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## WDRAŻANIE TEORII WIZUALIZACJI KOGNITYWNEJ W WIELKIEJ BRYTANII I STANACH ZJEDNOCZONYCH: KLUCZOWE OSIĄGNIĘCIA

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**Adnotacja.** W artykule przeanalizowano główne postępy we wdrażaniu teorii wizualizacji poznawczej w instytucjach szkolnictwa wyższego w Wielkiej Brytanii i Stanach Zjednoczonych. W artykule przeanalizowano najbardziej uderzające i znaczące przykłady praktycznego wykorzystania konstrukcji infografiki w instytucjach szkolnictwa wyższego. Przedstawiono krok po kroku plan tworzenia wykresów infograficznych z perspektywy różnych nauczycieli pracujących w instytucjach szkolnictwa wyższego w Wielkiej Brytanii i Stanach Zjednoczonych. Badanie wykazało najbardziej znaczące wyniki wdrożenia infografiki. Stwierdzono, że stopniowo infografika może przenieść studentów na wyższy poziom oceny i kreatywności. Kiedy badanie jest przeprowadzane przez studenta na własną rękę, poziom asymilacji pracy jest wyższy i zachęca ucznia do dzielenia się swoimi doświadczeniami z innymi, a infografika może mu w tym pomóc.

**Słowa kluczowe:** infodesign, infografika, teoria wizualizacji poznawczej, storytelling, podejście poznawczo-wizualne, komunikacja multimedialna, obrazy graficzne, rewizualizacja.

## IMPLEMENTATION OF THE COGNITIVE VISUALIZATION THEORY IN HIGHER EDUCATION INSTITUTIONS OF THE UK AND THE USA: KEY ACHIEVEMENTS

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**Abstract.** The article analyzes key achievements in the implementation of the theory of cognitive visualization in higher education institutions of the UK and the USA. The most outstanding and significant examples of practical use of infographic constructions in higher education institutions are analyzed in the paper. The step-by-step plan of infographic diagrams construction is presented in the article from the point of view of different teachers working at high schools of the UK and the USA. The most substantial results of the infographics implementation are demonstrated in the research. It is concluded that gradually infographics can move students to a higher level of evaluation and creativity. When the research is conducted by the student independently, the level of mastery of the work is higher and it encourages the student to share his experience with others and infographics can help him to do it.

**Key words:** info-design, infographics, theory of cognitive visualization, storytelling, cognitive-visual approach, multimedia communication, graphic representations, re-visualization.

## УПРОВАДЖЕННЯ ТЕОРІЇ КОГНІТИВНОЇ ВІЗУАЛІЗАЦІЇ У ЗВО ВЕЛИКОЇ БРИТАНІЇ ТА США: КЛЮЧОВІ ДОСЯГНЕННЯ

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**Анотація.** У статті проаналізовано основні досягнення в упровадженні теорії когнітивної візуалізації в закладах вищої освіти Великої Британії та США. У статті проаналізовано найбільш яскраві та значущі приклади практичного використання інфографічних конструкцій у закладах вищої освіти. Представлено покроковий план побудови інфографічних діаграм з точки зору різних викладачів, які працюють у ЗВО Великої Британії та США. У дослідженні продемонстровано найбільш суттєві результати впровадження інфографіки. Зроблено висновок, що поступово інфографіка може перевести студентів на вищий рівень оцінки та творчості. Коли дослідження проводиться студентом самостійно, рівень засвоєння роботи вищий і це спонукає студента ділитися своїм досвідом з іншими, а інфографіка може допомогти йому в цьому.

**Ключові слова:** інфодизайн, інфографіка, теорія когнітивної візуалізації, сторітелінг, когнітивно-візуальний підхід, мультимедійна комунікація, графічні зображення, ревізуалізація.

