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Dialogue of Cultures - Culture of Dialogue: from Conflicting to Understanding

LEARNING DATA VISUALIZATION IN ASSESSING LINGUISTIC COMPETENCE IN THE INTERNATIONAL BACCALAUREATE

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Abstract

Technical progress and the formation of a new information culture determine the design of effective educational activities and the assessment of students' achievement levels using the techniques of learning data visualization, the educational value of which in assessing the level of linguistic competence is emphasized in International baccalaureate programs. The understanding of visualization is traditionally based on the data representation in the form of an image, which helps to quickly and easily remember and understand the information, and visual tools are used to illustrate objects and phenomena. However, a different interpretation of visualization is based on associations, thought images, which are transferred from the internal plan to the external one in the process of cognitive activity. The methodology of visualization in assessment is one of the universal tools for forming productive ways of thinking, successful perception and reinterpretation of conceptual information which allows to solve a number of pedagogical problems. The pace of the learning process is enhanced as well as students' educational and cognitive abilities are encouraged. Students form and actively develop critical thinking skills, skills of imaginative representation of knowledge, and the overall level of visual literacy and culture increases. A methodically based approach to the use of visualization supports a higher level of students' cognitive activity, and modern technologies for processing and analyzing information contribute to the formation of students' skills to test knowledge using virtual simulators.

Keywords: Visualization, assessment, information, perception, competency, Baccalaureate**.**

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1. Introduction

Under the influence of economic and socio-political development in many countries, high quality of education is becoming an increasingly important factor for successful socialization and personal development, and the main condition of productive personal and business communication lies in linguistic competence as the main goal of teaching foreign languages to secondary school students in native and foreign practice.

Communication in a foreign language is culturologically determined, which, of course, impacts the effectiveness and culture of the students' common educational activity and allows them to efficiently use linguistic knowledge, adapt to the situation of speech communication, maintain self-control, and improve the culture of speech behavior.

Eloquence as the art of conveying thoughts has existed for many centuries. Since Ancient Greece thinkers have paid attention to the study of rhetoric, speech skills, and the speaker's personality. Many linguists noted the social role of language and the dependence of the degree of "language perfection" on the level of "development" of the society in which the corresponding language functions. Researcher Polivanov (1968, as cited in Koncevich, 2001), pointed to the mental and social nature of language, and, according to Leont'ev (1969), human speech activity is based on the need for communication and is always motivated, which indicates the complex nature of this type of activity and the need for complex formation and evaluation of linguistic competence (Polivanov, 1968, as cited in Koncevich, 2001).

2. Problem Statement

In modern sociolinguistics with the inevitable increase in the number of broadcast data in society it becomes more difficult to investigate the system of a single language, to study the influence of social phenomena on the interaction of languages and therefore becomes harder to interpret the results of educational achievements to assess the levels of formation of competences (in particular linguistic) and to identify the levels of development of educational programs.

There appears a problem of adequate assessment of linguistic competence.

3. Research Questions

- Is it possible to apply the methodology of learning data visualization widely used in foreign practice for assessing the students' linguistic competence?

4. Purpose of the Study

To study the factor of visualization of educational information in assessing the level of formation of linguistic competence of students based on the experience of International baccalaureate schools.

5. Research Methods

This research is part of a long-term effort to develop and apply new assessment materials using visualization. To do this, we conducted a large-scale content analysis including literature analysis as well as study of terms, modeling of a real learning system, and a pedagogical experiment.

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6. Findings

Technical progress and the formation of a new information culture determine the design of effective educational activities and the assessment of students' achievement levels using the techniques of learning data visualization, the educational value of which in assessing the level of linguistic competence is emphasized in International baccalaureate programs.

Dating back to the American concept of visual literacy of the 20th century, the technology of visualization of learning data is traditionally based on the representation of information in the form of an image, which contributes to rapid convenient memorization and comprehension of the information, since the principle of visibility in learning is very valuable.

The understanding of visualization as a process of observation is limited to the students' perceptual thinking and cognitive activity, and visual means serve in this case to illustrate objects and phenomena. A different interpretation of visualization is described in the "theory of frames" " (Minsky), where visualization is based on associations, thought images which are transferred from the internal plan to the external one in the process of cognitive activity (Minsky, 1979, as cited in Marinosjan, 2016).

Similarly, Verbickij (2017) differentiates the concept of "visual" from the concept of "illustrative", where the former is an image born from the internal plan of human activity, and the latter is a demonstration of specific objects from the outside.

