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VISUALIZING EDUCATIONAL INFORMATION: PRIMARY SCHOOL TEACHERS' VIEWS

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Abstract. *The study's major purpose was to compare primary school teachers' views on visualizing educational information under conditions of the reform of Ukrainian education being in progress and unforeseen global impacts (martial law in Ukraine and the Covid-19 pandemic). The survey was conducted within the time period of 2019 spring – 2022/2023 winter. The total number of respondents consisted of 265 primary school teachers.*
Gradual primary school teachers' reorientations regarding the essence of visualizing educational information were determined as a strong positive tendency: from the position of its identification associated with the didactic field of the use of visual means to the consideration of visualizing educational information as an effective didactic tool boosting the use of interactive methods of teaching and learning in primary school.
A significant rethinking of the didactic potential of using visualization in the educational process of primary school was being observed. The implementation speed of forms, methods and means of information visualization in the educational process of primary school changed positively as a result of experimental didactic influences. But the dynamics of changes was not correspondingly enough to the needs of modern educational requirements. Concluded the inappropriate development of primary school teachers' visualizing educational information skills that are to be intensively improved among primary school teachers.
Keywords: *primary school; primary school teachers; teachers' visualizing skills; visual literacy; visualizing educational information.*

Introduction

Civilizational changes, technological progress, expansion of the space of innovation activity in all spheres of society determine the expediency and necessity to search for new developmental perspectives in the field of education.

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In particular, the improvement of existing ones and the formation of new competencies amid teachers on the way of their professional training and professional activities. As the key result of teachers' education should be regarded sustainable development of their ability and willingness to use their systemic knowledge, skills, abilities and qualities as tools for finding out the most effective solutions of the professional and pedagogical tasks they face.

Achieving this result within the system of primary school teachers' professional training resulted as further development of their professional pedagogical competence implies understanding the importance of the following two major recommendations: (1) the effectiveness of professional and pedagogical education should be constantly being improved and (2) the strategy targeted at implementation competence-oriented/competence-based education amid primary school students is to be realized constantly as a prior pedagogical idea within contemporary class.

One of the educational innovations claimed to serve these pedagogical areas are to be renovated is the development of visual literacy of primary school teachers, their skills in visualizing educational information. The active use of visual content in all spheres of society strongly influence the system of primary education due to the wide capabilities of ICTs for visualization as a component of blended and distance education.

In pedagogy, at the theoretical and methodological level, opportunities for using visualization are actively being developed to enhance learning outcomes, foster critical thinking, creativity, communication skills etc. (Kędra & Žakevičiūtė, 2019; Özsoy & Saribaş, 2021).

Visualization of information in pedagogy is considered as:

- the process of visual representation of information (giving it a visual form),
- the formed visual image.

It should be noted that most modern scientists share the point of view of W. Zimmermann and S. Cunningham' (1991), that visualization is, first of all, the process of forming an image in the mind of an individual and/or bringing it out both by means of creating digital images or video sequences, and without their use.

So, for example, in the studies by Alessandrini & Rosso (2009), Ponners & Piller (2020), Salunkhe, Kaithathara, Darshan, Gowri & Shabarisha (2022) visualization is defined as the process of creating a thought image of an object in consciousness (according to the mechanisms of visual imagination, visual perception, and visual thinking). Kunjir and Patil (2020) consider visualization as a representation of text content in models, pie charts, graphs, maps etc. for ease of understanding. The interpretation of visualization Nissen (2020) is similar – as a representation of objects, situations, relationships, processes, phenomena or information through diagrams, graphs, images, or similar means. Tufte (2001, p.9)

suggests considering visualization as "a visual demonstration of information in the form of tables, diagrams and graphs", and Ursyn (2015) – transmitting information using its graphical representation

Derived from understanding visualization as a visual process, Zheng (2008) defines visualization as a method of conveying abstract and concrete ideas through the creation of images, diagrams, or animations and Wen & Wang (2020) define this concept as a data analysis method that focuses on the external representation of abstract or concrete ideas (image, diagram, animation etc.) to help understand the content of expressed information.

