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Features of Teaching Probabilistic –Statistical Consepts

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ABSTRACT

In the article, the issues of teaching probabilistic-statistical concepts of mathematics in academic lyceum schools with a practical orientation are considered. It also contains some definitions of the content, essence and implementation of teaching mathematics with a practical orientation.

KEYWORDS: *practical-applied issue, probabilistic-statistical thinking, practical-applied orientation of teaching.*

The student's conscious assimilation of mathematical content is closely related to the practical improvement of educational materials. One of the factors justifying the inclusion of probabilistic-statistical content in mathematics curricula of general secondary education, in addition to the development of the student's logical thinking skills, is the connection of probabilistic-statistical concepts with real life [1].

Here, it should be noted that, despite the existence of certain experience and scientific research on the teaching of probabilistic-statistical materials of mathematics, some problems and conflicts still arise in this regard:

- compatibility of means, forms and methods of the practical-applied orientation of teaching in the introduction of basic mathematical concepts;
- appropriateness of educational content and time allocation;
- one of the main problems is that the program, organizational, methodological tools and forms of special courses and elective courses for the practical directions of mathematics are not developed in academic lyceums and schools.

Probabilistic-statistical concepts with a practical-applied orientation is a purposefully selected system of knowledge and forms suitable for mastering, aimed at showing that the science of randomness can be used by students in their further activities to express real-world processes, is a set of methods and teaching tools. The concept of practical-applied guidance education is the whole variety of application of the science of randomness to the natural, humanities, engineering and specific professional activities of the future specialist. The essence of such teaching is reflected in the systematic use of functional-practical and professional-practical issues in other fields of science and students' future professional activities with specific meaningful examples.

Probabilistic-statistical problems can be mainly divided into four groups [2]: pure mathematical problems (based on basic formulas and theorems, intended for use in standard situations); illustrative-practical problems (practical content appears as an illustration of mathematical content); functional-practical issues (directed to mastering the skill of applying mathematical concepts in practical situations); professional-practical issues (intended to master the skills of applying mathematics in professional activities). Functional-practical and professional-practical issues are convenient didactic elements in teaching probabilistic-statistical concepts in a practical-applied direction. In particular, showing the necessity of mathematics, its practical direction in solving important tasks in the national economy and technology is closely related to the level of the teacher's ability to use applied problems [3]. Emphasizing that one of the main tools in practical-oriented teaching of probabilistic-statistical concepts is applied problems, they can be conditionally divided into two groups: 1) Problems that lead to the introduction of a new mathematical concept; 2) problems solved using the introduced new concept.

Example 1. If a new family wants to have three children in the future, what is the probability that all three children will be of the same sex, i.e. three girls or three boys.

Solution: We can write each situation in the form of an ordered triple, made up of q and o, depending on the order of birth. Then the space of elementary events $\Omega=$(o'o'o', o'o'q, o'qo', o'qq, qo'o', qo'q, qqo', qqq) consists of a set and it can happen with every elementary event with equal probability - $\frac{1}{8}$ According to the condition of the problem, we need to find the P (A) probability of the set (o'o'o', qqq). So the answer is:

$$P(A)=\frac{n(A)}{n(\Omega)}=\frac{2}{8}=\frac{1}{4}.$$

Example 2. According to statistics (World Health Organization 2019 Analysis Reference), approximately 1 in 1,500 people in the US die from lung cancer each year, and 1 in 2,000 smokers die from lung cancer. Find the probability that a person who does not quit will die of cancer in one year in the United States [4].

Solution: For a randomly selected person in the USA, let's define the event A - "this person smokes" and the event B - "this person dies of lung cancer in one year". In that case

$$P(B)=\frac{1}{1500}=0{,}00067 \text{ and } P(A\cap B)=\frac{1}{2000}=0{,}0005.$$

$$A\cap\overline{A}=\varnothing,\ A\cup\overline{A}=\Omega$$

considering that it is our goal $P(\overline{A}\cup B)$ is to determine the probability. According to the relationship of $P(A\cap B)+P(\overline{A}\cap B)=P(B)$

$$P(\overline{A}\cap B)=P(B)-P(A\cap B)=0{,}00067-0{,}0005=0{,}00017.$$

From this example, it can be seen that the desired result can be achieved even without finding the basic value P (A).

Example 3. There are 10 seeds in the package, 6 of them are dark and the remaining 4 are known to be empty. They are indistinguishable from their appearance. If two seeds are voluntarily taken from the package, then: a) both seeds are dark; b) at least one is null; s) find the probability that only one of them will fail [5].

