

Improving Cognitive Flexibility by Means of Associations

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Abstract: *The work examines the effect of association means on the cognitive flexibility of the brain. Nowadays the cognitive flexibility is one of the critical skills needed to succeed in the workplace. Cognitive flexibility corrects human behaviour in a certain way following the changing environment. It allows a modern person to work effectively to distract from the previous task, reconfigure a new set of answers to complete the current task. The article aims to determine the significance of the means of association for improving cognitive flexibility in foreign languages classes. The study involved 70 students of the Kyiv National University of Culture and Arts and was conducted between October 2020 and December 2020. Learning a foreign language and bilingualism in and of themselves have an impact on the cognitive functions of the brain. In our paper, we consider the means of associations not only as one of the tools for studying foreign languages but as a means of improving cognitive flexibility. According to the study, it can be concluded that, despite the increased interest in the associative method, multiple studies in this area of research demonstrate different and sometimes conflicting results. It is important to note that associative methods have a positive effect on improving cognitive flexibility in combination with creative thinking.*

Keywords: *Setting, anticipation, operational meaning, duration, apperceptive scheme.*

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Introduction

Nothing in the world stands still, and we must adapt to it. Every year changes are progressing more rapidly, so now we need to have flexible thinking and develop the plasticity of our brains.

One of the most complex functions of the brain is cognitive, through which a person interacts with the outside world, which allows realizing processes such as perception, thinking, attention, speech, memory and motor skills.

Brain plasticity, or neuroplasticity, is the brain's ability to form new neural connections. It allows neurons – the nerve cells that make up our brain – to adjust their work in response to changes in the environment and adapt to them. Norman Doidge, a psychiatrist and psychoanalyst, in his book *The Brain That Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science*, talks about people whose brains managed to recover from severe disorders, for example, after a stroke. The author argues that this organ can change, reorganize and form new neural connections throughout life, and not only in childhood, as science claimed before (Doidge, 2008, p. 224). At any age, a person can improve the brain or maintain it at the same level. Even with the approach of old age, the brain can change its structure and work only thanks to human thoughts and actions. To do this, you need to develop the flexibility of your thinking. Thinking flexibility, or cognitive flexibility, is the ability of the human brain to overcome habitual reactions and thought patterns in unfamiliar conditions and create new ones. That is, the ability to adapt to new situations, break up difficult tasks into small pieces, improvise and apply different strategies depending on the goals it faces. This property of the brain allows you to switch and think about something from different points of view. The cognitive flexibility of an individual, as the mental ability to quickly switch from one thought to another, to think about several things simultaneously, is becoming more and more in demand (Magnusson & Brim, 2014). It is human nature to strive for constancy. Change is scary in that it forces you to leave your comfort zone. But the attitude of not accepting changes and the inability to adapt to them prevents us from arranging our lives.

Sahakian et al. (2021) declared cognitive flexibility as one of the critical skills needed to succeed in the workplace in 2020. At present, when the rapid development of information technologies has a huge impact on the economy, the labour market, the level of income and on our life in general (Brynjolfsson & McAfee, 2011), the social order for training is also changing.

This is manifested primarily in the use of a competency-based approach in the training of future specialists, who, first of all, must be able to make creative decisions, quickly and clearly orient themselves in complex atypical situations, that is, be able to do what artificial intelligence is not capable of. Not the least role in this is played by the level of development of students' cognitive flexibility. The concept of cognitive flexibility can be defined as the ability of an individual to restructure his knowledge to be able to respond appropriately to a changing situation (Spiro & Jehng, 1990). In other words, it is about the ability of an individual to quickly adapt to changing conditions. Experiments show (Çelikkaleli, 2014) that an individual needs to have a certain degree of cognitive flexibility in order to be able to painlessly adapt, choose the best solution, avoid depressive moods, and not lose self-confidence. In any situation, individuals have several possible scenarios for the development of further events. But those individuals who predict a greater number of potential possibilities of probable scenarios have greater cognitive flexibility (Martin & Anderson, 1998). Thus, cognitive flexibility can be equated with flexible thinking (Brown & Campione, 1981). It is the plasticity of the brain that gives us the ability to overcome those mental barriers that prevent us from going beyond the established order of things.