Visualization is widely used in modern primary and secondary school educational process (Knoop-van Campen et al., 2024; Schoenherr & Schukajlow, 2023; Supli & Yan, 2023).

The importance of visualization in the professional and pedagogical activity of primary school teachers is determined by the characteristic features of Modern Primary School students (children of the Alpha generation): the visual orientation of their perception, their attention span and the existing phenomenon of clip thinking. It is advisable to pay attention to the "emotional coloring" of visual content that the teacher can use in the lesson. This property of visualization allows using it to motivate students to learn, create an emotionally comfortable educational environment both under conditions of traditional full-time education, and in lessons in the online format.

Taking into the account the importance and value the ideas and statements presented and summarised above the high-speed positive dynamics is observed in the pedagogical field closely connected with the implementation of educational information visualizing into the processes of teaching and learning in primary school.

So, the study's major purpose was to demonstrate that the implementation speed of forms, methods and means of information visualization in the educational process of primary school changed positively as a result of authors experimented didactic influences within the period of time determined by the beginning of the Covid-19 pandemic and the years followed it.

Research Methodology

In 2019 spring and 2022/2023 winter a questionnaire of primary school teachers was conducted. It was attended by 265 practitioners from 12 regions of Ukraine. The distribution of teachers by class (from 1st to 4th) was 24%, 28%, 25%, 23% accordingly, at the beginning of the study. In the course of devising and executing research initiatives, the team of researchers from Institute of Pedagogy of National Academy of Educational Sciences of Ukraine (Didactics Department) took into account the experience of scientific and pedagogical activity amid the backdrop of unforeseeable global perturbations, including the

Covid-19 pandemic and the imposition of martial law in Ukraine (Topuzov, Malykhin, & Aristova, 2022; Malykhin, Kaupuzs, Aristova, Orska, & Kalvans, 2023).

In the period between questionnaires, a team of scientists conducted a series of webinars and practical classes for teachers on the problems of visualization of educational information. Considerable attention was devoted to the possibilities of visualizing educational information in order to compensate educational losses under conditions of blended and distance learning in the country. Thus, in 2022, within the framework of teacher development courses "Compensation of educational losses in educational institutions under martial law and post-war reconstruction", a webinar was held on the topic "Distance education in primary schools: visualizations of educational information and ICT tools" (retrieved: https://youtu.be/P7AKpXDjuDY). The webinar discussed the modern possibilities of using visualization of educational information and ICT in the context of a remote form of organizing the educational process in primary school. Various aspects of the implementation of interactive interaction between students and teachers in online lessons were shown: the possibility of using an interactive whiteboard for collaboration, digital visual materials, electronic textbooks etc.

Also, from 2019 to 2022, teachers took advanced training courses introduced by the Ministry of education and science of Ukraine as part of the "New Ukrainian school" reform (Ministerstvo osviti i nauki Ukraïni, EdEra & Osvitorija, n.d.). The mandatory component of the program of these courses includes issues of familiarizing teachers with the didactic potential of using forms, methods, techniques and tools for visualizing educational information in primary schools and practical advice on their implementation in the classroom.

Instrument and Procedure

It is for this purpose the team of researchers from Institute of Pedagogy of National Academy of Educational Sciences of Ukraine (Didactics Department) developed a web-based questionnaire using Google Forms.

The key questions of the questionnaire were:

- Do you think it is advisable to develop visual literacy of students in primary school? (Answers: Yes; No; It's hard to answer)
- In your opinion, visualization of educational information in primary school is, first of all... (Answers: Use of pre-made visual didactic manuals in the classroom; Creation of visual educational material by the teacher directly in the classroom; Creation of visual educational material by students; Other)
- In your opinion, are the concepts of visual thinking and visual-imaginative thinking identical? (Answers: Yes; No; It's hard to answer). If you believe that the concepts of visual thinking and visual-imaginative thinking are not identical, explain what the difference is.

