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## **Features of the educational process as factors of illusion of knowledge in students**

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**Abstract.** The phenomenon of the illusion of knowledge as a mistake of metacognitive monitoring is considered in the article. The factors of illusion of knowledge that arise in the learning process (use of schemes and presentations, teacher feedback, group interaction, repetition of material, problematization of experience, type of test question, presence or absence of assessment situation) are analyzed. In the process of psychological and pedagogical experiment, the factors that increase the probability of the illusion of knowledge in the educational process of students have been identified

**Keywords.** metacognitive monitoring, illusion of knowledge, learning.

### **1. Introduction**

Judgments of metacognitive monitoring are an important source of student regulation of the process of cognitive activity during the assimilation of information. It is obvious that in case of excessive confidence, when memorizing the instructional material, the student will pay little attention to learning it, because he will mistakenly believe that he has mastered it. Instead, if the student underestimates his abilities, he will spend too much effort and time processing the information. Due to the negative impact of the illusion of knowledge on the productivity of memorizing information, there is a need for a comprehensive study of this phenomenon in order to minimize its impact on the process of working with information. It is especially important to study the causes of this phenomenon. In particular, the study of this aspect will allow a deeper understanding of the essence of this phenomenon. Also, knowledge about the factors of the illusion of knowledge makes it possible to adjust and influence the process of this phenomenon

### **2. Literature review**

The fact that students overestimate their own knowledge, or ignore the lack of awareness of information, is one of the manifestations of the ineffectiveness of metacognitive monitoring. The accuracy of metacognitive monitoring allows the individual to successfully use effective metacognitive strategies to achieve the goals of cognition. This gives an advantage in planning information processing processes and defining effective strategies in the future. One of the problems of studying the illusion of knowledge is the differences in the definition of this phenomenon. The illusion of knowledge is identified with such concepts as "cognitive optimism" and "excessive confidence". Close to the concept of the illusion of knowledge is

"subjective confidence". D. Metcalfe uses the term "cognitive optimism", considering it as a tendency of the individual to reassess the level of their own knowledge [11].

The concept of the illusion of knowledge is used to explain confidence in the success of information storage processes at a time when this process failed (S. Ward and G. Clark) [20]. M. Augustyuk considers the illusion of knowledge as a mistake of metacognitive monitoring, which arises due to excessive subjective confidence in knowledge, which does not correspond to the objective success of tasks [1]. P. Lindstrom defines the illusion of knowledge as a phenomenon that can hinder the effective learning of those students who cannot provide the correct information, focusing on the reading process [10]. According to the researcher, the essence of the illusion of knowledge is the absence of an error signal, that is, a signal that the information is incomprehensible. Such a signal, first of all, presupposes the presence of an emotional response, because such an emotional response differs between those who show the illusion of knowledge and those who tend to accurately assess their own knowledge.

A. Glenberg, A. Wilkinson and W. Epstein consider the concept of failure in the self-assessment of cognition, which, in our opinion, is close to understanding the phenomenon of the illusion of knowledge. Researchers believe that the illusion of knowledge is a misconception that the understanding of information was achieved when in fact it did not happen [6]. That is, the illusion of knowledge occurs when readers are unable to find contradictions in the text, appreciating the level of understanding of the text. Comparing the illusion of knowledge with the illusion of perception, the authors call it a discrepancy between subjective evaluation and objective result.

Based on our analysis of the psychological literature, we distinguish our own definition of the illusion of knowledge. So, we understand it as inadequate confidence (excessive or insufficient) in the correctness of the learned information in the process of educational activities.

In domestic studies, the illusion of knowledge is often associated with confidence. In our opinion, such an interpretation of the illusion of knowledge is the key to understanding it. In particular, A. Odaynyk emphasizes that it is necessary to distinguish between the concepts of personal and situational confidence [14]. It is with the latter that we identify the illusion of knowledge. According to the researcher, such confidence is a metacognitive characteristic associated with the control over the implementation of their own judgments and is determined by internal regulatory mechanisms, rather than external regulation. The author analyzes the effects that occur in the case of inadequate confidence: the phenomenon of lack of confidence, the phenomenon of excessive confidence and the effect of complexity-ease. It is established that with increasing complexity of the task the number of correct answers decreases, but the level of human confidence in their correctness increases. However, as the complexity of the task decreases, the number of correct answers increases, but the level of confidence decreases. In general, people tend to exaggerate the level of information assimilation.

