Influence of the specialty of respondents on the effect of using chewing gum when solving a mathematical test

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Abstract. The paper presents the results of studies of the influence of the specialty of students on the effect of using chewing gum when solving a mathematical test. It is shown that in respondents studying in specialties for which the disciplines of the physics and mathematics cycle are basic and are taught in a large volume of credit points, the use of chewing gum in solving test tasks in mathematics has a negative effect. In respondents for whom the basis of the specialty is subjects of the natural science cycle, and physical and mathematical disciplines are taught to a lesser extent, chewing gum does not have a reliable effect on the result.

1 Introduction

Studies of the effect of using chewing gum on cognitive function have been conducted for a long time [1], while the importance of chewing movements for the preservation of mental abilities in old age is noted [2]. It is also indicated that the lack of chewing stimulation negatively affects the memory of mice during growth [3], and in general is a risk factor for cognitive dysfunction [4]. This is because chewing helps maintain cognitive functions in the brain that depend on the hippocampus, a part of the central nervous system vital for memory and learning [5]. It has been shown in mice that tooth loss at an early age leads to cognitive impairment [6]. Also, altered chewing in animals [7] and discomfort during chewing in humans negatively affect cognitive abilities [8]. On the contrary, the use of chewing gum (and gum as a very ancient form of relaxation) has a positive effect on cognitive function and learning [9], including under stressful conditions [10]. The purpose of this study was to study the effect of chewing gum on the results of completing tasks in mathematics in students of various specialties having different levels of mathematical training.

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2 Materials and methods

The research was carried out with groups of mechanics students and biotechnology students of the St. Petersburg State Technological Institute (Technical University), St. Petersburg, Russia (mechanical students have more hours to study the disciplines of the physics and mathematics cycle than biotechnology students). The tests were carried out in the middle of the fall semester of the 2019/2020 academic year in order to eliminate the influence of stress due to the upcoming exams and, on the other hand, to exclude the influence of long summer holidays. The groups were formed by lot. The study used a math test with computational exercises of addition, subtraction, multiplication and division, but the tasks were quite cumbersome and required attention and concentration. Calculations were made without using a calculator on a sheet of paper. It was necessary to complete the largest number of exercises in 15 minutes. To exclude the possibility of solving the test in a shorter period of time, the number of tasks is given in excess. This circumstance was previously explained to the respondents in detail. The control and experimental groups consisted, respectively, of 57 people for mechanics, 19 and 23 people for biotechnologists. The subjects participated in the testing only once. The research used the Mentos mint chewing gum.

The Mann-Whitney test was used to process the data. The critical values of the criterion up to 60 variants were taken according to [11]. The level of significance was taken as $p \leq 0.05$.

3 Results and discussion

The test results are shown in Figures 1 and 2. When the Mann-Whitney criterion is used among mechanical students, the null hypothesis is rejected ($U_f=746$; $U_{st}=1333$) - chewing gum significantly worsens the test results in mathematics among mechanical students. For respondents-biotechnologists, the situation is different: the null hypothesis remains ($U_f=192$; $U_{st}=152$) - chewing gum does not reliably affect the results of testing in mathematics of students of biotechnology.

Fig. 1. Distribution of test results for the experimental and control groups of mechanical students. Column color: red - with gum, blue - without gum.

Since students deal with mathematical problems on a daily basis, and mechanics in a much larger volume, the simplest arithmetic operations are performed, for the most part, unconsciously. Chewing gum not only does not help mechanics to concentrate, but, on the

contrary, distracts with monotonous actions. Apparently, the volunteers mentioned in article [1] are not experts in disciplines related to mathematics, so chewing gum helps them to concentrate and gives reliable positive results. Thus, the solution of test exercises by experts in the subject area and non-specialists differs in that the specialist is more fully concentrated in solving the problem, and any other actions are perceived by him as additional tasks that distract from the main task, by analogy with driving, which requires full attention [12].

Fig. 2. Distribution of test results of the experimental and control groups of biotechnology students. Column color: green - with gum, yellow - without gum.

4 Conclusions

The use of chewing gum leads to different results depending on the specialty of the respondents. If the respondents specialize in the field of knowledge in which the test is carried out, chewing gum worsens the results. Thus, when studying cognitive functions associated with the influence of additional tasks on the result of the main test task, one should take into account the respondent's specialty (life experience) in order to avoid false positive/false negative results.

5 Contribution of authors

Kozlov G.V. - idea of work, verification of test materials and work plan, direct testing (biotechnology respondents), processing, discussion, writing and editing of the paper.

Luch A.P. – development of test materials, direct testing (respondents of mechanics and biotechnologists), processing results, including primary protocols, discussion, editing the paper.

Pushkarev M.A. - discussion, checking the results, writing and editing the paper.

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