- What do you see as the benefits of using visualization in the educational process? (Answers: In the development of cognitive processes; In increasing students' motivation to learn; In improving the assimilation of educational material (accessibility, clarity of its presentation and integrity of perception); In facilitating the formation of students' skills; In intensifying the educational process; In improving discipline in the classroom)

In connection with the global trend of digitalization of education, a question on the introduction/use of digital visualization in the educational process of primary schools was added to the questionnaire:

- Is your classroom equipped with digital learning equipment (computer, multimedia whiteboard etc.)? (Answers: Yes; No)
- Do you have any difficulties with the use of modern ICTs in the development/use of digital content? (Answers: Yes; No)
- How often do you use traditional visual means (illustrations, drawings, diagrams, tables etc.) and modern visual means (presentations, smart maps, interactive images, animations, videos etc.) in your lessons? (Answers: Constantly; Several times a week; Rarely; Never)

In the Ukrainian education system, before the introduction of the "New Ukrainian school" reform, visualization was the least used in the language and literary lessons. In this regard, the questionnaire included questions:

- How often do you use visualization of educational information in language and literature lessons? (Answers: Weekly or more often; Several times a month or less; Never)
- Evaluate the level of providing the language and literary industry with visual didactic material on a 10-point scale
- How often do you use pre-made visual educational materials in your language and literature classes? (Answers: Weekly or more often; Several times a month or less; Never)
- How often do your students create illustrations, diagrams, tables, smart maps, diagrams etc. in language and literature classes? (Answers: Weekly or more often; Several times a month or less; Never)
- How often do you use graphical analyzers (t-diagram, Yes-No ratio scale, diagrams (Venn diagram, cyclic diagram, tree diagram, Fishbone diagram etc.) in your language and literature lessons? (Answers: Weekly or more often; Several times a month or less; Never)

Data Analysis

As can be seen from the above, the vast majority of questions in the questionnaire are closed. The quantitative and qualitative data analysis involved a thorough compilation of the information gathered. This process included

presenting the processed data through pie charts, bar charts comparing and summarizing the information, and engaging in discussions to share the findings with the academic community.

Results and Discussion

According to the results of the 2019 survey, the overwhelming majority of teachers (98.9%) noted the expediency of forming visual literacy of students in primary schools and, at the same time, preferred to use visualization of educational information in lessons as a means (64.7%), rather than a method (33.2%) of teaching. This indicates that the majority of teachers does not fully understand the essence of visualization as a component of the modern educational process, and actually identify it with the use of visual means.

The survey also revealed that primary school teachers lack awareness of the psychological basis for implementing/using visualization in pedagogy. For example, the majority of respondents (75.9%) identify the concepts of visual and visual-imaginative thinking, and among respondents who separate these concepts, less than 4.8% clearly understand the difference between them. As a result, a significant percentage of primary school teachers do not realize all the benefits of using visualization of educational information in the educational process (Fig. 1).