We have considered studies in which one way or another the problem of the accuracy of metacognitive monitoring is considered in the context of educational activities. Thus, E. Savin plays a significant role in personal factors of confidence in a particular area of knowledge [19]. D. Hacker, L. Ball, M. Kener emphasize that confidence in the accuracy of the problem depends on the complexity of the training material [8]. Scientists have considered the use of problematization of experience as a factor in improving the accuracy of metacognitive monitoring (AE Fomin, TM Miller, L. Jerassi). N. Rozumovska revealed the interaction of feedback factors and metacognitive judgments about how successfully the task was performed [18]. According to the researcher, the presence of feedback increases the accuracy of

metacognitive judgments. J. Danloski and K. Raven found that in situations where subjects had the opportunity to re-read the text, the accuracy of monitoring increased [4].

Studies of the illusion of knowledge due to incorrect perception of the lightness or complexity of the text are quite widely presented (McGrihan, Mueller, Fods and Castel, etc.). When using accurate, clear instructions, judgments about the correctness of learning were more accurate.

As we can see, today there are links between the accuracy of metacognitive monitoring and the characteristics of the learning process. However, among the studied factors there are no ones that are directly related to educational activities.

There is a logical problem of classification of factors of accuracy of metacognitive monitoring. On the one hand, such factors may be those that characterize the personality of the teacher and those that characterize the learning process.

A sense of the complexity or simplicity of the material that needs to be learned by the student can lead to the illusion of knowledge. Thus, A. Brown noted that the subjective perception of the complexity or simplification of the problem can affect the processes of metacognition [2]. It is quite logical that the subjective feeling of lightness of the material will cause a misconception about the simplicity of its assimilation, which will lead to the illusion of knowledge. The feeling of complexity of the task affects the incorrect assessment of the text, which leads to the illusion of knowledge. D. Moore and P. J. Healy wrote that in the case when the tasks are subjectively difficult, the subjects overestimate the level of actual performance and mistakenly believe that they coped worse than others, if the tasks are easy, the subjects of educational activities underestimate the level of assimilation and mistakenly believe that they did better than others [13]. The level of complexity of information plays an important role in establishing the accuracy of metacognitive judgments. Emphasizing the inclusion of meta-thinking processes in the activity, A. Brown notes that their appearance and disappearance depends on the factors of complexity of the problem and the motivation of the researcher to solve it [2]. B. D. Pulford argues that overconfidence depends on the complexity of the task, emphasizing that overconfidence is usually more likely when the task is difficult, and less likely when the task is easy (in which case it is often a question of insufficient confidence) [17].

Speaking about the way of presenting educational information, we mean the use of various methods of presenting texts - the division of information into paragraphs, the use of diagrams, tables, figures and more. Because this presentation simplifies the material, makes the learning process easier, the student may overestimate the level of learning this information. Thus, B. Pulford argues that excessive confidence can be manifested when the presented material is perceived as easy to learn [17]. According to L. Lin, K. Zabucky and D. Moore, subjective interest in information causes excessive confidence in the correct understanding of the material [9].

We asked ourselves the question: can the illusion of knowledge be influenced by the way knowledge is tested? If the student knows what type of questions will be asked after processing the information, will it affect the emergence of the illusion of knowledge? In particular, there are the following types of tests: choosing the correct answer from the set, answer yes / no / I do not know, own answer.

The causes of systematic errors in judgments are the tendency of subjects to choose affirmative answers rather than negative ones, as well as the tendency to ignore the answer that does not coincide with the chosen one. As J. Pallier and others have found, open-ended questions, in contrast to the multiple-choice test, contribute to greater accuracy of metacognitive judgments [15]. This is due to the fact that in the tasks of choosing from the set there

are so-called "familiar words" that can confuse the subjects in the choice, which is not in open-ended questions. However, this is not an indication that these issues are not without objectivity.

