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COGNITIVE EFFECTIVENESS OF SCHOOL LEARNING¹

ЭФФЕКТИВНОСТЬ КОГНИТИВНОГО ОБУЧЕНИЯ В ШКОЛЕ

Abstract

The article deals with the issue of effectiveness of school learning from the viewpoint of cognitive processes. The concept of cognitive effectiveness of learning is considered. The phenomena of cognitive inefficiency of school learning are analyzed. The phenomena are: non-preservation of educational knowledge in long-term memory, inability to concentrate on homogeneous educational material for the required period of time, insufficient formation of the competence of reading comprehension. The possible impact of digitalization and gadgetization on these phenomena is marked. The factors that positively and negatively affect the cognitive effectiveness of learning are analyzed. It is concluded that the problem of

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cognitive efficiency of learning is complex and requires scientific attention, analysis and research.

Keywords: cognitive effectiveness of school learning; cognitive factors of learning; non-preservation of educational information in long-term memory; loss of concentration; attention problems in school; reading comprehension problem.

Introduction

The problem of effectiveness of school learning is extremely important and relevant. In the absence of the effectiveness the entire education process becomes of little value. It is obvious that this problem is complex and requires consideration of various social, cultural, pedagogical and psychological factors. The cognitive component of the problem is one of the most important. To refer to this component we can use the term "cognitive effectiveness of learning".

Methods

A search and analysis of literary sources were conducted on the key words "cognitive processes in learning", "memory in learning", "attention in learning", "metacognitive processes in learning", "cognitive learning", "attention problems in learning", "memory problems in learning", "school gadget-stress and its effect to learning"; the theories and concepts possibly connected to the cognitive effectiveness of school learning were analyzed.

Results and Discussion

Definition of the concept

What is cognitive learning effectiveness? Learning can be inefficient and effective. If it is effective, pupils achieve their learning goals — they form the necessary competencies, skills, and abilities, acquire and retain the necessary knowledge, and can successfully apply what they have been taught in practice. Learning process takes place without loss of resources — time, human, intellectual, etc. If it is ineffective, the educational goals are not achieved, competencies are not formed, pupils do not save knowledge, and resources are wasted. It is obvious that the effectiveness of learning is provided by the cognitive processes. The pupil receives new knowledge using the processes of perception and attention, understands and comprehends it using the processes of thinking, stores it in memory, learns the necessary patterns of thinking and imagination. The use of cognitive processes in learning can be effective and help to learn. And it can be ineffective as well. In this case pupils do not retain academic knowledge in memory, or do not keep them within the right time, do not develop

the proposed models of thinking, etc., as a result the necessary competencies are not developed.

Since the role of the cognitive sphere in learning is obviously huge, and without proper work of cognitive mechanisms a person will not be able to learn anything, the importance of the issue of cognitive efficiency for learning and education is not just high, but critical. Of course, when considering the work of cognitive functions in the framework of education, it is necessary to understand that in reality their activity is inseparable from the activity of emotions and motives, from personality, it occurs under the influence of the social environment in today's constantly changing world.

If we are talking about the cognitive effectiveness of learning, then we need to formulate what is effective learning in the aspect of the cognitive sphere, cognitive-effective learning.

So what is cognitive-effective learning? This is learning which is effective in terms of cognitive processes, cognitive resources of the pupil, namely, which provides adequate perception, understanding and comprehension of educational knowledge, preservation of the studied knowledge for the desired period, the required level of educational attention, uses cognitive processes so as to obtain the desired learning result, achieve learning goals, and also provides the necessary development of the cognitive sphere.

To avoid confusion, let us note that cognitive-effective learning and cognitive learning are not the same thing. If cognitive training aims to improve the cognitive activity of an individual, cognitive and intellectual development by special educational methods [Loarer, Yuto, 1997. P. 17], then cognitive-effective learning is learning that effectively involves cognitive processes, achieves the desired educational effect by use of the pupil's cognitive sphere.

Effectiveness of various cognitive processes

Consider the effectiveness of various cognitive processes in learning separately.

The processes of memory. What kind of learning in the aspect of memory is effective? There are two main types of memory [Brief psychological dictionary, 1985. P. 231], which differ significantly in functions and mechanisms of operation. This is a short-term memory that stores the information received from the senses or recalled from long-term memory. Short-term memory is also called working or operational memory [ibid. P. 232]. And long-

term memory that provides long-term, sometimes throughout a person's life, storage of large amounts of various information [ibid.].