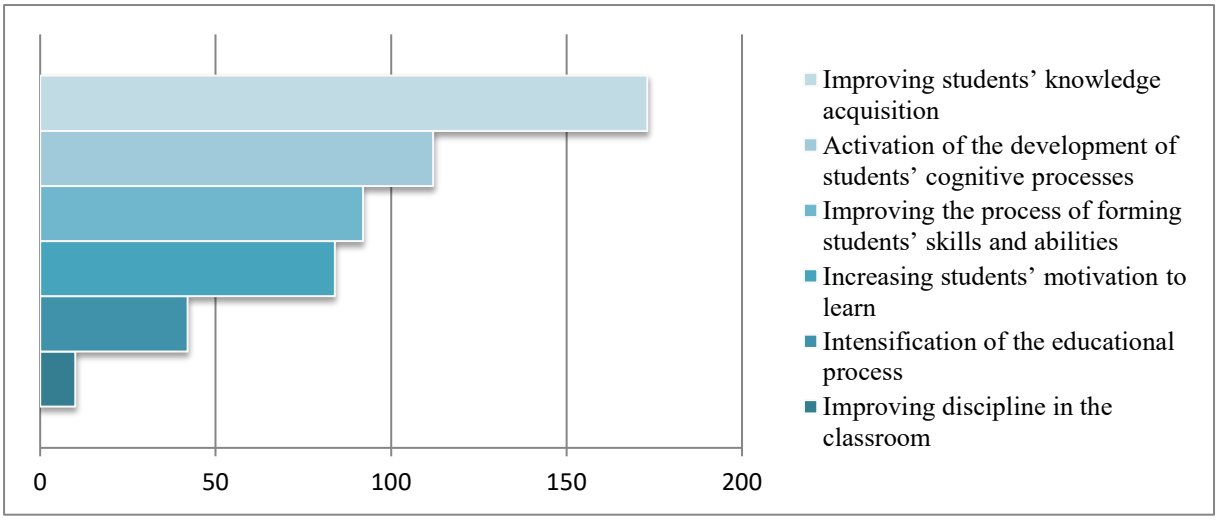

Figure 1 ***The point of view of primary school teachers regarding the function of visualization in the educational process (teachers' vision)***
Source: own elaboration on the basis of data obtained during research

According to the results obtained, the vast majority of teachers note the importance of visualization in mastering the knowledge component of subject competencies (92.5%). However, its significant impact on the formation of students' skills and abilities was noted by only half of the respondents (49.2%). This can be explained by the existing stereotype of identifying visualization and

illustration (the perception of visualization only as a means of passive learning). A lack of understanding of the benefits of using visualization to intensify the learning process and improve classroom organization and behavior most likely indicates a lack of understanding of the links between:

- activation of students' cognitive interest → increasing students' motivation to learn → improving discipline in the classroom;
- increasing the assimilation of knowledge by students + improving the process of forming students' skills → intensifying the educational process.

Concretizing the issue of using visualization within individual academic subjects, attention was focused on the language and literary field, because in domestic education it was traditionally characterized by a simplified approach to the use of visualization: in the lessons of teaching literacy, literary reading, as well as native and foreign languages in primary school, illustrative visual materials are mainly used. Significant efforts were made to address this gap during the implementation of the 2018 education reform. The requirements for visual literacy of students in the context of language and literary education have acquired a new meaning. At the same time, according to the results of the survey, although the vast majority of primary school teachers (89.3%) constantly use visualization in the educational process, in literacy, language learning and literary reading lessons. The use of pre-prepared visual content, that is, classical visual means, prevails. Only about a third of teachers (35.3%) prefer visualization techniques in learning activities. In particular, graphic analyzers proposed in the methodological recommendations of the New Ukrainian School are actively used by 13.9% of the surveyed teachers (Fig. 2).

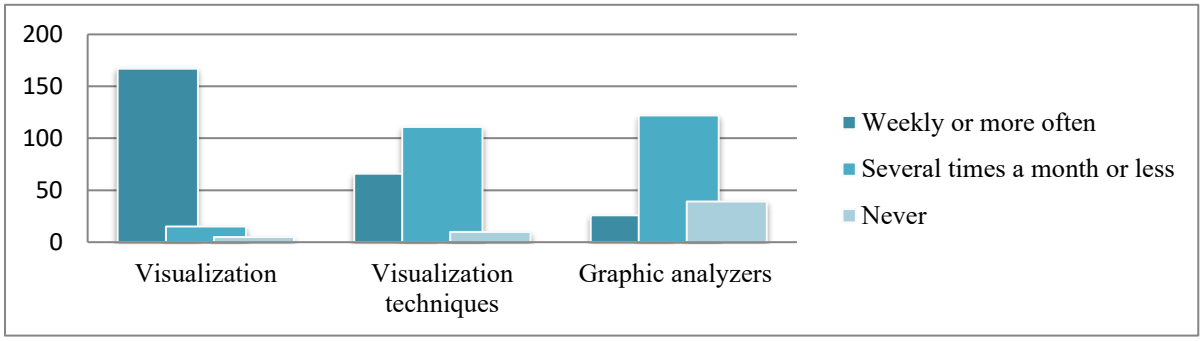

Figure 2 ***Frequency of visualization usage at the lessons of the language and literary field***
Source: own elaboration on the basis of data obtained during research.

The situation under consideration determines the request of teachers to expand the variability of available educational visual content. Teachers note insufficient provision of subjects in the language and literature field with visualization tools: 33.7% of respondents indicated a low level, 46.5% of

respondents indicated an average level, and only 19.8% of respondents indicated a high level of provision.

