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International Conference on Interdisciplinary Studies and Scientific Research

Berlin, Germany

30th January, 2024

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DEVELOPMENT OF RESEARCH SKILLS OF STUDENTS IN NATURAL SCIENCE TEACHING

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Abstract

This article is aimed at developing the research skills of students in the teaching of natural sciences and eliminating existing shortcomings in teaching. The article emphasizes the importance of science teachers for the development of students' research skills and academic preparation. It lays the groundwork for future research to improve and expand strategies for developing students' inquiry-oriented thinking skills.

Keywords: Science education, research, research-oriented approaches, manipulation, prediction, control variable, independent variable, dependent variable, fair test, hypothesis, natural-scientific literacy, tolerant attitude.



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In secondary schools, there are essential guidelines for teachers in developing students' research skills and nurturing future inventors, and how young children work with processes or objects that are new and unfamiliar to them. , it is natural for them to investigate, manipulate, feel, be curious, and seek answers through various questions. Who will they have to ask for answers? Junior researchers Where?, When?, Why?, How many times?, How much? etc. they try to find answers to such questions.

It is in the example of teaching natural sciences that students should be encouraged to find their own answers by carrying out as simple experiments as possible to these questions. Young researchers will have a strong sense of wonder about how natural phenomena occur, how natural processes work, and the inventions made by people in relation to nature. They try to know the world around them. It is one of the main tasks of pedagogues to teach from the elementary school age that this can be done with the help of scientific research.

We will analyze ways to take a step towards science and provide important instructions about scientific research by increasing natural and scientific literacy among primary school students. In this case, using the following diagram, we will study the methods of conducting research through the information and tasks presented in the textbook of natural sciences of the 4th grade students (Fig. 1).



Figure 1. Methods of conducting research through the information and tasks presented in the textbook of natural sciences

Let's look at a few examples of how students conduct their scientific research based on the sequence presented in the above diagram. For a small scientific research, a specific topic is initially selected. In this case, choosing a research topic is primarily based on researching an existing problem or new ideas. It is recommended to carry out preliminary research by methods of determining the composition and amount of food products used in daily life.

What causes substances to dissolve or not to dissolve in water? We will learn how to carry out this research. The following substances are tested during the research: soil, salt, sugar, coffee, sand and oil.

What questions should be used initially when conducting research?



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Whenever we learn something, *how?*, *why?*, *how much?*, *why?*, *how many times?*

starting with questions such as

- Which substances dissolve easily in water?
- What environment is necessary for the substance to dissolve in water?
- Why do some substances do not dissolve in water?

These questions need to be answered after the results of the research.

A prediction is an opinion about what will happen as a result of the analysis, and there are two stages of prediction, which are as follows (Figure 2).

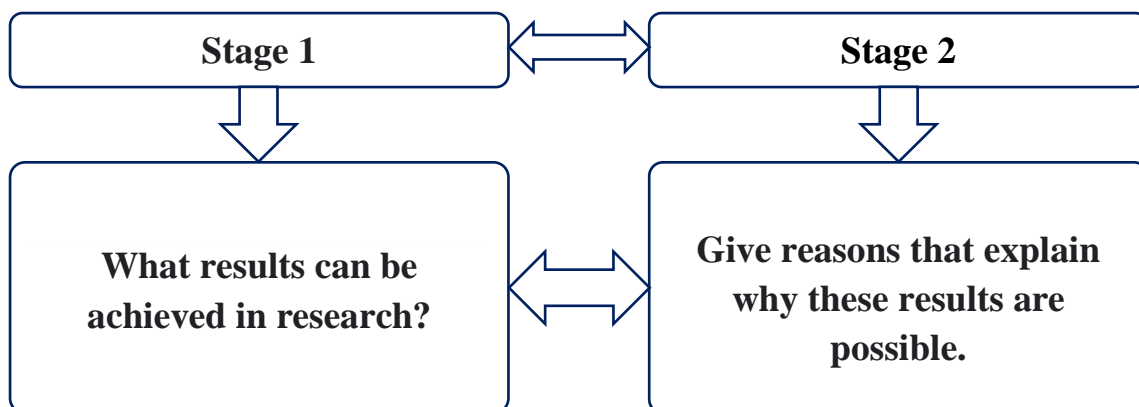


Figure 2. Prediction steps

These steps prevent the prediction from becoming a guess. Now let's give examples of reasons for asking questions and making predictions.