Solution: a) it can be seen, P (1— seed is full)$=\frac{6}{10}$. Now if the first seed taken is full, then there will be 9 seeds left in the packet and 5 of them will be full. That is why

P (both seeds are full) $= P$ (1-seed is full)$\cdot$ P (2-seed is full, if 1- seed is full)$=\frac{6}{10}\cdot\frac{5}{9}=\frac{1}{3}=0{,}33$

we find that.

b) A - let both seeds be full events. In that case $\overline{A}$ -the event means that at least one of the two seeds is empty. P (at least one of the two seeds fails)$=1-P(A)=1-0{,}33=0{,}67$.

c) The event that one of the two seeds is full and the other is empty can be realized in two different ways. Because the first seed is full and the second is empty, or the first seed is empty and the second is full. If a black seed is selected, then there are five black seeds and four black seeds left in the pack. That is why P (2-seed is empty, if 1-seed is full)$=\frac{4}{9}$ it follows that. That is why

P (1-seed is full va 2-seed is empty)$=$ P (1-seed is full)$\cdot$ P (2-seed is empty, if 1-seed is full) $=\frac{6}{10}\cdot\frac{4}{9}=\frac{4}{15}$

It follows that. As well as,

P (1-seed is empty and 2-seed is full) $=\frac{4}{10}\cdot\frac{6}{9}=\frac{4}{15}$

These two events are mutually exclusive events, that's why P (only one of both seeds is empty) $=\frac{4}{15}+\frac{4}{15}=\frac{8}{15}$.

To check the accuracy of this found probability, we consider the following probability:

P (both seed are empty)$=P$ (1-seed is empty) $\cdot P$ (2-seed is empty, if 1-seed is empty) $=\frac{4}{10}\cdot\frac{3}{9}=\frac{2}{15}$.

Now the events "both seeds are true", "only one seed is null" and "both seeds are null" are mutually exclusive events, and all three together give all possible states. Therefore, the sum of their probabilities should be equal to 1. This can be easily checked.

Example 4. According to statistics (World Health Organization 2019 analysis reference), 1 in 3 people smoke in the USA, and 1 in 1500 people die from lung cancer during the year. Also, one in 2,000 smokers dies of lung cancer during the year. Are smoking and lung cancer deaths related? Compare lung cancer deaths among smokers and nonsmokers**.**

Solution: A - the event of a voluntarily selected person becoming a smoker, $\overline{A}$ -the event of a voluntarily selected person not smoking and B - Let there be a case of dying of lung cancer of a voluntarily selected person during the year. In that case

$$P(A)=\frac{1}{3}\approx 0{,}33,\quad P(B)=\frac{1}{1500}\approx 0{,}00067$$

and

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$$P(A \bigcap B) = \frac{1}{2000} = 0{,}0005$$

From these

$$P(A \cap B) > P(A) \cdot P(B)$$

because events A and B are interrelated. Thus, P (the death of a smoker from lung cancer during the year) $= P$ (B , if A occured) $= \frac{P(A \cap B)}{P(B)} = \frac{0{,}0005}{0{,}33} \approx 0{,}0015$

we will have value. The above can be interpreted as follows: you can say that the probability that someone will die from lung cancer is 0.00067 without any information. However, if you know that this person is a smoker, then this probability is more than twice that, i.e. equal to 0.0015. Based on these data, you can find the probability that a non-smoker will die from lung cancer during the year.

$$P(\overline{A} \cap B) = P(B) - P(A \cap B),$$

(here $\overline{A}$ - A event opposite event) according to relationship so,

P (the death of a non-smoker from lung cancer) $= P(B,$ if $\overline{A}$ -occured) $= \frac{P(\overline{A} \cap B)}{P(\overline{A})} = \frac{0{,}00067 - 0{,}0005}{1 - 0{,}33} = 0{,}00025$

Thus, the chance of a smoker dying from lung cancer is six times greater than that of a non-smoker.

It should be noted that the relationships and connections that we see are called in mathematics "correlation" (degree of dependence) between smoking and lung cancer events.

It is appropriate to take into account the following when teaching probabilistic-statistical concepts with a practical orientation [6]:

- improvement of methodological aspects of the method of describing the concept of subject and object of combinatorics, probability theory and mathematical statistics;
- to ensure that there is sufficient information from the practical point of view that clarifies the phrase "an event occurred" and to form probabilistic-statistical thinking (thinking); (By probabilistic-statistical thinking, we mean a specific form of thinking, which allows us to think about the possibility of the beginning of one or another process, to reason about their probability, to draw correct conclusions, to logically evaluate situations that create randomness, to get out of them allows you to find ways and predict the future;
- it is necessary to provide more practical examples of the direct connection between the concept of conditional probability and the concept of independence of events.

Also, probabilistic-statistical practical problems must meet the following requirements:

- practical problems should be aimed at the development of students' probabilistic-statistical thinking, strengthening their interest in learning mathematics;
- implies an organic connection with the system of concepts in the mathematics course;
- expressing the content of the students in relation to their future professional activities;
- practical issues are like variable knowledge in content [8].

One of the main factors in the development of students' motivational activity is the increased use of practical problems in the process of teaching mathematics. From this point of view, the methods and means of practical-applied orientation of teaching in the consistent development of the ability of academic lyceum and school students to increase the probabilistic-statistical thinking potential, to form a system of sufficient knowledge and skills, to apply mathematical knowledge in practical activities and pedagogical possibilities are of great importance.

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