Psychotherapists note that cognitive flexibility is not a phenomenon in itself, it is a certain position in life that demonstrates understanding and acceptance of the position of "different". Practical psychologists and counsellors are advised to take into account the factors and levels of cognitive organization, as well as cognitive adaptation in working with the client. The presence of a wide range of thinking ways on a particular conceptual topic or situation indicates a high level of cognitive flexibility. The use of multiple representations is important at different levels of personality development. Gerontopsychologists have proven that the level of cognitive flexibility correlates with diverse longevity, busy lifestyle, reduced risk of dementia (Horn & Masunaga, 2006). However, the explanation of such relations is not entirely clear. One hypothesis is that the developed cognitive sphere is the result of many stimulating efforts that have been made on the mind and body for a long time (the hypothesis of "mental training") (Salthouse, 2006). Critics of this approach rightly point out that this evidence is only evidence of a causal relationship: older people with relatively better cognitive flexibility seek and support a wider range of diverse actions throughout their lives. In other words, it is cognitive plasticity that stimulates them to seek different kinds of cognitive training. Thus, the complexity of the selection of diagnostic tools often depends on how researchers explain this phenomenon. The article aims to determine the

place of the means of association for increasing cognitive flexibility in foreign language classes.

Literature Review

An analysis of recent research and publications that have begun to address this issue on which the author relies. In his works, Jean Piaget (1950) presents a person as an active, dynamic and creative person with his inherent mental structures – schemes that process and organize the information obtained. With age, these patterns evolve into more complex cognitive structures. Intellectual development goes through four stages, from early childhood to 12–15 years and beyond (Horn & Masunaga, 2006). The following understanding of flexibility is closely intertwined with the understanding of the peculiarities of adult thinking. According to the researcher V. Sheiko, during childhood and adolescence, a person acquires more complex internal structures of understanding the world. During this period, powerful tools of formal operational thinking are formed, which is a key achievement. In early adulthood, intellectual abilities are used to achieve success and determine the subsequent lifestyle. K. W. Schaie called it a period of achievement. A person uses intellectual potential, problem-solving skills, decision-making in the process of achieving goals and implementing a life plan (Ivanova, 2011).

A person who successfully copes with this reaches a certain level of development of independence and moves to another stage of cognitive abilities – a period that includes social responsibility. In middle age (maturity) according to V. Sheiko (Galaziynsky, 2011), a person uses cognitive abilities to solve other people's problems: in the family, society, at work, etc. He argues that the core of adult cognitive development is not increased opportunities or changes in cognitive structures, but the flexible use of intelligence at different stages of life.

The German psychologist Kohler (1970) dealt with this question. The author proposes the principle of isomorphism. There is a mutually unambiguous correspondence between the structure and dynamics of the external observable world, the cerebral cortex and subjective reality. The general precedes the personal, the properties of the system determine the properties of its elements, not vice versa.

The researchers singled out the components of creative thinking, which are indicators of the flexibility of thinking: a) the ability to see the problem in the usual conditions; b) the ability to abandon the wrong hypothesis; c) the ability to find new connections and relationships between

objects; d) the ability to create new ways of acting or creatively use the old (Andreeva, 2009; Ivanova, 2011).

Individual features related to the nature of decision-making are manifested as “flexibility–inertia” of mental actions. The parameter “flexibility–inertia reflects the change of old ways of action, the replacement of old hypotheses and plans if they no longer meet the conditions of activity that have really changed.

In the modern domestic psychological literature, the concept of flexibility is also considered in two aspects: as a personal characteristic (intellectual flexibility) and as a feature of mental activity (flexibility of thinking). The most complete is the definition introduced into domestic psychology by Menchinskaya (2004): flexibility of thinking is manifested in the appropriate variety of methods of action, in the ease of restructuring existing knowledge, in the ease of transition from one activity to another, overcoming the inertia of the previous action, in feedback formation, in the freedom of restructuring in the images created accordingly, and hypotheses in accordance with the conditions of the problem (Guz, 2014).

The conditions of the task and their complexity require the individual to constantly search for alternative answers. The results obtained as an outcome of N. Menchinskaya's research allow us to consider flexibility not only as the ability to move from one type of activity to another but also as of an opportunity to see all the potential applications of human cognitive flexibility. Accordingly, the author singled out the following manifestations of the flexibility of thinking:

- consideration of the task as a problem in which it is appropriate to vary the methods of action;
- conditions determine the ease of restructuring knowledge or skills and their systems in accordance with the proposed changes;
- ability to switch, or ease of transition from one mode of action to another.