Question. What substances dissolve well in water?

Prediction. Salt and sugar dissolve well in water.

Reason. Salt and sugar in the form of crystals, consisting of small particles.



When planning an inspection, information is gathered about what needs to be done. It will also be necessary to plan how the analysis of the experiments will produce specific results (Figure 3).

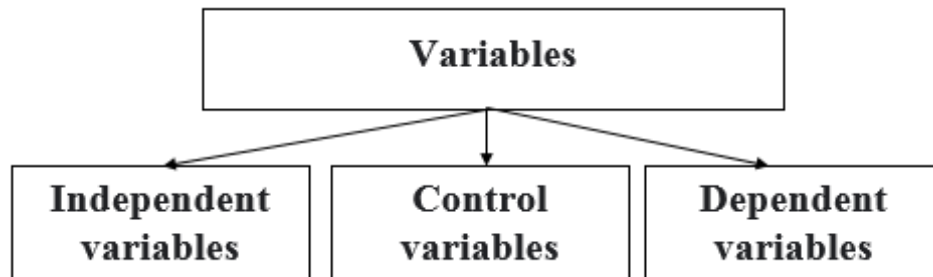


Figure 3. Variables

What is a control variable? First, let's find out the answer to this question. A control variable is an experimental condition or element that is the same throughout the experiment, is not of primary importance in the experiment or study, and does not affect the outcome of the experiment.

What is required to be kept the same? These are called control variables.

- amount of selected water and substances
- water temperature.

What is an independent variable? An independent variable is a single variable and is not modified by any other variable that is being measured.

What needs to be changed in the composition of the drink? They are independent variables.

- selected solid and liquid substances.

What is measured in an experiment is called the dependent variable. Its value depends on the change of the independent variable. In this investigation, which substance completely dissolved and how long it took is the dependent variable.



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Understanding these types of variables is critical to conducting valid and reliable scientific research.

Conduct observations

They are weighed to make sure that each dissolved substance is in the same amount. All the selected substances are monitored in small groups, under the supervision of the teacher and in compliance with the technical safety rules, the process of dissolution in water. It is determined which of the given solid substances dissolve quickly and completely in water, which dissolve slowly, and which are almost insoluble.

Re-analysis of the results. There are different ways to record results. Tabulating the results in this study will ensure that the data analysis is clear and orderly. The results can also be used to draw a diagram or graph. It is also useful for communicating ideas from research results to other researchers (Table 1).

Table 1. Solubility of substances in water

A solid substance	Soluble in water	It does not dissolve in water	Time taken to reach
Salt			
Sugar			
Coffee			
Sand			
Soil			
Fat			



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It is necessary to carefully consider the results obtained at the end of the inspections. In this case, it is determined which substance dissolves well in water, and the dissolution process of selected substances in water is compared. Based on the results of the analysis, the following questions arise.

- a. Were the initial predictions correct?*
- b. How reliable were the results?*
- c. Can other methods be used to obtain more accurate analysis?*

Conducting scientific research is always aimed at various questions and investigations.

- 1. What do you think is the reason why some substances dissolve slowly in water?*
- 2. Can coffee dissolve better than sugar when dissolved in water?*
- 3. When sand is dissolved in water, which part can remain dissolved?*
- 4. What means or environment are required to accelerate the process of dissolution of substances given for research in water?*
- 5. Compare coffee particles with salt particles. Does particle size affect dissolution?*
- 6. Why did the oil not dissolve in the water, what do you think is the reason for this?*

Testing an idea, called a valid hypothesis, is a common way to conduct an experiment, but children often do experiments without a hypothesis in mind to see what happens. Teachers will need to provide guidance on these hypotheses. A useful test in science teaching is a controlled experiment in which several conditions are compared with the same factor (called the variable) being investigated. The concept of a "fair test" or control experiment is important, but



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developing appropriate controls for experiments is a difficult process for many elementary school students, high school students, and some university students. All experiments "work", although the results are not always what we expect. When experiments do not produce the expected results, it is sometimes because the hypothesis being tested needs to be reconsidered or because the experiment itself is poorly designed. It should be emphasized that in any natural science research, students learn not only by doing, but also by thinking and talking about what they have done. Students learn by fitting their discoveries to existing patterns of experience and thus continue to develop and refine the ideas they already have about the world in which they live.

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