M. K. Carvalho de Filho found significant differences between the performance of tasks and the accuracy of judgments about the accuracy of the answer [3]. Subjects are more accurate in the case of open-ended questions than in multiple-choice questions. Having found the influence of the number of correct answers in the test item on the confidence in their solution, E. Savin a concluded that the subjects are more confident in the accuracy of the test items with three correct answers than with one or two [19]. Also, regardless of the type of test, students tend to overestimate their own knowledge, they show the effect of overconfidence. In addition, the effect of the interaction of the factors "the number of correct answers in the test item" and "self-confidence" was revealed: subjects with low self-confidence are more confident in performing test tasks with exactly three correct answers.

N. Rozumovskaya's research confirms the influence of feedback on students' metacognitive judgments [18]. According to research, the presence of feedback leads to a decrease in optimism in predictions about the correctness of the tasks. The same study found that not only feedback but also group specificity affected the accuracy of judgments. The effect of interaction of factors "professional group" and "feedback" in their joint influence on students' metacognitive judgments about how they performed the test tasks was revealed. This indicates that it is important not only to have feedback, but also the specifics of the group, where the appropriate psychological and pedagogical influence. T. Miller and D. Jerassi found differences between the level of confidence in the knowledge of students with different levels of academic achievement [12]. Thus, students with a low level of academic performance showed a higher level of false confidence in the correctness of their knowledge.

A. Fomin singled out the factor of using the method of problematization of experience [5]. The method of problematization of experience is to contrast the existing thoughts, ideas and assessments of the individual and the new experience gained in the learning process. An example of problematization of experience can be the comparison of the subject of educational activities of subjective assessments of their own knowledge in answering test tasks and objective test data, which he then receives from the teacher. These data indicate that the psychological and pedagogical interaction of student and teacher affects the accuracy of metacognitive monitoring. The data obtained by the researcher indicate that the problematization of experience has a significant positive learning effect. Confidence in the correctness of the wording is reduced. We can talk about the positive role of problematization in the development of more accurate metacognitive monitoring.

The presence or absence of repetition of material can also be a factor in the illusion of knowledge. Thus, in the studies of J. Danloski and K. Rawson, it was found that re-reading the material increased the accuracy of assessing the assimilation of information [4]. The authors compared the accuracy of the assessment of the material depending on the time of repetition - immediately after the first acquaintance with the information, and a week later. Differences were found in the accuracy of the assessment of information assimilation depending on the time allotted for repetition. Thus, in the case of rapid re-reading of information, students were less accurate.

A. Fomin and A. Pavlenko investigated the influence of the situation of assessment of educational achievements on metacognitive monitoring of solving tests of subject knowledge of subjects of educational activity. The situation of assessment of academic achievement means the situation in which the subjects performed a test to monitor academic achievement. Whereas the absence of such a situation meant that students took the test not to assess their knowledge, but to construct the test. Subjects who performed the test in a situation of assessment of

academic achievement showed lower confidence in the decision, compared with those students who took the test without assessment of achievement [5].

### 3. Method

The sample consisted of 76 students, representatives of various specialties, represented at the National University of Ostroh Academy, out of which - 28 male and 48 female subjects. The average age of the subjects was 19,8 years. The sample was formed by random sampling. The participants of the experiment formed one experimental group with intragroup variables. The experimenter presented a lecture material for students in one of the 6 blocks (see Table 1), in which various factors were presented. After processing the materials for each block, a survey was conducted, which checked the level of assimilation of information and judgments about the studied

*Table 1. Blocks of experimental research*

<i>N<sup>o</sup></i>	<i>The factor under study</i>	<i>The topic the students worked on</i>	<i>Means used</i>
1.	Using schemes. Evaluation situation. Open-ended questions.	«Mental phenomena»	Structure of mental phenomena (mental states, processes and properties). The printed scheme for each student.
2.	Using the presentation Evaluation situation. Questions with answer options	"Directions of psychology: psychoanalysis"	Presentation on psychoanalysis, which consisted of 10 slides, which presented the main provisions of this area.
2.	Group interaction Evaluation situation. Open-ended questions.	"Directions of psychology: behaviorism and cognitive psychology"	Using the method of "openwork saw".
4.	Problematization of experience. Questions with answer options. No situation situation assessment	"Directions of psychology: humanistic psychology"	The use of questions that stimulate the search for a problem in the educational material, the mismatch of personal experience with aspects of the topic covered
5.	Providing feedback Open-ended questions No assessment situation.	"Periodization of age development"	Teacher's critical assessment of students' judgments
6.	Repetition of material. No assessment situation.	Repetition of all the above topics	Repeated testing