The psychological essence of flexibility is also considered in the perspective of the study of creative thinking. Researchers note that flexibility is a necessary component of the creative component. However, it is studied by them in structural unity with other features of creativity.

Cognitive flexibility is one of the main mental abilities that underlie creative thinking (Barbey et al., 2013). Cognitive flexibility is the ability to break old cognitive stereotypes, overcoming functional habits, and thus create new creative connections between phenomena or concepts (Guilford, 1965).

Cognitive flexibility refers to elastic strategies for switching from one stimulus, operations and mental attitudes to others, responding to the requirements of circumstances (Barbey et al., 2013). It is assumed that the main elements of cognitive flexibility arise from a distributed network of brain regions that support certain competencies for human intelligence (Ritter et al., 2014).

The level of flexibility of thinking is assessed in terms of “plasticity” – “rigidity”. Rigidity (from Latin *rigidus* – hard) means difficulty (up to complete inability) in changing the subjective program of human activity in conditions that objectively require its restructuring. Plasticity, in contrast to rigidity, presupposes the ease of such restructuring. According to current neurophysiological data, the level of flexibility reveals significant correlations with such a primary property of the nervous system as mobility – the ability to quickly respond to changes in the environment, which is diagnosed by the rate of occurrence and termination of a nerve impulse in response to an external stimulus. There are 3 types of flexibility: cognitive (cognitive), affective (emotional) and motivational. Cognitive flexibility is associated with the restructuring of perceptions and representations in situations’ changing and, as a result, with timely and adequate decision-making.

Results

Cognitive Functions

The study involved 70 students of the Kyiv National University of Culture and Arts. The study with equal gender representation was conducted between October 2020 and December 2021. The state of cognitive functions was studied using the Montreal Cognitive Assessment Scale. This scale is currently recommended by most cognitive experts for effective assessment of concentration, attention, all types of memory, executive function, visual constructive skills, language ability, abstract thinking, orientation, and counting. The highest number of points that a respondent can score is 30, the number of points 26 and above is considered a standard value. The scale is validated in Ukrainian; its sensitivity is significantly higher than the closest analogues (in particular, the Mini-Cog scale), has a minimal probability of obtaining false positive and false negative results and is actively used by both domestic and foreign researchers when verifying functional capabilities and limitations in the cognitive sphere in including students (Soldatova, 2010; Zakharov, 2012). The IOC test provides an assessment of short-term memory and recall; attention, concentration, working memory; linguistic functions and orientation in the range of values from 0 to 5 points, spatial-

visual abilities and executive functions in the range from 0 to 4 points, and abstract thinking in the range from 0 to 2 points (Kuznetsov et al., 2021).

Table 1 presents the results of assessing the state of cognitive functions of students at the beginning of the study in October 2020.

Table 1. The cognitive functions state of the students (N= 80)

Narrative variables (average values in points)	M (SD)
Short-term memory and recollection¹	4,3 (0,3)
Spatio-visual abilities²	3,5 (0,2)
Executive functions²	3,3 (0,3)
Attention, concentration, and operational memory¹	4,5 (0,3)
Language functions¹	4,6 (0,5)
Abstract mind³	1,7 (0,6)
Orientation¹	4,5 (0,6)
Total	26,4 (2,8)

Note: M is the arithmetic mean of the variable; SD – standard deviation. ¹ – the maximum value is 5 points; ² – the maximum value is 4 points; ³ – the maximum value is 2 points. The maximum possible number of points is 30. The normal range is 26-30 points.

The total indicator of the assessment of cognitive functions among students was 26,4.

Level of Cognitive Flexibility

The level of cognitive flexibility of thinking can be assessed using the method of Lachins A. S. (Nikiforov et al., 2007).

The method is as follows: the subject is asked to write the phrase “The snow has already melted in the field” in four different ways.

Method 1. After the command “Start!” write this phrase as many times as you can before the “Stop!” command.

Method 2. After the command “Start!” write this phrase in block letters as many times as you can before the command “Stop!”

Method 3. After the command “Start!” write this phrase as many times as you can before the command “Stop!”, as follows: the first and all odd letters should be written and capitalized, and the second and all even letters should be small and printed.

