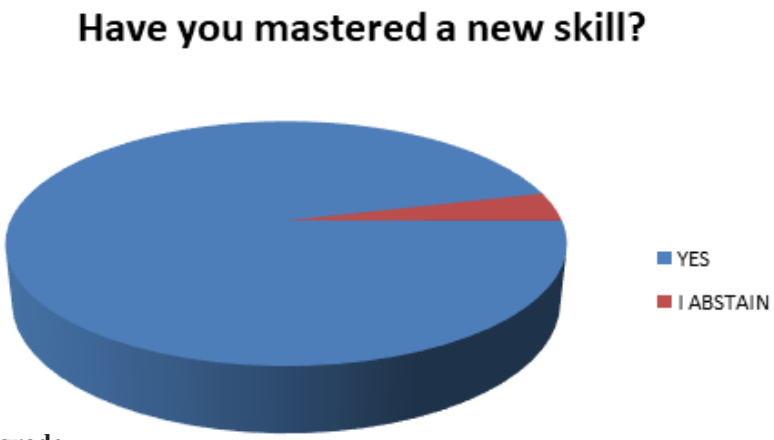
2. Did you learn anything new?
   71 students answered **YES**
   5 students answered **NO**
   2 students answered **I ABSTAIN**

Fig. 2. Answers to a question from the survey:
Did you learn anything new during the home experiment?



8th grade

3. Have you mastered a new skill?
193 students answered **YES**
9 students answered **NO**
6 students answered **I ABSTAIN**

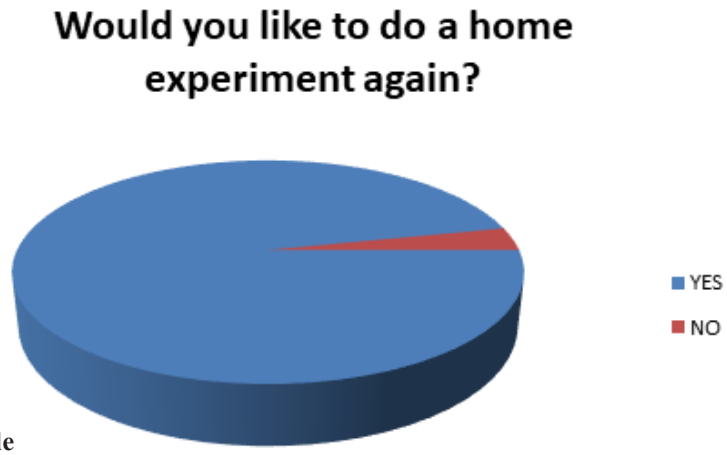


9th grade

3. Have you mastered a new skill?
75 students answered **YES**
0 students answered **NO**
3 students answered **I ABSTAIN**

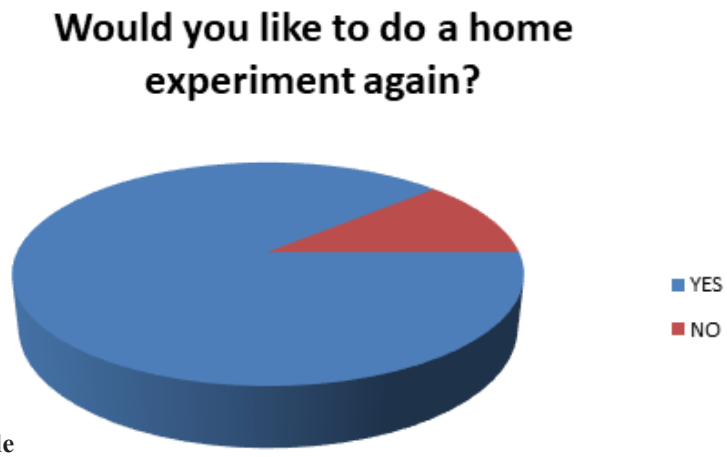
Fig. 3. Answers to a question from the survey:
Have you mastered a new skill during the home experiment?

The fourth question from the survey is related to the evaluation of the satisfaction of the Supplementary material of this teaching method (Would you like to do a home experiment again?) (Fig. 4).



8th grade

4. Would you like to do a home experiment again?
   201 students answered **YES**
   7 students answered **NO**



9th grade

4. Would you like to do a home experiment again?
   69 students answered **YES**
   9 students answered **NO**

Fig. 4. Answers to a question from the survey:
Would you like to do a home experiment again?

According to the results of the survey we can say: 8th grade students like the home experiments more than 9th graders. The reasons for this are most likely related to the learning content that student's study and the attractiveness of the home experiments.

In conclusion we can note that a home experiment significantly increases the motivation of the students in the study group.

Thanks to e-learning, the educational work did not interrupt during the restrictions imposed by COVID-19 (for both lockdowns). The technological world we live in provides us solutions for quick and reliable answer to the challenges. Today, these opportunities we can use to support the learning process and contribute to a new approach to education.

CONCLUSION

Project-based training includes a specific design and philosophy of the learning process. It is related to the organization of a purposeful activity of the student, in accordance with his / her personal needs and interests. It is based on the idea of leading the educational and cognitive activities of students in the process of obtaining results in solving practical and theoretically important problems. (Yotovska and Necheva, 2018). The PBL functions as a flexible learning environment that is organized around learning, not teaching, which can develop students' potential in an innovative and working model. Through PBL, a relationship can be established between the curriculum and real life. It can sometimes depend on the great success of the professional development of the personality. PBL can also give a person a chance to appear and participate in a discussion, talk about a topic

Author contribution statement: NK designed chemistry experiments. HV designed biology experiments. NK analyzed the results and wrote the manuscript.

Declaration of interest statement: All authors declare no conflict of interest.

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