In the previous century American psychologist Rudolf Arnheim (2004) introduced the concept of "visual thinking». While investigating its features, he clearly distinguished this process from other means of visibility and illustration (drawings, objects, etc.) and emphasized the difference in the very nature of these phenomena. Visual thinking, in his opinion, acts as a guide to understanding and connecting the image with other objects of reality (Arnheim, 2004).

The stated theory about the peculiarities of thinking is reflected in many studies of modern scientists and forms the basis for working out the methods for developing students' cognitive abilities and competencies in schools. One of the tasks for teachers today is to form connections of objects and phenomena with the surrounding reality through visual thinking in the framework of a practice-oriented approach.

Modern cutting-edge technical tools and facilities transform the idea of visualizing information in the learning process and give it new features. The use of tables, diagrams, drawings, mind maps, scribing, infographics is now based on the leading role of image perception in the cognitive process, and taking into account the increasing information load and digitalization of society, we become a "civilization of images" (Few, 2019).

In his book «Solving problems and selling ideas with pictures", visual thinking specialist Dan Roam considers visual thinking as a method for solving any tasks and problems, provided that the emphasis is based on the common questions " Who/what?", "Where/when?"and "Why/why not?" (Roam, 2011). Thus, everything that we see around us is divided into 6 categories, within which a person analyzes processes and phenomena in nature and the world in time and space. Creating such an "evacuation plan", the student systematically learns to select information, analyze and explain it, establish cause-and-effect relationships, and plan a successful path to the goal, to achieve a deep conceptual understanding.

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In the process of analyzing the significant qualities of an object, the student brings to the fore the most relevant questions and categories in order to answer them more accurately, using the available information. Selecting a category defines the direction of responses in the information flow and determines the final result (Rendgen, 2018).

Similarly, the conceptual understanding and the formation of linguistic competence is achieved in the IB programs, in which the content in question is examined according to one out of six "Global contexts" (Table 1. Global contexts in the International Baccalaureate system) of students' choice and is directly related to the students' individual life experiences to encourage their motivation. Education through "global contexts" contributes to the formation of the student's personality, who becomes aware of himself as a part of the global world community (From Principles into Practice, 2019).

Table 01. Global contexts in the International Baccalaureate system

MYP Global Context	Developed and Explained
Identities and relationships	Who we are: an inquiry into ourselves; our personal beliefs and values; physical and mental health; relationships with families and friends, interaction within communities and cultures; human rights and responsibilities.
Orientation in space and time	Where we are in place and time: an inquiry into our place and time characteristics; personal histories; homes and journeys; explorations of individuals and civilizations, from different perspectives.
Personal and cultural expression	How we express ourselves: an inquiry into the ways we come up with ideas, our feelings, beliefs and values; the ways we develop and perform creativity.
Scientific and technical innovation	How the world works: an inquiry into the interaction between the world of nature and human society; the influence of scientific and technological advances on the society and environment.
Globalization and sustainability	How we organize ourselves: an inquiry into our decision-making about the world; the function of organizations in terms of economic activities and their influence on humankind and the environment.
Fairness and development	Sharing the planet: an inquiry into equal rights, opportunities and responsibilities to share global resources with other people and other living creatures.

Thus, teaching and learning in the IB MYP program is based on a contextual understanding of objects and phenomena. Contexts for learning, and therefore for everyday practice, are a set of situations and circumstances designed to guide learning, appealing to the learner and aimed at building their competencies.

With the acquisition of new experience and new levels of competence, students' perception of objects, phenomena and concepts changes, as well as the interpretation of reality in different contexts varies, i.e. the presence of a context implies the possibility of considering the same phenomenon from new points of view to improve the students' understanding and motivation for discussion (Lima, 2017).

Teaching and assessment within Global contexts allows:

- teachers to design the future activities for students taking into account their individual learning style, different experiences, and cultural characteristics; to offer students authentic tasks and ways to achieve different levels of understanding when evaluating competencies;

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- students to compare different views of reality, transfer their learning experience from one context to another; develop critical and creative thinking through contact with numerous, often conflicting and open to interpretation clusters of values and cultural views; develop self-regulation and find their own meaning of each context in the process of research, which often leads to students' awareness of their further professional affiliation.

In the IB MYP program, learning contexts are used for modeling and" visualization " of life events and circumstances, strengthening international thinking and involving students on a global scale, which becomes important and relevant in the formation of linguistic competence and the development of students' personal qualities (Sahlberg, 2016).