Method 4. After the command “Start!” write the phrase in your usual handwriting, but at the same time repeat each letter twice. Work as quickly as possible until the command “Stop!”

Data processing and analysis

1. The number of letters written in each task is calculated: M1, M2, M3, M4.

2. The average value is calculated for three tasks:

$$Mav = \frac{M2 + M3 + M4}{3}$$

3. The coefficient of creative flexibility is determined: Cflex

$$Cflex = \frac{Mav}{M1}$$

If Cflex lies in the range from 0.5 to 1, it means that the subject has plastic thinking, easily and quickly passes from one activity to another, quickly responds to changes in the input situation, can make adequate decisions. Cflex value less than 0.5 indicates rigidity of thinking, i. e. low level of creative flexibility. The subject can not respond to changes in the situation quickly and adequately, has difficulty in changing the subjective program of activity. As a result of the testing, it turned out that in the subjects the coefficient of cognitive flexibility is in the range from 0.5 to 0.1, which indicates a fairly high level of plasticity of thinking.

Discussions

Cognitive Flexibility and Foreign Language Learning

Since one of the tasks of this article is to determine the development of cognitive flexibility in university students in foreign language classes, we paid special attention to the association method in the study of foreign languages. It seems to us that work on this should be carried out in two directions: the complexity of the problem/situation being solved and the susceptibility of the trainees to the restructuring of their knowledge. We propose the following ways to improve cognitive flexibility:

1. Replacing habitual tasks/conditions with new ones. An example of this is working in pairs, where each time the participants in the pair work will change. The same applies to teamwork on projects. Testing of words knowledge can be carried out not only in the form of tests but also in the form of crosswords, quests, interactive exercises, etc.

2. Providing opportunities for new experiences. This may relate to an unexpected topic proposed for discussion or an unusual class format. A topic for discussion can be presented, for example, by an ethical dilemma, when there is no rigidly defined correct solution. Different people make decisions about the same issue in different ways. You must answer the questions for yourself without discussing them with others. Be prepared to explain your decision (Whetten & Cameron, 2007, p.50).

3. Creative tasks that develop divergent thinking. These include complex problems that can be broken down into simpler ones. Encourage learners to make quick, albeit wrong, decisions, recognize their mistakes, and

try to solve the problem over and over again. It is moments like these that foster divergent thinking and teach trainees not to look for the simplest solutions to problems.

4. Assignments that encourage an independent search for information. Allow them to use various sources to satisfy their curiosity and answer the questions posed. Encourage independent ways to solve the problem, extraordinary answers to the questions posed. Encourage independent ways to solve the problem, extraordinary answers to the questions posed. Try to avoid evaluative statements, both negative and positive. This will help create a tolerant atmosphere that will encourage the generation of a wide variety of ideas.

So, new conditions require new approaches, new solutions. Educational activities should prepare trainees to work in this rapidly changing world. It will also depend on teachers how quickly and successfully learners will be able to adapt to their new working environment. We believe that the development of cognitive flexibility should become an integral part of the learning process. In the course of foreign language training, the student's ability to think about several things at the same time (i.e., to show cognitive flexibility) is a prerequisite for a successful speech act: the student speaking in a foreign language must not only have an idea of the purpose of speaking (i.e. create a mental image in his head) but quickly and correctly select the lexical units necessary for the transmission of the formed thought, correctly form them in terms of grammar, stylistics, speech registers of a foreign language, Paraverbal (intonation) constructs, etc.

Although today many mnemonic techniques facilitate the construction of associations for memorizing various kinds of information, there is no universal technique that would be suitable for all cases. In our study, we consider the method of association not only as one of the tools for studying foreign languages but as a means of improving cognitive flexibility. And the study of a foreign language itself and bilingualism itself already have a beneficial effect on the mental abilities of people, on the development of cognitive functions (Javan & Ghonsooly, 2018).

Associative thinking is built, first of all, on our creative abilities, namely, on the ability to create something new, modifying the existing one. Often you have to create associations and organize material for memorization yourself. Not everyone is good at associative memory, but you can learn it.

There are two main approaches to teaching vocabulary using the association method: the phonetic association method and the suggestive association method. The method of phonetic (sound) associations is based

on memorizing foreign words using consonant words of the native language (Rogova et al., 1991).