Obviously, both types of memory are constantly used in the learning process. Therefore, there are signs of cognitive effectiveness in relation to both of them. For short-term memory, this is the ability to save the different types and necessary amounts of information used in training activities that come as a result of the work of perception and attention mechanisms or extracted from long-term memory, and the ability to successfully provide mnemonic support for the patterns and the models of thinking and imagination involved in training. For long-term memory — this is the possibility of long-term preservation of the necessary educational information and its actualization in the framework of educational activities of the processes of thinking and imagination.

There is a question, how much long should the educational knowledge be stored in the long-term memory? It should be available to a person all his life, providing his General erudition and information base for further development? Or if it is not used in life, it can be forgotten forever, erased, and this can be considered a normal phenomenon? If in professional training there is no doubt that the requirement for long-term preservation of the knowledge is necessary, then in General education, when a person acquires knowledge, most of which is practically not used outside of training, and may never be required in later life, the question of whether such education should focus on the preservation of knowledge or this emphasis should be placed on the development of intellectual functions, on teaching a person to learn and think, is open. Still, it seems that learning knowledge must be stored in long-term memory for a long time, otherwise the training itself becomes largely meaningless.

Then there is the second question. What should a modern person keep in their memory after completing school education? What knowledge? Perhaps it makes sense to conduct certain studies in this regard, determining the amount and content of knowledge that provides normal life activity after completion of education.

There is also the question of updating knowledge from long-term memory. After, for example, school education, a person should be able to independently, freely, «at will» recall this knowledge, or they can only be updated in certain cases — if there are some stimulating associations, hints, in specific social situations (for example, in a dialogue)? Which knowledge should be recollected «at will», and which — only in certain cases? It seems that

the more knowledge a person can «at will» recall based on the results of school education, the more effective this education was.

There is evidence that pupils with short-term memory deficits often find it difficult to retain instructions, for example, they may remember a three-point instruction, but when they complete the first, they forget the second and third points. They also have problems with reading. Having read a paragraph, they may completely forget the beginning of it [Thorne, 2006]. A deficit of long-term memory often can be a cause of not remembering some facts, dates, and rules that were studied, of the material that was studied in the last school year [ibid.].

Thus, learning can be considered effective in the aspect of memory, if it provides a successful long-term (perhaps even lifelong) preservation of the required amount of information for a person's later life, allows it to be recalled «at will», and provides the necessary development of short-term memory for successful intellectual activity.

In addition to the main types of memory described, there are many other types that differ in a variety of ways. There are different classifications of these types. Definitely, each type of memory has its own place in ensuring cognitive success and learning effectiveness, so it is an urgent task to conduct research on the role and significance of these types of memory in learning, on related to these types of memory cognitive educational difficulties, and on the possibility of developing different types of memory to ensure effective education.

Process of thinking. What kind of learning in the aspect of thinking is effective?

Thinking is a necessary component of learning. It provides understanding, comprehension, processing of educational information, solving educational tasks. The training involves different types of thinking — verbal and logical, practical and theoretical, analytical and intuitive, involuntary and «at will», associative and discursive, etc.

One of the most important types of thinking from the point of view of learning is operational thinking — mental operations of generalization, comparison, analysis, synthesis, abstraction, classification, categorization, etc. When solving educational tasks, performing various educational actions, various mental operations are involved. Without the formation of these operations, successful training and development is impossible.

Learning will be cognitively effective in the aspect of thinking, if a pupil has the necessary level of formation of the required types of thinking, the necessary level of the mastering of models and patterns of thinking involved in the educational processes.

Processes of imagination. What kind of learning in the aspect of imagination is effective?

Imagination allows you to imagine and predict the result of activity [Brief psychological dictionary, 1985. P. 49], including the educational one, to orient in activity. Imagination is involved in generating and transforming imaginative representations, in particular, the necessary educational images, images of tools and learning outcomes. Imagination helps develop memory by providing visualization of what is remembered [Thorne, 2006]. Imagination, along with intuition, plays an important role in the processes of creativity, in the disclosure of creative possibilities of a person [Brief psychological dictionary, 1985. P. 351].

Lack of imagination can affect the effectiveness of solving creative learning tasks, as well as tasks with a high level of uncertainty or insufficient initial data.