We focus on the rapid global penetration of digital technologies into the educational process (caused by the rapid development of information and communication technologies), the available opportunities for their use in training and the actualization of the problem of implementing distance learning in Ukraine. According to the study, about 70% of primary school classrooms are equipped with the necessary informational and communicational equipment, and almost 100% of teachers in these classes use digital visualization tools in the educational process. However, it is worth noting that even teachers of non-equipped classes try to provide a modern level of learning by including elements of digital visualization in independent learning of students (Fig. 3).

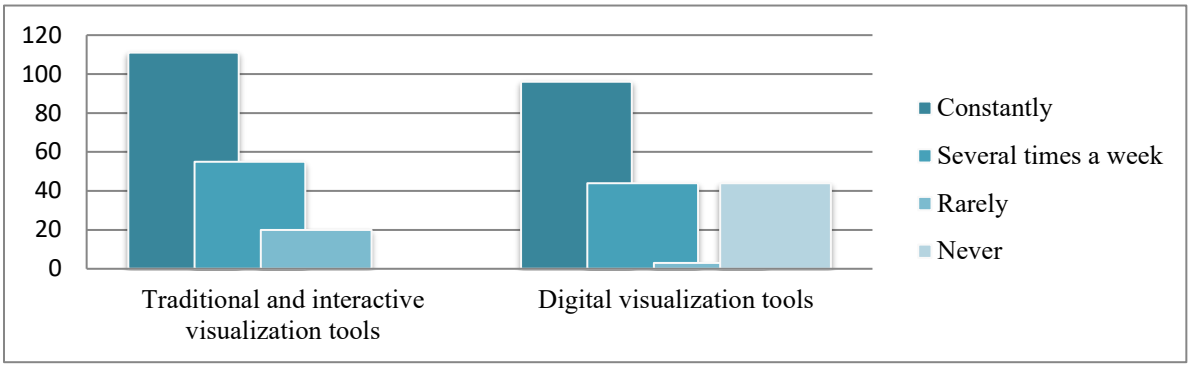

Figure 3 ***Correlation in the use of traditional and modern visibility***
Source: own elaboration on the basis of data obtained during research.

In classrooms that are equipped with modern digital equipment, teachers use both traditional and digital visualization tools (Fig. 4).

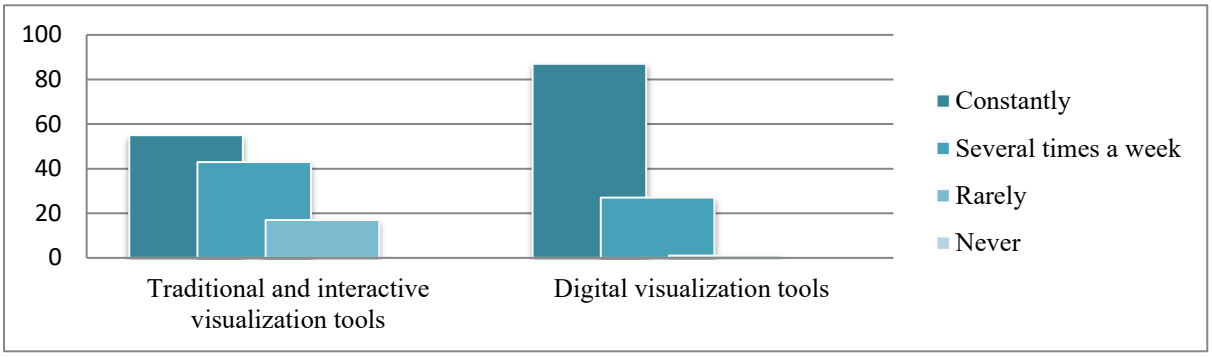

Figure 4 ***Correlation in the use of traditional and modern visibility by teachers in classrooms equipped with modern digital equipment***
Source: own elaboration on the basis of data obtained during research.