The method of phonetic associations helps to quickly remember the meanings of words if you take into account the following rules:

1) the amount of information memorized at a time should be strictly limited. Even a small increase in it leads to partial or complete forgetting;

2) our memory is capable of receiving from 2 to 26 units of information in one sitting;

3) the unit of memorized information should be as long as possible (a block of words or a phrase). Those who teach or force to learn single words should be punished for wasting time and memory on an especially large scale;

4) after the process of assimilating information, there must necessarily be a pause, during which it is necessary to unload the brain from mental work as much as possible.

The association method is one of the main methods for developing memory. It is imperative to know about it, since it is very useful in itself, and it is also an integral part of most memorization methods, including learning foreign words. It is hard to imagine any memorization technique at all without this method. Association is an attempt to associate something with something in the broadest sense. That is, an association is a kind of virtual connection between two or more phenomena. These can be objects, feelings, thoughts, words, and so on, in which the recollection of one of them entails the appearance of another in our imagination. If you ask everyone to answer what comes to their mind at the mention of the word “red”, you can get the following answers – “blood”, “fire”, “passion”, etc. It depends on the individual experience of each of the respondents. All these associations are formed in consciousness and are called free. To master the method of associations, you just need to practice creating associative links between any elements. To further enhance the effect of the association method, it is better to come up with the most unusual, non-standard and even incredible associations.

Types of associations

A little more detail should be told about the method of associations, namely, how to choose the right associations for learning words. Indeed, in this case, we also need to have some techniques. Words can be associated in several ways.

- Words can be associated with a similar sound to the word in the native language.

In this case, we associate with the sound of the Ukrainian word that we know. This way you can easily memorize pronunciation and spelling.

- Words can also be associated with a situation. For example, the word “frustrated” can be remembered by remembering a situation when you felt really upset.

Here emotions also begin to play a role in memorization. You recall the emotions and feelings you experienced in the past and try to put a word on them. Emotionally, our brain memorizes words more efficiently. Next time, remembering the word memorized in this way will be much easier. Thus, you can try to give an emotional colouring to any words that you learn, thereby greatly increasing the chances of remembering them.

- Associations of a word with a person. This is especially effective when words are studied to describe the appearance or character of a person.

We pronounce a word, put a picture on it (imagine), see the spelling of the word itself, as well as its translation. All this together in a complex gives a very strong effect - easy memorization of words. Moreover, these words fall into the active vocabulary (memorized subconsciously), which means that the likelihood that we will forget them greatly decreases.

- Associations of a word with the sound it denotes.

Just try in your mind to reproduce the sound, the sound you want to learn the meaning of. The word “bark” can be remembered by imagining a huge barking dog.

- Rhymed lines are easy to learn and hard to forget, especially if they are also funny.

This method is suitable for both children and adults.

The advantage of the associations’ method is the development of figurative thinking, which makes the lessons diversified, motivates to obtain reflexive knowledge and forms vivid memorable images. The learner creates automatic connections between images or situations, words and expressions. It is believed that the use of this method in a foreign language lesson stimulates verbal communication, contributes to more confident and effective use of a foreign language in the field of professionally-oriented foreign language activity.

The proof is the results of a study and questionnaire survey conducted among students of the Kyiv National University of Culture and Arts on the topic: “The associative method in learning English” as part of the research on the topic: “Improving the cognitive flexibility by means of associations”. The purpose of this part of the experiment was to prove the effectiveness of the associative method in memorizing foreign words. This part of the study took place in two stages. The first step was to experiment

itself. For the experiment, students were asked to share into groups. Some of the students studied lexical units using only rote memorization, and some of them association methods mentioned above, selecting stimulus words and reaction words. For effective memorization, it was necessary to compose plots from a word-consonance and translation so that the approximate sound of the word and its translation were, as it were, in one bundle.

The assessment of the cognitive flexibility of thinking in groups was carried out according to the method of A.S. Lachins, which we mentioned earlier (Nikiforov et al., 2007). The coefficient of cognitive flexibility of the subjects in both groups, as previously reported, was in the range from 0.5 to 1, which means that the subjects had sufficient plastic thinking. For effective memorization, it was necessary to compose plots from a word-consonance and translation so that the approximate sound of the word and its translation were, as it were, in one bundle. The main task was to compose your associative image. It was necessary to come up with bright, unusual, non-standard associations. It is interesting to note that in the process of working in the first lessons, students exchanged images that arose in them. At the same time, everyone had their own associations. And therefore, everyone memorized words with “their own” associations.