Cognitive-effective learning in the aspect of imagination is provided by the formation of mechanisms of the pupil's imagination, by his capabilities in building educational images, by the ability to build a program of actions in situations with a high level of uncertainty that does not allow effective use of thinking mechanisms.

Process of perception. What kind of learning in the aspect of perception is effective?

Perception ensures that information enters the psyche, is received by the psyche, and that objects, events, and situations in the external world are reflected in a holistic way [Brief psychological dictionary, 1985. P. 52], informs the psyche about what is happening outside and inside the human body. Without the activity of perception processes, information about reality will not get into memory, will not be processed by the mechanisms of thinking or imagination. Perception is closely related to attention. The lack of perception of educational information can become a serious obstacle to learning.

Cognitive-effective learning in the aspect of perception is provided by the formation of mechanisms of perception of the pupil, the possibility of forming integral (combining information obtained through various channels of perception, using various analyzer systems) representations of objects and processes of the external and internal world.

Attention processes. What kind of attention in learning is effective?

Attention processes provide the ability to focus subjective activity on an object, image, process, or event [Brief psychological dictionary, 1985. P. 40]. The characteristics of attention, namely, its selectivity, volume, stability, switch ability and disreputability, are the parameters

of cognitive-effective learning in the aspect of attention. Learning activities require a certain level of each of these characteristics, and if one of these levels is not provided by the cognitive sphere, then learning will begin to experience difficulties. Attention also performs the function of internal control of compliance of mental action with the program of its implementation; a high level of such control increases the effectiveness of activities, in particular, educational activities, helps to overcome distraction [Brief psychological dictionary, 1985. P. 42]. The scientific literature presents methods for attention developing [Thorne, Thomas, Lawson, 2005].

Question of the level and development of intelligence.

Separately, we can specify the question of the necessary level of general cognitive abilities that ensure successful learning. Practice shows that people with a low level of intelligence experience serious learning difficulties and require specialized educational programs [Lebedinsky, 1985. P. 47]. For each training activity, for each type of training, there seems to be a minimum level of intelligence that allows this activity to be carried out successfully.

Another issue is the need and value of developing intelligence in learning. In fact, training should develop intelligence, as it is declared by classical pedagogical science, or it is necessary to develop intelligence in order to ensure the required training, according to the apologists of cognitive training [Loarer, Yuto, 1997. P. 20]? How important is it to improve intelligence in the learning process, and can intelligence develop in learning at all? With the obvious importance of intelligence for cognitive-effective learning, these and many other questions related to intelligence still require research and answers.

The process of speech. What kind of learning in the aspect of speech is effective?

Speech and language factors are definitely extremely important for learning. Speech difficulties can seriously hinder a child's learning and require special learning technologies. Speech mediates the processes of thinking, imagination, memory, and perception. In the learning structure, speech provides communication between participants of the educational process, understanding the pupil by the teacher and vice versa, reasoning when solving problems, and much more. Thus, the factor of effective use and proper development of speech is one of the most important in ensuring the cognitive success of learning.

Speech can be written and spoken; there are production and understanding of speech. The scarcity of any type of speech can negatively affect learning and create learning

difficulties. Therefore, monitoring the formation of all these types of speech is an important component of cognitive-effective learning.

Significance of metacognitive processes for cognitive-learning effectiveness.

Metacognitive processes provide a person with knowledge and understanding of the activities of their cognitive sphere [Chernokova, 2011. Pp. 153-158; Brown, 1987. Pp. 65-66]. They are aimed at the regulation, coordination, integration, and organization of the processes of the cognitive sphere [Karpov, Skiteva, 2005. P. 131]. Pupils' understanding of the features of their cognitive sphere, what cognitive competencies they have already mastered and what they haven't yet, and an adequate understanding of their current level of knowledge proficiency will allow them to adequately plan independent classes, determine opportunities for immediate development, distribute educational time, etc. A person (and a pupil, respectively) with developed metacognitions has good self-regulation capabilities, is able to make effective decisions [Kluwe, 1987. Pp. 31-32]. Metacognition formation will ensure self-regulated learning [Ridley et al., 1992. P. 293], will allow pupils to "answer" for their thinking [Dirkes, 1985. Pp. 96-97]. The development of the metacognitive sphere will provide the pupil with general strategies that will allow him to correctly organize and direct his cognitive activity and make it effective [Loarer, Yuto, 1997. P. 21]. The "Dunning-Kruger effect" is known. Its meaning is that people who have a low level of cognitive abilities subjectively overestimate them, and those who actually have a high level of such abilities tend to underestimate them [Kruger, Dunning, 1999. P. 1121]. Metacognition processes allow to manage learning: plan and forecast results, analyze errors, monitor learning activities, and check the results of these activities [Brown, 1987. Pp. 65-116].