According to the frequency of use of face-to-face lessons, digital visualization prevails. It cannot be considered as a positive trend, because, according to the principle of visibility, in primary education it is important to use traditional teaching means (objects, phenomena of the surrounding world and demonstration of ways of acting with them (or material models of the above), which have a sensory-figurative effect on the student's consciousness.

Summarizing the results of the 2019 survey, we note the existence of a stereotype among primary school teachers in associating the visualization of educational information with the use of visual means, particularly its digital variant, within the teaching community. There is a superficial awareness among educators regarding the psychological and pedagogical foundation, as well as the didactic potential of visualization in the educational process. However, we note the absence of implementation of visualization methods in the teaching and cognitive activities within the scope defined by the New Ukrainian School Concept (Ministerstvo osviti i nauki Ukraïni, EdEra & Osvitorij, n. d.). These indicate a relatively low level of visualization skills in the majority of primary school teachers.

At the end of 2022, a second survey of primary school teachers was conducted to find out the dynamics of the implementation/use of visualization in the educational process of grades 1-4 from 2019 to 2022. A comparative analysis of the results of the 2019 and 2022 surveys on key issues is given in Table 1.

Table 1 ***Comparative analysis of results of the survey of primary school teachers in 2019 and 2022*** *(compiled by Auhors)*

Survey	2019	2022	Dynamics
The essence of educational information visualization in primary education:			
Teachers who identify the visualization of educational information with using of visual means	64.7%	56.3%	– 8.4%
Teachers who define visualization primarily as a teaching method	33.2%	37.9%	+ 4.7%
Primary school teachers' point of view on visualization functions in the educational process			
Improving students' knowledge acquisition	92.5%	88.5%	– 4%
Activation of the development of students' cognitive processes	59.9%	85.9%	+ 26%
Improving the process of developing students' skills and abilities	49.2%	82.1%	+ 32.9%
Increasing students' motivation to learn	44.9%	79.5%	+ 34.6%
Intensification of the educational process	22.5%	85.9%	+ 63.4%
Frequency of using visualization methods in the educational process (on the example of the language and literature field)			
Weekly or more often	35.3%	39.7%	+ 4.4%
Several times a month or less	59.3%	52.6%	– 6.7%
Never	5.4%	7.7%	+ 2.3%

In general, we observe a gradual reorientation among teachers in defining the essence of visualizing educational information: shifting from considering it as synonymous with the use of visual means to viewing it as an interactive teaching method. There is also a significant reevaluation by teachers of the didactic potential of using visualization in the educational process of primary school.

At the same time, the dynamics of implementing/using visualization in the educational process are positive but not as rapid. Primarily it indicates insufficient development of visualization skills among primary school teachers. In particular, around 40% of respondents face difficulties in transforming textual educational information into a visual form. Additionally, we observe limitations and uniformity in the digital resources used in modern pedagogical practices in primary schools. The most commonly used ones are kahoot.com and padlet.com, also teachers often use liveworksheets.com, mindmeister.com, wordart.com and rebus1.com.

Recommendations and Conclusions

Primary school teachers are increasingly shifting their focus towards recognizing the significance of visualizing educational information. This positive trend involves transitioning from merely identifying it within the didactic realm of visual means to acknowledging visualizing educational information as a potent didactic tool. This shift encourages the adoption of interactive teaching and learning methods in primary schools.

There was a notable reconsideration of the didactic possibilities associated with employing visualization in the primary school educational process. The rate at which forms, methods, and means for visualizing information were integrated into primary school education showed the improvement due to the experimental didactic influences. However, the pace of these changes did not adequately align with the demands of contemporary educational standards. It was deduced that there is insufficient progress in the development of primary school teachers' skills in visualizing educational information. There is a pressing need for intensive enhancement in this area.

Therefore, based on the results of the conducted study, we affirm the relevance of emphasizing the aspect of visualizing educational information in the training of future primary school teachers in higher education pedagogical institutions. It is also necessary to focus the attention of the pedagogical community on purposefully forming and developing the relevant skills of primary school teachers, particularly within the framework of their postgraduate education, including professional development courses.

Targeted didactic influences are necessary for the development of digital visualization skills among primary school teachers.

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