**Introduction.** Infographics as a successful combination of the art, statistics and design has a wide introduction nowadays. Cognitive graphics is increasingly and successfully used for educational purposes. With the help of the basic provisions of the theory of cognitive visualization it is possible to create an educational infographics that attracts attention, stimulates discussions and joint actions, helps to make decisions and draw conclusions, makes complex three-dimensional material on any subject less complicated and more interesting.

The use of infographics in higher education is the most effective due to the experience and relative maturity of the student compared to the schoolchild.

In higher education institutions in the UK and the USA there are many different ways to use infographics at lectures and workshops: educational infographics can be used to introduce the topic of the lesson or a preliminary overview of the main issues of the topic. Cognitive graphics is a perfect tool for information visualization and teaching data visualization concepts.

All the luminaries of infographics were somehow related to the problem of educational infographics, because most of them taught in higher education institutions. Edward Tufte, Professor Emeritus of Princeton University's Woodrow Wilson School developed a course of lectures on statistical graphics, which later became an interconnected chain of seminars that he conducted with a well-known statistician John Toki, considered to be a pioneer in the field of information design. The materials of this course became the basis for the first book by Edward Tufte "Visual display of quantitative information".

One of Tufte's followers W. Fanguy uses infographics for higher students' concentration on the topics. S. Bisso, another Tufte's student, who is now a teacher of San Pedro High School suggests using infographics for comparative characteristics. S. Matrix and J. Hodson have been introducing the Tufte's theory of visual argumentation in higher education institutions for several years. Their works are devoted to improving of multimodal communication skills of every student. D. Laufenberg, the author of the project "Teaching with infographics/A student project model", tries to implement infographics in History and Sociology. B. Vogelsinger uses a humorous approach of infographics in Literature.

**The aim of the article** is to analyze the key achievements in the implementation of the theory of cognitive visualization in higher education institutions of the UK and the USA.

**Results and their discussion.** First and foremost, we can't but mention the core instructions of Professor Tufte concerning the work with infographics in high schools:

1. Use infographics to stimulate the group of students to debate or discuss the material learnt. For example, use a comparative graph to show the two sides of the argument.

2. Encourage students to create their own infographic designs during the lesson. This will not only develop their computer skills but also enhance their critical thinking and creativity.

3. Use infographics as outfits guides. Instead of showing a simple picture use online infographics to show both a picture and useful information at once.

4. Work with interactive infographics that will students the opportunity to make their own adjustments to their infostructures, to answer and ask online questions, to present their point of view to a group of students and see the opinions of others, to correct mistakes.

5. Inspire students to create infographics as homework. One student or a small group of students will work on an infographic project on a specific topic and explain it to other students.

6. Help students to use cognitive visualization in presentations as reporting tools. Infographic presentations can transfer knowledge of a particular topic faster and more efficiently than textual information.

One of the Tufte's followers W. Fanguy believes that the human brain was not designed to sit quietly for hours absorbing tons of monotonous information. He considers that our brain pays attention to sudden drastic changes and simply ignores or passively monitors subtle differences in steady states or gradual changes (Fanguy, 2016).

Teachers are in a constant struggle for a student attention. Visual stories address their attention to the right direction. W. Fanguy that when several images are processed simultaneously, a person process them 60000 times faster than perceives textual information. W. Fanguy recommends the use of infographics to present new material to students. This technique is simple but effective. The process of explaining the material should consist of the following steps:

1. Create your own infographics based on these tips: determine the audience who exactly works with your infographics; do research on the topic you are trying to graphically depict using reliable sources; choose the right color scheme; first focus on the skeleton – the structure of the infographic then fill in the problems using additional information to tell the story; repeat what was said briefly; add the sources used; share the information with the students at the end.

2. Create a context where you should explain why your infographics are important information. Start with exciting words about what your design is and use other materials to complete the lesson (video, links to news, embedded content).

3. Give the student time and opportunity to analyze infographics independently.

4. Disclose the information. The students should be able to draw conclusions and depict them to show their understanding of the material.