Thus, taking into account the metacognition factor in the framework of training and controlling possible distorting effects is an important component of cognitive-effective learning, which will allow the teacher to adequately assess the capabilities of pupils in terms of learning programs, and the pupils themselves to plan their educational activities more effectively.

Phenomena of cognitive-ineffective learning

A number of apparently significant learning phenomena in terms of cognitive ineffectiveness can be identified [Elshansky, 2018. Pp. 56-61]. First of all, this is the non-preservation of educational knowledge in long-term memory. Today's schoolchildren or students, coming from the summer holidays to study, often with very great difficulty can

remember even the names of the disciplines studied in the previous academic year. This is definitely a very serious problem of modern education and demonstrates its imperfection.

The degree of long-term non-preservation of educational knowledge is probably determined by a number of factors:

the absence/presence of homogeneity of educational knowledge on the school subject, it can be assumed that it is better to preserve in long-term memory a highly homogeneous knowledge, that is, knowledge that somehow repeats itself at different stages of the development of the discipline, having a "core" of concepts, models and theories used throughout the entire period of study of the discipline, organized on the principle of enlarging the passed, that not consists of unrelated sections being studied in different time periods;

unformed information-cognitive basis, necessary for the successful development of the discipline and formed in the course of previous training, this basis determines, in particular, the zone of immediate development, without its presence, the pupil will experience serious learning difficulties, as he will have to get the missing information and cognitive components, which are based on the study of the discipline, in the course of its study; here we can also suggest the idea of developing criteria for cognitive readiness to learn various disciplines and methods of testing pupils for such readiness;

the "loss" of educational knowledge in the huge amount of information that a modern person receives every day, because significant brain resources are now directed to processing information flows generated by the digitalization of modern life;

lack of necessary additional training of the cognitive sphere, in particular, memory, lack of development of mnemonic techniques that help to better remember and save information;

the focus of the training is not on long-term preservation of knowledge and providing opportunities for its free «at will» recollection, but on learning knowledge that is recalled only in the conditions of a hint, for example, in tests that offer a choice of correct and incorrect answers, it is obvious that the task of free recalling knowledge from memory and its recognition are two different competencies;

incorrect selection of the form of learning — often incorrectly selected form of presentation of educational material, failure to take into account individual cognitive characteristics of pupils (lack of personalization of training according to cognitive characteristics), lack of individual adaptation of educational material significantly reduce the

assimilation of knowledge, their retention in long-term memory; today, there is a large-scale introduction of digital technologies in the educational process, it is obvious that each such technology should not only be tested for how successfully the educational knowledge is stored in the long-term memory of the pupil in its use, but also for how the technology is good for the implementation of measures for individualization and personalization of learning;

lack of emotional comfort in the learning process, in particular, today's pupils often experience stress caused by the use of gadgets (primarily smartphones) [Thomé, Härenstam, Hagberg, 2011. Pp. 66; Samaha, Hawi, 2016. Pp. 321; Van Deursen, Bolle et al., 2015. Pp. 411-412], the so-called gadget-stress, memorizing material in a situation of experiencing stress can be reduced, since the pupil's mind in this case is filled with non-educational ideas related to the use of gadgets, or the child may simply be in an emotional state in which he cannot perceive (and, accordingly, save) the educational material.

Unconscious attribution of non-relevance to educational information; there may be unconscious cognitive mechanisms that process information according to the criterion of relevance/non-relevance, while information defined by these mechanisms as irrelevant is forgotten.

Another important phenomenon that reduces the cognitive effectiveness of learning is the inability of pupils to concentrate on a homogeneous educational material for the desired period of time (lesson), loss of educational attention — the pupil loses concentration from a certain point and ceases to perceive what, for example, the teacher says; an additional factor that negatively affects the educational attention is a gadget, the pupil's attention may be diverted to gadgets, it turns out that a pupil concentrates hard because of the homogeneity of the material, and a distraction to the gadget (which is a distracting stimulus) provokes a shift to non-academic activities, thus "turning off" the pupil, takes him out of the learning process entirely.