Learning in global contexts allows learners to project the relationship of the phenomena and concepts under investigation to their own activities and apply knowledge in life contexts which helps increase the level of motivation in the learning process and "visualize" the importance and significance of the concepts studied.

The programs and educational environment of the International baccalaureate consider the world as the broadest context for study and research that only students with international thinking, a high level of linguistic competence and different models of information processing can successfully achieve in highly globalized societies of the 21st century.

Blurring borders between states, strengthening relationships between nations, and increasingly complex learning in context provide students with opportunities to analyze numerous options for significant practice-oriented learning tasks that young people face in real life contributing to the development of their understanding, the formation of a level of competence, and the working-out of creative solutions.

Learning in context inspires teachers to develop a wide range of ideas and issues that are relevant personally, locally, nationally, internationally, and globally. This doubtlessly requires careful preparation on the part of the teacher and constant monitoring of the levels of understanding in the form of a formative assessment in the process of interaction with students (McQueen, 2019).

As learners develop competencies in the learning process, they become more and more aware about their place in this world. Educational activities in global contexts involve a synthesis of understanding, practical skills, and individual self-determination that work together to define a global competence (Kriebel & Murray, 2018) aimed at making students take responsible action to create a better world for themselves and for the whole society they live in.

Global contexts contribute to the emergence and functioning of a common language for meaningful contextual learning, and determine the appropriate circumstances and situations that provide a more focused view of the formation of linguistic competence and teaching and learning in general (Stake, 2004).

Contexts determine the starting points for the investigation of objects and phenomena, set the angle of consideration of situations, structure the content of the program, and ensure the formation of students' international thinking, multilingualism, and intercultural understanding. Global contexts are based on the issues of global significance that guide teaching and learning in the International baccalaureate programs, providing relevance and motivation for students.

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These and other contexts for teaching and learning inspire the study of our common human nature and shared responsibility for the planet, "visualize", define problems in a society on the national and global scale, and turn the subject content to the students' personal interests.

For each topic within subject groups in the MYP program, students and educators identify one global context that provides a focus for meaningful teaching and learning in the international education program. During the course of the educational program, students must explore all six Global contexts in the International Baccalaureate programs. The selected global contexts form the basis for students' research questions during the study of the topic. However, many of the studied phenomena can be considered in different global contexts.

The study of subject content through the "visualization" of educational data based on the global context in the International baccalaureate programs allows students to form a deeper understanding of the subject matter and more successfully apply their skills in the real world. Repeated cycles of research, action, and reflection can lead students from academic knowledge to practical understanding, developing a positive attitude to learning, and a sense of personal and social responsibility (Scott, 2018)

Nevertheless, the visualization of learning data is not a new phenomenon in education. For example, Shatalov's (1980, as cited in Gurkova, 2016) method of reference schemes is based on the compressed presentation of educational data according to the reference abstract. However, the logical relationships between the concepts were available only to the participants of the educational process, and the independent study of information on the "foreign" scheme caused a lot of difficulties (Shatalov, 1980, as cited in Gurkova, 2016).

At present, existing models of presenting information in a compressed form are increasingly appealing to the ability of a person to think in images, make diagrams in the mind, "encode" the material and, if necessary, restore it, mentally recreate any objects of reality. The data are arranged in organized complete information blocks, so that large amounts of information become convenient for a person of clip culture, who is unable to systematically perceive information and, consequently, consistently express their thoughts.

According to research by psychologists and physiologists, the left hemisphere of human brain focuses on verbal and symbolic functions, while the right hemisphere focuses on spatial and synthetic functions. The learning process is often based on a combination of logical and visual-imaginative thinking in order to provide balanced work of the left and right hemispheres of the brain, however, the emphasis on students' visual thinking provides a synthesis of knowledge and the possibility to conjure up the studied phenomena, even if this is not possible (Man'ko, 2009).

The analysis of the situation in society and in education in particular demonstrates how deeply clip consciousness is rooted in the mind of generation Z and how important it is to efficiently use its features in the educational process in order to grasp brief information and be able to pass on fundamental knowledge in the future (Healy, 2018; Kirk, 2019).

Psychological features of modern society determine the effectiveness of the principle of cognitive visualization, i.e. the level of students' achievement increases if the visibility of the information offered in the process of learning and evaluation performs not only an illustrative, but also a cognitive function, and

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if the image-bearing right hemisphere begins to work in the process of processing and assimilation of the material.