S. Bisso who considers herself a follower of Tufte, teaches in San Pedro School. She is constantly looking for innovative methods to improve the learning process of students. S. Bisso suggests using infographics for comparative characteristics. The teacher demonstrates an example of comparison and contrast between the main characteristics

of London and Paris. There are two wonderful mega-cities but each of them has its own personal unique style and culture. It will be boring for students to present these diverse features with the help of a simple list. They will not be able to even mention some of the important points of the topic because they did not pay proper attention to them. But the presentation of London and Paris with beautiful but unsaturated infographics can change the student's attitude to the topic and increase the level of learning (Bisso, 2016).

S. Matrix and J. Hodson have been implementing the theory of visual argumentation in the practice of higher education institutions for several years. They are convinced that infographic tasks inspire students to improve the skills of multimodal communications without the need to repeat the basic compositional material by the teacher (Matrix & Hodson, 2014).

Moreover, infographic tasks serve as a multimodal learning tool that allows each student to apply the key competencies needed to develop digital skills. These teachers believe that the main competencies for infographic tasks are content management and content creation. If the visualization of a topic has a high level of critical content, if it is made taking into account the identification of the audience and the correct construction of messages, students will be able to find themselves in an amazing educational "landscape", where information has no boundaries and all limited reality will be displayed in the classroom.

D. Laufenberg, a part-time lecturer at the Pennsylvania Academy of Scientific Leadership and a teacher of sociology and history at a public school, is the author of the project "Teaching with infographics/A student project model". She admits it is easy to implement infographic projects in a school like hers, because of access to technology. But she spent 11 years working in such high schools, where access to computer technology was limited and this hampered and sometimes made it impossible to teach students effectively (Laufenberg, n.d.).

D. Laufenberg developed visual literacy in history course by analyzing documents from primary sources, photography, pictures and advertisements, interacting with charts, graphs. She constantly asked students to understand the ways the infostructures "speak". Infographics work in class, from D. Laufenberg's point of view, because it can summarize pages and even sections of information that require reading hours to study.

Teaching students to consume infographics is one of the most important tasks of any teacher. Not less important is to show students how to create their own infographic structures in order to understand complex information, to break it into pieces, then to use the symbols and images for attractive and efficient transfer of information. An example of such a task is the creation of infographic structure proposed to the students in the process of studying the history of the USA which should reflect one of the most significant current events – oil spill. Since oil spill news was dynamic and changed very often, the students used infographics of Times to track the spill Oil in the Gulf to check the information every day and keep up with the news.

D. Laufenberg summarizes her experience of mutual practice of creating infographics in high school in such steps:

1. Introduce the topic to the students. (The students began by discussing the infographics posted in the New York Times concerning the topic of their research).

2. Allocate time for the construction of a historical basis of the theme. (The group specifically got acquainted with certain historical sources that reveal the topic of environmental disasters in general and the history of environmental problems in the United States in particular).

3. Focus the research of the whole student group on a certain aspect of the topic being studied. It is difficult for students to reveal the whole topic in general that is why D. Laufenberg divided it into aspects. The first aspect, for example, was to characterize the potential impact of the catastrophe on the fauna living in the gulf. The next aspect could be the impact of the problem discussed on the economic situation for people living in a gulf area, etc.

4. Identify smaller global joint research topics related to the main global topic. (Students formed joint group of three members. They selected one of the 10 environmental disasters to consider in the group).

5. Provide students with time and freedom to conduct research and solve problems of collaboration and its organization. (Students were given 4 periods of 260 minutes to exploration, cooperation and infographic creation. After a year of working at graphic structures they were well versed in the technology of presenting information graphically). But when they were given the task to tell a graphical story with a small text they had to understand which parts of the topic are most important how best to display each piece of information. Sometimes there was not enough material, other times – too much to learn. Students had to choose the clearest facts of the problem. They turned to the gulf oil spill infographic as a reference model for their research to create the infographic structure that would reproduce the basis of the problem under consideration, to present the reaction of the public and government immediately after the incident; to observe the actions of government and citizens for some time.