After reviewing the information in each block of the experiment, students answered the questions (5 open-ended questions, which allowed to assess such a factor as the presence of open-ended questions (block 1, block 3, block 5) and 5 questions with a test question (block 2 and block 4) to test the impact of test questions on the emergence of the illusion of knowledge), which related to the information considered in the lecture. With their help, we could objectively assess the level of information assimilation by students. To each question, students answered two more questions:

1. "How difficult is this question?" - to establish the level of complexity / ease of the material;

2. "How confident are you in the accuracy of your answer to the question" - to assess retrospective judgments about the study. Students rated from one to ten, where one is the minimum confidence / maximum difficulty, and ten is the maximum confidence / minimum difficulty. The time for making judgments is arbitrary.

The study of the peculiarities of the illusion of knowledge is carried out using the confidence index (O/U index). This is a parameter for evaluating meta-memory judgments, which states the nature of the correspondence between subjective evaluation and an objective indicator of playback performance: the effect of overconfidence or underconfidence. The O/U index was proposed by S. Liechtenstein and B. Bischohoff to measure the effect of excessive confidence or excessive uncertainty. The O/U index can range from:

1. From -1 to 0 - in this case the effect of excessive uncertainty is established;
2. From 0 to +1 - in this case the effect of excessive confidence is established

#### 4. Results and discussion.

On the Table 2 presents the indicators of the O/U index in terms of situational factors, namely the peculiarities of the organization of the educational process.

**Table 2. Descriptive statistics of O / U index indicators in the studied**

Factors	Number of subjects	Average indicator	SD	Minimal indicator	Maximal indicator
Group interaction	76	0,4168	,50448	-1,00	1,00
Visual information	76	0,2478	,65807	-1,00	1,00
Presentation	76	0,2436	,51747	-1,00	1,00
Problematization of experience	76	0,2705	,51679	-1,00	1,00
Providing feedback	76	0,5447	,46324	-,60	1,00
Test questions	76	0,2132	,58709	-1,00	1,00
Repetition	76	0,2674	,63085	-1,00	1,00
Evaluation situation	76	0,1484	,64449	-1,00	1,00
Open questions	76	0,1668	,63281	-1,00	1,00
No evaluation situation	76	0,3597	,53323	-1,00	1,00
General significance	760	0,2879	,58076	-1,00	1,00

Using one-way analysis of variance ANOVA revealed a statistical difference between the O / U index in terms of situational factors [ $F = 3,392$ ;  $p = 0.000$ ].

We can conclude that students tend to show the effect of excessive confidence, because all values of the O / U index, regardless of the factors above zero. This means that students tend to overestimate their knowledge. This result confirms the already existing studies of the accuracy of metacognitive monitoring (A. Karpova, E. Savina, M. Augustyuk and others).

In addition, we used LSD analysis, which allows us to determine which differences between the O / U index are the most significant. In particular, statistically significant differences between the indicators of the O / U index in terms of the following factors:

- Between the factor "group interaction" ( $M = 0.4168$ ;  $SD = 0.50448$ ) and the factor "question with answer options" ( $M = 0.2132$ ;  $SD = 0.58709$ ) at the level of significance  $p = 0.029$ ; factor "assessment situation" ( $M = 0,1484$ ;  $SD = 0,64449$ ) at the level of significance  $p$

= 0,004; factor "open-ended question" (M = 0.1668; SD = 0.63281) at the level of significance  $p = 0.007$ ; Between the factor "use of schemes" (M = 0.2478; SD = 0.65807) and the factor "provision of feedback" language "(M = 0.5447; SD = 0.46324) at the significance level  $p = 0.001$ ;