The principle of cognitive visualization is successfully applied in the International Baccalaureate program for secondary school students (Middle Years Program) when assessing the level of students' linguistic competence but not just for the purpose of more accessible and easy learning of the material, but as an integral part of the students' cognitive activity.

Given example. Students are invited to perform a summative task on the topic in order to determine their level of linguistic competence in different types of speech activity. To determine the level of achievement in learning the educational material when performing a reading task, students are offered to study the text and the image to the text, answer a number of questions about the content of the text, analyze visual information, realize and argue their point of view based on both the studied material and the personal experience of the student, which contributes to the perception of the entire text as an information unit.

With this synergetic approach to the formation of linguistic competence, students gradually develop all types of speech activity that allow them to communicate freely and competently on the one hand, as well as improve their cognitive and creative abilities, achieve understanding of the situation through reflection and empathy, and develop conscious learning of universal educational actions. Thus, there is a comprehensive assessment of the formation of linguistic competence and all its components: motivational, cognitive and active; there arises a need to perform a specific speech act, demonstrate linguistic and cultural knowledge and determine the necessary communication skills (Korobkova & Ivankova, 2016).

Let's state another example. As a summative task, students are shown a video clip with an audio track. The proposed channels for processing information are different. However, students should answer the questions about what they have just seen and heard, identify semantic reference points for memorization, critically analyze the information and form logical conclusions based on their life experience. Researcher Mayer points out the beneficial usage of such "multimedia" for students in the more successful formation of mental models, the development of abilities for analysis and comparison, the formation of associations and cognitive interest, the integration of new knowledge, the development of critical thinking (Mayer, 2009).

Having a set of specific tasks completed, the assessment subjects (teachers or students themselves) define the level of achievement against the pre-known criteria in accordance with the particular subject area of the International Baccalaureate program.

There is a variety of tools used for visualizing the information, however, the data and the designed tasks must be meaningful and properly designed:

- tasks must be understandable for students, i.e. they can be offered in their native language at the initial «learning phase»;

- tasks must be different in structure and content;

- you can offer students multi-level and modular tasks in which you can change some of the conditions;

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- objective and valid tasks must make it possible to achieve certain results and each of the presented levels;

- students should have a strong intention to get the result when completing the task, and not just "try" to complete the task;

- it is necessary to develop the students' ability to work at the level of creative thinking, because the images are stored in everyone's memory and, if necessary, are built into a chain of associations;

- in the process of developing educational materials, it is important to duplicate verbal information with image-bearing information and vice versa, in order to provide students with the opportunity to easily restore logical connections, support the activity of students, and their self-regulation in the learning process;

- tasks should allow students to use a foreign language in accordance with the situation and as a means of communication in all types of speech activities, forms and situations of communication to improve their level of linguistic competence.

When selecting or designing effective tasks aimed at systematic learning, analysis, comparison, and generalization of information, the teacher must take into account 3 questions:

1) How do I feel about the content of the material? What are the main ideas, facts, and processes that students should understand when completing a task?

2) What kind of visual information will help students better understand the content of the material?

3) How can students ' personal experience be updated and critical thinking be stimulated? (What questions should I ask students?)

Thus, an integral part of the process of assessing the students' linguistic competence should become the technology of learning data visualization, as a system that includes:

- a set of educational knowledge in the subject area that reflects the conceptual perception of the world around us;

- visual methods and techniques for presenting information;

- technical means of visual transmission of information;

- a set of psychological techniques for improving visual thinking in the learning process.

7. Conclusion

The methodology of visualization in assessment is one of the universal tools for forming productive ways of thinking, successful perception and reinterpretation of conceptual information which allows to solve a number of pedagogical problems. The pace of the learning process is enhanced as well as students' educational and cognitive abilities are encouraged. Students form and actively develop critical thinking skills, skills of imaginative representation of knowledge, and the overall level of visual literacy and culture increases. A methodically based approach to the use of visualization supports a higher level of students' cognitive activity, and modern technologies for processing and analyzing information contribute to the formation of students ' skills to test knowledge using virtual simulators.

Using a variety of tools and forms of assessment in the process of learning and developing the level of linguistic competence allows to track the students' difficulties, provide relevant information

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about the students' progress, plan and adjust the educational process, identify the levels of achievement against the criteria assessing competencies and improve the quality of educational activities in general.

Students acquire and develop the ability to see the situation conceptually which in the future makes it possible to hold, analyze, structure the information for further use, realize the essence of the problem, effectively learn the world around them and make efficient decisions about the situations in the real world.

