

UDC 372

**DEVELOPMENT OF A CONCEPTUAL UNDERSTANDING OF THE  
MATHEMATICS OF STUDENTS IN GRADES 7-10 THROUGH SOLVING PROBLEMS  
FROM REAL LIFE**

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Mathematics is everywhere around us. Every figure, movement, time is calculated by mathematics. As said, that mathematics is the tool of measuring. Without it would be impossible to create any theorems, definitions, science experiments. Almost all students during the school think that: “How and when will use these mathematical formulas, definitions, how mathematics will help in our life?” To answer these questions, we need to show them that solving mathematical problems is very interesting and could help them to understand mathematics more deeply. In this research will be discussed and analyzed how solving mathematical problems from real-life will develop critical thinking skills, improve their mathematical understanding and mathematical literacy skills of students from 7-10 grades. In addition, in this article represented some specific problems from particular mathematical topics.

At present, the importance of research based on real life examples is high not only in international schools, but also in secondary schools. Modern education is not enough to educate students when modern methods of information and education are developing rapidly. In addition to good knowledge, it is also important to develop research skills in order to maximize the ability to use this knowledge in practice. When it comes to understanding the problems from real life context by students, it is difficult for teachers to connect many topics from mathematics in grades 7-10 with

real life. I hope that this research will provide a sophisticated and effective tool for the teachers in the middle school.

The mathematical curriculum of the international programs occupies the unique place in scientific research, within there real-authentic problems also has a special place. Practical role of the mathematics for personality and society is a significant subject. As a result of these works, the practical significance of mathematics increases and the cognitive interest of students develops. This stimulating job helps students learn new concepts and skills or develop existing skills. This is also a serious problem in PISA (Programme for International Student Assessment) studies. That is, mathematical literacy - determines the ability of a person to be able to determine moreover, understand the role of mathematics in the world in which he lives, also provides a reasonable mathematical idea and use mathematics as a means of creativity, active and critical thinking in the present and future. This utility mainly focuses on real-world problems. In particular, mathematical studies can be used to develop the skills of students, such as:

- Recognize the problems that can be solved by the ongoing mathematics in the environment;
- Formulate these issues in math language. Creating a hypothesis;
- Classification;
- Developing direct and countermeasures;
- Practice;
- Evaluation, control, revision;
- Solving these problems using mathematical facts and methods;
- Ability to organize material;
- Analysis of applied methods;
- Interpretation of the results obtained;
- Formulate, prove, and defend the outcome of a decision.

Here has showed some problems that have created for to the students for particular topics. All problems and research works have been created by me and teachers from Mathematics Department of Nazarbayev Intellectual school of Astana. This research work has been created for 7's grade students, which they will solve during one lesson on topic "Degree". Research workcalles **"Radioactive decay"**, theme: Multiplication of degrees and exponentiation of the product. This work could be done individual or in pairs. Time to complete: 1 hour

**The aim of work:**

- a) Identification of the rule of pattern and the development of the ability to state the formula, which is found from the pattern.
- b) Calculate the decay time using aformula of radioactive decay that they have found and determine its benefit to society.

**Evaluation Criteria:**

1. Investigation of patterns
  - a)The student used mathematical methods to correctly detect patterns in all different situations of radioactive decay.
  - b) The student was able to use models to give correct answers to situations 1 and 2, and formulas for situation 3
  - c)The student has confirmed and justified the formulas in the situation 3
2. Communication
  - a) Able to consistently use the appropriate mathematical language
  - b) use various forms of mathematical representation to consistently present information correctly
  - c) efficiently navigate between different forms of mathematical representation
  - d) the lines of reasoning are complete and correct, sequentially organized using a logical structure.

**Radioactive decay**

**Introduction**

Radioactive material emits rays consisting of particles that we do not see. If the rays are strong, they are dangerous to the health of people, animals and plants. In the process of feeding the rays, the amount of radioactive material becomes less. This is called "radioactive decay." The speed at which the radioactive material decays is often measure by the 'half-life', that is, the time required for the decay of half of the radioactive material. The half-life of "Uranus 232", for example, is 70 years. Therefore, if we started with 10 kg of uranium now, in the 70s we would have 5 kg, in another 70 years 2.5 kg would remain.