The experiment lasted for three weeks. A vocabulary survey was conducted every week. Thematic testing was carried out first after a month, then after two months and after three months. 30% of students chose to learn words using the traditional method. 70% chose to study vocabulary using the association method. Let's call them group number one and group number two. It is also necessary to take into account the creative orientation of the university's specialties. Creativity plays an important role in building associations and more. “Having a creative mind is one of the gateways for achieving fabulous success and remarkable progress in professional, personal and social life” (Khalil et al., 2019).

The experiment lasted for three weeks. A vocabulary survey was conducted every week. Thematic testing was carried out first after a month, then after two months and after three months. And during the experiment, indeed, in the first month in the groups there was a drop in performance in the first group by 5%, and in the second by 3%. But, if in the first group, the drop in memorability by the final testing was 30%. Then, the second group has phenomenally improved their results. When passing, 30% of the students of the second group received excellent results, 50% good and 20 satisfactory. What should also be noted is the knowledge of vocabulary from different topics and the ability to use it in various situations, which is also cognitive flexibility.

At the next stage of the study, a questionnaire was conducted to identify the attitude of students to this method. Students were asked to fill out a questionnaire and answer the following questions: 1) Your attitude to the associative way of memorizing; 2) You will apply the associative method when learning foreign words; 3) Which of the ways of learning a foreign language do you consider the most effective: a) mechanical; b) associative; c) mixed.

The analysis of the survey showed the following. 85% of students showed a positive attitude to the use of the associative method. They note the improvement in the quality of the lesson, the availability of the material and its clarity. 11% of students are indifferent to the application of this method. 4% of students have a negative attitude to this method, since, using the method of associations, they experience difficulty and misunderstanding when learning a foreign language. The majority of students (80%) answered the second question in the affirmative. Namely, that the associative method will be used in the study of foreign words. 10% of students answered negatively that they would not, and only 10% of students do not know if they will use this method. The survey was conducted among students of both groups (those who studied the language using the traditional method and those who used the method of associations). 85% of students who did not use the association method would like to start using it.

According to this study, it can be concluded that, despite the increased interest in the associative method, multiple studies in this area of research demonstrate different and sometimes conflicting results. This is quite understandable since some people do not have developed imaginative thinking, the use of which is necessary for the associative approach. And for them, it is easier to remember the word itself, by memorizing it, than to come up with an association. And for someone with creative thinking, it is convenient to use the method of association. "Contrary to many peoples beliefs, creativity is also important in science and innovation. For example, we have discovered that entrepreneurs who have created multiple companies are more cognitively flexible than managers of a similar age and IQ" (Sahakian et al., 2021).

At the same time, the use of the associative method allows you to increase motivation for learning English, develop cognitive interests. The positive aspects of the associative method are that its skilful application allows the formation of general and professional competencies of students, simulates future professional situations.

It should be noted that any training changes the brain. Any information coming into it from the outside increases the quantity and

quality of neural connections increases the efficiency of grey and white matter. Our brain is always trying to improve and optimize any process.

Knowledge of the second, the third and more languages make the picture of the world for a person richer and richer, each object receives many associative “clues” for memorizing, storing and retrieving from memory. Language affects our thinking and the process of cognition, gives an idea of several pictures of the world, provides an opportunity to look at everything that surrounds us from a different angle and perceive situations from different points of view.

Conclusions

The associative technique increases motivation and interest in new knowledge, speeds up memorization and increases the volume of new words. It's also a good job for creative brain activity.

Developed associative thinking gives us a number of advantages:

Higher speed compared to other types of thinking, because in the process of finding solutions, an individual does not resort to implementing sequential logical steps, but operates with ready-made associative chains, images;

The ability to identify and establish unexpected relationships between phenomena, objects, to carry out non-stereotypical, original thinking;

Associative thinking plays a leading role in the creative activity of an individual since it allows to reveal deeply hidden properties of phenomena, objects, to model images, situations that do not exist in the real world, to manipulate them;

Provides the ability to create conceptual models, since it does not provide for fragmentation, fragmentation of the studied objects, phenomena, processes, covering them completely.