An important cognitive phenomenon that negatively affects the learning process is also often the lack of competence to understand what is read, the inability to work correctly with texts, this phenomenon is often called functional illiteracy, a person can read, but cannot properly understand the text read.

Factors that positively and negatively affect the cognitive effectiveness of learning

We can separately list the factors that definitely have a positive effect on the cognitive effectiveness of learning. This: special cognitive training, for example, through exercises that

develop memory, attention, thinking and imagination; adaptation of educational material and training programs to the individual educational needs for each pupil, ensuring the successful performance of this particular pupil, maximum personalization and personification of learning, taking into account the cognitive styles of pupils; formation of the attitude to remember information, rather than search for it on the Internet; regular repetition of educational material, in particular, learned in previous years; organization of training from the position of the principle of enlarging the past; ensuring the activity of the pupil, his involvement in the educational process; creating the necessary educational motives; distribution of memorization over time (there is evidence that such memorization provides better preservation of the material [Botokanov, Sarymsakov, Esenalieva, 2015. P. 143]); reducing the level of influence of the non-educational gadget use and gadget-addiction; providing an emotionally comfortable educational environment for the pupil's cognitive sphere, the absence of educational stress; perception of educational knowledge by the pupil as relevant; maximum understanding of knowledge, its meaningful interpretation; organization of learning of different disciplines in those ages, when they are due to the age peculiarities of memory mastered the best way, for some ages it is also effective to use imaginative thinking and imagination to better preserve information.

We also indicate a number of groups of factors that negatively affect the cognitive effectiveness of learning. If we talk about what reduces such efficiency today, these are: factors of gadgetization — the non-educational use of gadgets, gadget-addiction, gadget-stress, and even if a pupil do not take his gadget to a lesson, this factor will continue its negative effect, since the child even without his gadget thinks that he needs to do something, for example, in a game on a gadget, check new messages in communication programs, etc., and this will distract him from educational activities; factors of informatization and digitalization — modern processes of digitalization create a super-saturated information environment, in the labyrinths of which educational knowledge is not only "lost", but often devalued, since the availability of information forms the idea of the absence of necessity of preservation of educational knowledge in memory or of the formation of some educational thinking skills, forms the attitude to delegate cognitive functions to gadgets; factor of not taking into account for individual cognitive characteristics — this was discussed above, we emphasize once again that different people have different individual characteristics of the cognitive sphere, so "averaging" pupils on these indicators, applying a unified approach to all

is definitely counterproductive; negative social and cultural factors — learning occurs in society, so social factors affect the cognitive effectiveness of learning, for example, the loss of educational attention may be due to the mechanisms of social "infection" or imitation, which A. Bandura described [Bandura, 2002. Pp. 94-124; McCormick, Martinko, 2004. P. 2] — one pupil loses attention, others look at him and also stop concentrating on educational activities, pupils "infect" each other with ideas about the value or vice versa about the non-value of some educational information, this may affect its preservation, etc. Cultural factors also definitely affect the cognitive effectiveness of learning, for example, in our (modern Russian) culture, a significant, often almost complete, loss of school knowledge in adulthood is perceived as a normal phenomenon, so no one raises the alarm about this, does not raise the question of transforming education so that it ensures the preservation of school knowledge for life at least at some minimum level, providing General erudition.

Conclusion

There is a question of what state a person should be in in order for his cognitive sphere to function effectively in the learning process. Should it be some special state of consciousness, for example, the state of flow, which M. Chiksentmihayi wrote about [Chiksentmihayi, 2013]? Or should it just be a calm comfortable state? This issue needs to be worked out and investigated. At the same time, it is obvious that the influence of distress and other emotionally negative states on the cognitive effectiveness of learning is negative. A person in a state of stress is focused on his experiences, not on learning, so leveling the possible negative emotional impact on the cognitive sphere is one of the tasks of organizing effective learning.

In conclusion, it should be noted that the problem of cognitive efficiency of learning is definitely complex, requires scientific attention, analysis and research, but at the same time improving the quality of education, improving education in its organization, taking into account the factor of cognitive efficiency, can be very significant, help to overcome many educational problems observed today, and effectively use existing educational resources.

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