**Situation 1:Radioactive materials - hazardous to health.**

The half-life of radioactive materials can be very long or very short. Scientists have discovered radioactive materials that were buried in the ground. They believe that there is about 1000 kg, and they found that the radioactivity is very high and dangerous. Only when it drops to 20 kg will the land area be safe again for people, animals and plants. The half-life of the material is 25 years.

- a) Approximately how long will it take for the area to be safe again? Use tables and/or diagrams to find an answer and explain your reasoning clearly.
- b) If you wanted to find out how many kg are left after 35 years and after 90 years which of the following would you use and why?
- Table
  - Diagram
  - Graph
  - Other
- c) Use the answer you selected above to find how many kilograms are left after 35 years and after 90 years. Explain.

**Situation 2: Radiocarbon Decay**

We all have some radioactive material in our bones called Carbon-14. Archeologists use this to find out how old bones are that they find buried in the ground. The half-life of Carbon-14 is about 5000 years. A living person now has about 0.8 mg of Carbon-14 in their bones and the archeologist measured 0.1 mg in the bones she found. Approximately how old do you think the bones are that she found? Use tables, diagrams and/or formulas to answer the question.

**Situation 3: Rapid radioactive decay**

Some radioactive materials decay very quickly. Let's say we have 1600 g of radioactive material with a half-life of 20 seconds, and we want to know by the minute how much radioactive material will remain

- a) Use charts and tables as needed to find a formula where n is time in minutes. Explain your reasoning.
- b) What would happen if we started with 8100 g and after 20 seconds only one-third ( $\frac{1}{3}$ ) of the material will remain? Use charts and tables as needed to find a formula where n is time in minutes. Explain your reasoning.

By this investigation, students will be able to identify the rule of the pattern, be able to solve real-authentic problems.

In addition, there is another example, which has given to students from 10's grade. This is research work that they should do at home. Topic is Sequences and Series, the time for work is 1 week. **The purpose** of the research work:

- understand how the compound interest formula is used in real life;
- understand how useful are the skills of calculating compound interest for a reasonable decision-making

**Objectives** of the study, they should **study and select** the research object, where compound interest percentages are calculated. For example, consumer loans, mortgage loans, car loans, leasing, investments, deposits, insurance, etc. **Consider** and decide on the choice of services offered by banks, insurance companies, microcredit organizations on the Kazakhstani financial market for

comparative analysis in order to determine the most favorable conditions. **Decide** on the problematic issue of their study.

They can choose one of the following problem questions or determine the problem yourself:

- 1) In which bank, on what deposit and in what currency is it more profitable to accumulate savings?
- 2) In which bank is it more profitable to take a consumer (money) loan (credit)?
- 3) What is more profitable: leasing or car loans?
- 4) Is it more profitable to take a mortgage loan, or rent house/apartments, to collect the necessary amount on deposit, or to collect on deposit 50% of the required amount, while also renting a home, then to arrange a mortgage?
- 5) Is life insurance a better alternative to deposits?

They should **provide** all the data necessary for their study. After completing the calculations, **make an analysis and conclusion** about the most beneficial terms of the proposed financial services.

**Reflect** the results obtained by answering the questions:

- What is the degree of accuracy of their calculations? **Justifying** answers.
- **Explain, justify the** usefulness of mathematical knowledge and skills on this topic in the context of real life.

From this work, they will be able to create the formula for calculating deposits, credits, loans in different conditions: with compound or simple interest, time, currency. To create formula they will use geometric series. This skill and knowledge will be very useful for their future. As students become adult, they will about their savings and face with loans, credits and by this knowledge, they can properly choose best option for themselves.

By conclusion, students whose solved kind of problems and completed research work such as above, improved their performance and more easily understood the concept of particular topics. I've analyzed that students got better marks on that topic after they had solved real-life authentic problems. In addition, results of survey among students has showed that most of them understand the topic from mathematics better if they solve problems from real world problems. I hope that the proposed work will greatly enhance students' interest in the subject, develop their research skills and critical thinking skills, and improve their math skills, that is, flawlessly performing tasks based on real life, and will be instrumental in effective use of subject knowledge gained from mathematics.

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