Language allows us to think about things through the lens of other things. It helps you think in new ways about new things and turn your ideas into new ones. Language allows us to voice our guesses, make sense of the world, based on experience and intuition. Language allows you to construct ideas and draw conclusions based on facts. Language is also the key to cognitive flexibility. With the help of language, we create associations between things – in terms of proximity, similarity or opposition. Associative thinking opens up the ability to think about things through the lens of other

things, improves cognitive flexibility and allows new ways of looking at problems and combining intelligence to find innovative solutions.

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References

- Andreeva, G. M. (2009). *Psibologiya social'nogo poznavaniya* [Psychology of social cognition.]. Aspect Press.
- Barbey, A. K., Colom, R., & Grafman, J. (2013). Architecture of cognitive flexibility revealed by lesion mapping. *Neuroimage*, 82, 547–554.
<https://dx.doi.org/10.1016%2Fj.neuroimage.2013.05.087>
- Brown, A. L., & Campione, J. C. (1981). Inducing flexible thinking: A problem of access. In M. Friedman, J.P. Das & N. O'Connor (Eds.), *Intelligence and learning* (pp. 515- 529). Plenum.
- Brynjolfsson, E., & McAfee, A. (2011). *Race Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*. Digital Frontier Press.
- Çelikkaleli, Ö. (2014). The Validity and Reliability of the Cognitive Flexibility Scale. *Education and Science*, 39(176), 339-346.
<https://pdfs.semanticscholar.org/a8c4/8d8b4e97c422ca25f6365f6c4ee8f756416a.pdf>
- Doidge, N. (2008). *The Brain That Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science*. Penguin Books Ltd.
- Galazhinsky, E. V. (2011). Rigidnost' kak obshchesistemnoe svojstvo cheloveka i samorealizaciya lichnosti [Rigidity as a system-wide property of a person and self-realization of an individual]. Materialy konferencii “Chelovek v psihologii: orientiry issledovaniy v novom stoletii” [Proceedings of an interuniversity scientific conference ‘Man in psychology: research guidelines in the new century’]. Karaganda, Kargu], 38-48.
<http://flogiston.ru/articles/general/galazhinsky>
- Guilford, D. (1965). Tri storony intellekta [Intelligence has three facets.]. In A. M. Matyushkin (Ed.), *Collection of translations “Psychology of Thinking”* (pp. 433-456). Progress, Moscow. <https://baguzin.ru/wp/dzh-gilford-tri-storony-intellekta/>
- Guz, N. V. (2014). Osoblyvosti stavlennia molodshykh shkoliariv do navchannia [Features of the younger students’ attitude to learning]. *Nauka I Osvita*, 6, 35-41. <http://www.irbis-nbuv.gov.ua/cgi->

bin/irbis_nbu/cgi/irbis_64.exe?I21DBN=LINK&P21DBN=UJRN&Z21D=&S21REF=10&S21CNR=20&S21STN=1&S21FMT=ASP_meta&C21COM=S&S21P03=FILA=&S21STR=NiO_2014_6_9