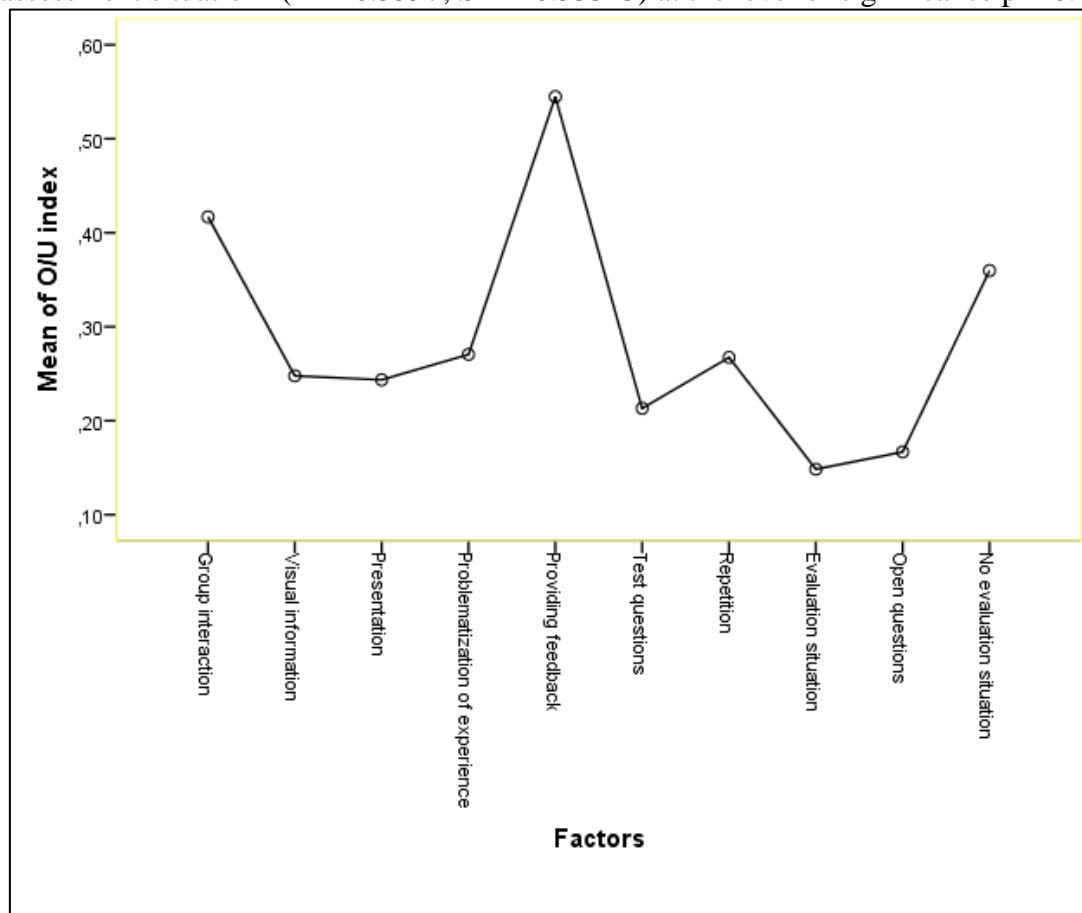
- Between the factor of "use of presentations" (M = 0.2436; SD = 0.51747) and the factor of "feedback" (M = 0.5447; SD = 0.46324) at the level of significance  $p = 0.001$ ;

- Between the factor "problematization of experience" (M = 0.2705; SD = 0.51679) and the factor "feedback" at the level of significance  $p = 0.003$ ;

- Between the factor "providing feedback" (M = 0.5447; SD = 0.46324) and the factor "question with answer options" (M = 0.2132; SD = 0.58709) at the level of significance  $p = 0.000$  ; the factor of "repetition of material" (M = 0,2674; SD = 0,63085) at the level of significance  $p = 0,003$ ; factor "assessment situation" (M = 0,1484; SD = 0,64449) at the level of significance  $p = 0,000$ ; factor "open-ended question" (M = 0.1668; SD = 0.63281) at the level of significance  $p = 0.000$ ; factor "no assessment situation" (M = 0.3597; SD = 0.53323) at the level of significance  $p = 0.047$ ;

- Between the factor "assessment situation" (M = 0,1484; SD = 0,64449) and the factor "absence of assessment situation" (M = 0,3597; SD = 0,53323) at the level of significance  $p = 0,023$ ;

- Between the factor "open-ended question" (M = 0.1668; SD = 0.63281) and the factor "no assessment situation" (M = 0.3597; SD = 0.53323) at the level of significance  $p = 0.038$ .