Therefore, it is necessary to adjust the teaching process according to the needs of the society and adapt methodological techniques to the modern educational process, aimed primarily at the formation and evaluation of students' competencies, including linguistic one. According to researcher Rybnikova (1985, 1985, as cited in Sosnovskaja, 2016), a well-chosen method provides "both academic success, discipline, and productivity of teacher's work as well as the development of the student's competences".

for the development of the students' ability to use the necessary information, to gain independence in the process of learning, and to show readiness to self-improvement throughout life. Now training in schools is more likely to be based on implicitly expressed text information rather than on visual information. However, it is necessary to review training technologies in order to keep up with the times, since "reading" the text can constitute a problem for the current generation of students.

References

Arnheim, R. (2004). *Art and visual perception, second edition: A psychology of a creative eye*. University of California Press.

Few, S. (2019). *The Data Loom.* Analytics Press.

From Principles into Practice. International Baccalaureate Organization. (2019). Middle Years Programme Guide. Cardiff: The International Baccalaureate Organization Ltd.

Gurkova, V. S. (2016). Metod obuchenija po V.F.Shatalovu [The teaching method according to V.F. Shatalov]. *Nauchnye issledovanija i razrarabotki molodyh uchenyh, 9-1*, 50-55.

Healy, K. (2018). *Data Visualization: A Practical Introduction.* Princeton University Press.

Kirk, A. (2019). *Data Visualisation: A Handbook for Data Driven Design.* Sage Publications Ltd.

Koncevich L. R. (2001). O rukopisnom nasledii E.D. Polivanova v Prage [About the handwritten heritage of E. D. Polivanov in Prague]. In O. V.Nikitin, & F. M.Berezin (Eds.), E.D. Polivanov i ego idei v sovremennom osveshhenii [E. D. Polivanov and his ideas in modern lighting] (pp. 187–190). Smolensk: Smolenskij gosudarstvenny`j pedagogicheskij universitet.

Korobkova, J. V., & Ivankova, M. S. (2016). Vizualizatsiya obrazovatel'nyh rezul'tatov [Vizualization of educational outcomes]. *Mezhdunarodnyj studencheskij nauchnyj vestnik, 6*, 129.

Kriebel, A., & Murray, E. (2018). *#MakeoverMonday: Improving How We Visualize and Analyze Data, One Chart at a Time.* John Wiley & Sons.

Leont'ev, A. A. (1969). *Yazyk, rech', rechevaya deyatel'nost'* [Language & speech activity]. Prosveshhenie.

Lima, M. (2017). *The Book of Circles: Visualizing Spheres of Knowledge.* Princeton Architectural Press.

Man'ko, N. N. (2009). Kognitivnaya vizualizatsiya didakticheskih obyektov v aktivizatsii uchebnoj deyatel'nosti [Cognitive visualization of educational objects for boosting learning activity]. *Izvestija altajskogo gosudarstvennogo universiteta. Serija: Pedagogika i psihologija, 2*, 22-28.

Marinosjan T. E., & Kurovskaja, Y. G. (2016). «Arhetip» y «freim» v filosofskoj antropologii i analiticheskoj filosofii [The archetype and the frame in philosophical anthropology and analytic philosophy]. *Filosofskie nauki, 5*, 30-36.

Mayer, R. E. (2009). *Multimedia learning. Psychology of learning and motivation.* Cambridge University Press.

McQueen, M. (2019). *Teaching for tomorrow: A blueprint for Future-Proofing Our Schools, Students and Educational System.* The Bookbaby, Kindle Edition.

Rendgen, S. (2018). *Information Graphics.* Multilingual edition. Taschen

Roam, D. (2011). *The Black of the Napkin (Expanded edition): Solving problems and selling ideas with pictures.* Penguin Books.

Sahlberg, P., Hasak, J., & Rodriguez, V. (2016). *Hard Questions on Global Educational Change.* The Teachers College Press.

Scott, E. P. (2018). *The Model Thinker: What You Need to Know to Make Data Work for You.* Basic Books Publisher.

Sosnovskaja I. V. (2016). Prognosticheskij aspekt nekotoryh metodicheskih polozhenij uchenija M.A. Rybnikovoj [Prognostic aspect of some methodological provisions of M. A. Rybnikova's teaching.]. *Pedagogicheskij imidzh, 1*, 56-61.

Stake, E. R. (2004). *Standards-Based and Responsive Evaluation.* Sage Publications Inc.

Verbickij, A. A. (2017). Teorija i tehnologii kontekstnogo obrazovanija [Theory and technologies of contextual education]. MPGU.