- Horn, J., & Masunaga, H. A. (2006). Merging theory of expertise and intelligence. In K. A. Ericsson, N., Charness, P. J. Feltovich & R. R. Hoffman, RR. (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 587–611). Cambridge University Press.
<https://psycnet.apa.org/doi/10.1017/CBO9780511816796.034>
- Ivanova, V. V. (2011). *Psykhologichni osoblyvosti rozvytku tvorchykh zdibnosti molodshykh shkolariv u poznavchalnii diialnosti* [Peculiarities of the development of creative thinking in the transition period from preschool to primary school age]. *Aktualni problemy psykhologii. Psykhologhiia obdarovanosti* [Current issues of psychology. Psychology of giftedness], Collection of scientific works of the H.S. Kostyuk Institute of Psychology of NEAS of Ukraine, p.118-126.
<http://www.apppsychology.org.ua/data/jrn/v6/i16/15.pdf>
- Javan, S. S., & Ghonsooly, B. (2018). Learning a foreign language: A new path to enhancement of cognitive functions. *Journal of Psycholinguistic Research*, 47(1), 125–138. <https://doi.org/10.1007/s10936-017-9518-7>
- Khalil, R., Godde, B., & Karim, A. A. (2019, March 22). *The Link Between Creativity, Cognition, and Creative Drives and Underlying Neural Mechanisms*. *Frontiers in Neural Circuits*. <https://doi.org/10.3389/fncir.2019.00018>
- Köhler, W. (1970). *Gestalt psychology: An introduction to new concepts in modern psychology* (Vol. 18). WW Norton & Company.
- Kuznetsov, V. V., Kosilov, K. V., Kostina, E. Y., Karashchuk, E. V., Fedorishcheva, E. K., & Barabash O. A. (2021). Ocenka kognitivnykh funktsiy studentov medicinskih universitetov v processe obucheniya, svyazannaya s sostoyaniem in zdorovya [Cognitive status and health-related quality of life for medical students]. *Research and Practical Medicine Journal*, 8(1), 85-96. <https://doi.org/10.17709/2409-2231-2021-8-1-9>
- Magnusson, K. R., & Brim, B. L. (2014). The Aging Brain. In *Reference Module in Biomedical Sciences*. Elsevier. <https://doi.org/10.1016/B978-0-12-801238-3.00158-6>
- Martin, M. M., & Anderson, C. M. (1998). The cognitive flexibility scale: Three validity studies. *Communication Reports*, 11(1), 1-9.
<https://psycnet.apa.org/doi/10.1080/08934219809367680>
- Menchinskaya, N. A. (2004). *Problemy vospitaniya, obucheniya i psicheskogo razvitiya rebenka* [Problems of upbringing, education and mental development of a child]. MPSI, Voronezh.
- Nikiforov, G. S., Dmitrieva, M. A., & Snetkov, V. M. (2003). *Praktikum po psibologii menedzhmenta i professionalnoj deyatel'nosti* [Workshop on the psychology of management and professional activity]. Rech. <https://www.klex.ru/v2d>

- Piaget, J. (1950). *The Psychology of Intelligence* (1st ed.). Routledge.
<https://doi.org/10.4324/9780203164730>
- Rogova, G. V., Rabinovich, F. M., & Sakharova, T. E. (1991). *Metodika obucheniya inostrannym yazykam v srednej shkole* [Methodology of teaching foreign languages in secondary school]. Education.
- Ritter, S., Kuhn, S., Muller, B. C. N., van Baaren, R. B. Brass, M., Dijksterhuis, A. (2014). The Creative Brain: Corepresenting Schema Violations Enhances TPJ Activity and Boosts Cognitive Flexibility. *Creativity Research Journal*, 26(2), 144–150. <http://dx.doi.org/10.1080/10400419.2014.901061>
- Sahakian, B. J., Langley, C., & Leong, V. (2021, June 25). *Why is cognitive flexibility important and how can you improve it?* World Economic Forum.
<https://www.weforum.org/agenda/2021/06/cognitive-flexibility-thinking-iq-intelligence/>
- Salthouse, T. A. (2006). *Mental exercise and mental aging: Evaluating the validity of the «use it or lose it» hypothesis*, Perspectives on Psychological Science, 1(1), 68–87.
<https://doi.org/10.1111/j.1745-6916.2006.00005.x>
- Schaie, K. W., & Willis, S. L. (Eds.). (2011). Handbook of the psychology of aging (7th ed.). Elsevier Academic Press.
https://www.researchgate.net/profile/Catherine-Bowen/publication/234013321_Aging_in_the_Work_Context/links/5f75d61092851c14bca48371/Aging-in-the-Work-Context.pdf
- Soldatova, E. L. (2010). Sistemogeneticheskij podhod k izucheniyu razvitiya i funkcionirovaniya vzrosloj lichnosti. [A systemogenetic approach to the study of the development and functioning of the adult personality]. *Bulletin of the South Ural State University. Series: Psychology*, 27(203), pp. 63-65.
<https://dspace.susu.ru/xmlui/handle/0001.74/3096>
- Spiro, R. J., & Jehng, J.-C. (1990). Cognitive flexibility and hypertext: Theory and technology for the nonlinear and multidimensional traversal of complex subject matter. In R. J. Spiro & D. Nix (Eds.), *Cognition, education, and multimedia: Exploring ideas in high technology* (pp. 163–205). Routledge.
- Whetten, D. A., Cameron, K. S. (2007). *Developing Management Skills*. Pearson Prentice Hall.
- Zakharov, V. V. (2012). Nejropsihologicheskie testy. Neobhodimost' i vozmozhnost' primeneniya [Neuropsychological tests. Necessity and possibility of application], *Consilium medicum*, 13(2), 98-106.
<https://medi.ru/info/11155/>