*Fig. 1. Differences in the O/U index depending on the characteristics of the organization of educational activities*

Qualitative analysis allows us to conclude that the most pronounced effect of overconfidence is presented in cases where the teacher provides feedback. It follows that positive support and positive feedback determine the belief of students that they have mastered the material well enough, which, however, is not a guarantee of the actual availability of this knowledge. On average, the effect of excessive confidence is manifested in the case when learning is organized in the form of group interaction. Combined with the previous factor, we see that external reinforcement, which comes from both the teacher and the students, external criticism and discussion helps to increase the illusion of knowledge in students. In the process of discussion, reflection on the information that is processed in the learning process, the student has a sense of better learning. However, discussion alone does not automatically mean memorizing them.

The lowest values of the O/U index, and, accordingly, the smallest manifestations of the effect of overconfidence were found in the following factors: the use of clarity, including handouts in the form of diagrams, and presentations. That is, visual presentation of information, visual reinforcement increases the accuracy of metacognitive monitoring. We can explain this by the fact that in the case of information perception through two channels, audio and visual, the process of memorizing information is more efficient. Accordingly, such an organization of the process of memorizing information increases not only the level of memorization, but also the accuracy of metacognitive monitoring. By a similar principle, we can explain the higher values of the O/U index in the case of repetition of the material.

In the case of re-processing the same information, the student more effectively assesses the level of acquisition of their own knowledge. Problematization of experience involves comparing the existing knowledge of the student with those that he acquired during the lecture. Understanding new data in the context of one's own experience (including life, everyday life) increases the adequacy of awareness of the level of acquired knowledge, and, accordingly, reduces the effect of excessive confidence. This thesis is confirmed by the fact that there are differences in what type of question is offered to students to control knowledge. Thus, in the case of open-ended questions, the level of overconfidence is lower, and in the case of questions with a test answer - higher. We attribute this to the fact that giving an open answer, which must be expressed in one's own words, activates the processes of metacognitive monitoring. This increases its accuracy. While test questions can be performed more automatically, and do not provide such a high level of involvement of metacognitive activity. It also reduces the level of overconfidence and the assessment situation. It is established that in the case when students expect that their knowledge will be evaluated, the illusion of knowledge is manifested to a lesser extent. Perhaps this is due to the motivational characteristics of students - in this case, they are more responsible for the acquisition of knowledge, choose effective strategies for monitoring their own learning activities.

Therefore, the situational factors studied by us can be divided into three groups according to the criterion of indicators of average values of O/U index:

1. The factor that characterizes the highest O/U index: providing feedback;
2. Factors characterizing high indicators of O/U index: absence of a situation of an estimation and group interaction;
3. Factors that characterize the indicators of O/U index above average: the use of clarity (diagrams and presentations); use of the method of problematization of experience; use of questions with answer options and open-ended questions, repetition of material and assessment situation.

The results of our experiment confirm the work of J. Pallier, who found that open-ended questions contribute to greater accuracy of metacognitive judgments [15]. The researcher

explains this fact by the fact that in the tasks of choosing from the set there are familiar words that can confuse the student in the process of choosing the correct answer. E. Savin and A. Fomin presented similar results [5; 19]. However, N. Razumovska in the context of the factor of "providing feedback" found the opposite effect - a decrease in cognitive optimism [18]. Instead, in our study, this factor contributes to overconfidence. The results of our study are confirmed by the work of A. Fomin on the role of problematization of experience - yes, students are more accurate in the case of this method [5]. Repetition of the material also increases the accuracy of assessing the assimilation of information in the studies of J. Danloski and K. Rawson [4]. A. Fomin and A. Pavlenko established a pattern of confidence in knowledge in the absence or presence of assessment [5].

### 5. Conclusion

We studied the indicators of the illusion of knowledge in terms of the organization of the learning process (use of schemes and presentations, teacher feedback, group interaction, repetition of material, problematization of experience, type of test question, presence or absence of assessment situation). It is established that the highest indicators of the illusion of knowledge (the effect of excessive confidence) are recorded in the case of teacher feedback to students. Slightly lower are the indicators of the illusion of knowledge in terms of using the method of group work and test tasks in the absence of an assessment situation. The most adequate are the indicators of the illusion of knowledge in the case when the teacher uses during the lesson visualization, repetition of material and provides a situation of assessment.

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