6. Daily interest in the most important issues of the research topic to anticipate the development of public understanding of the problem, further inquiries and tests. (Students began each lesson by discussing three important issues of the topic).

7. Present the work of a small group to the whole class (after the students have done their research and completed the design of their infographic story it was time to reveal the story. All works were printed on sheets of paper and presented to the audience. The students discussed which of the works were the best and why).

8. Give feedback individually to small groups and the whole group about the positive and negative experience of creating infographics. (The students shared their impressions about the work and the problems encouraged during its implementation. They also found commonalities and differences between their personal theme and the gulf disaster. The students predicted the further behavior of American government, business interest in solving the problem).

9. Review the essential questions and make a final discussion about the variety of students' answers. (The students were given half a lesson to answer the essential questions, to provide specific examples for studying the material).

10. Make predictions and connections with other events in the present or in future, based on the trends and patterns observed in the case study. (Based on the information gathered students had to predict the future path of errors related to the gulf disaster and other environmental disasters) (Laufenberg, n.d.).

B. Vogelsinger, an American teacher from Doylestown, Pennsylvania, uses Holme's graphic humorous approach to reading. At the beginning of his pedagogical career, B. Vogelsinger believed that the way for students to improve their writing skills lies in giving the text more depth, more detail, more complex sentences in making the texts longer. But after the introduction of infographics his previous thoughts melted like snow.

Replacing articles with infographic constructions caused a positive reaction from students. The first thing they understood was saving time on reading infographics compared to reading an article or an essay. Moreover, if this infographic was expressive and had humorous content, the perception improved greatly.

The ultimate goal of B. Vogelsinger was to teach students to create their own infographic constructions. To do this he discussed with his students various examples of modern infographics, trying to answer the questions: "Which infographics are the best and why?", "How does the author interest the audience, even those viewers who were not initially interested?", "Is text or visual accompaniment more important in each of the examples?", "How the use of color form white spots contributes to the ability to focus on the main idea of infographic design?", "How does the font size affect the selection of certain facts?", "Does infographic construction make a presentation or an argument?". The students came to the conclusion that the way you convey information in infographics is not less important than that why you create it and what you are going to show. The second step was to make a sketch and to experiment with a certain topic on the laptop of each of the students using the templates. Next part of the task is an independent work on creating infographics taking into account the type of audience and the best examples of info-gurus. The presence of humorous content and illustrative style are mandatory (Vogelsinger, 2014). G.R. Lamb shares his experience of using infographics in his biology classes in high school. The main goal was to teach students graphic representation to promote infographic literacy in the 21<sup>st</sup> century. G.R. Lamb's students used infographics for visual reading aloud and reflection aloud and making different projects. The teacher projected a scientific infographic on the board and explained how to read information, interpret meaning and understand the hidden content. Re-visualization forces students to reconsider the topic again, to find new perspectives and more deeply reveal the old ones. Author projects for students are the last link in the chain of practical implementation of visualization. It allows students to make their own infographics on a given topic (Weidler-Lewis et al., 2018).

C. Peck, a high school teacher from California, is also involved in infographic projects with her students. Since she teaches literature she considers herself a supporter of this easier and brighter humorous creative approach of Holmes in infographics. Mainly she uses infographics as an alternative way of writing an essay. C. Peck gives the task to read and analyze the story, to make a comparative analysis of the two novels and interpret them graphically, students work in groups to create their own infographic design on a given topic. Most often Peck's students work in the classroom under the guidance of the teacher and after the completion of the work present their infographics and listen to the feedback of classmates (Peck, 2015).

K. Schrock, an American teacher and a sincere follower of N. Holmes also tries to help students to create their infographics step by step. K. Schrock created a course of presentations for teachers and students in which she revealed the nature of infographics, the history of infographic structures, the advantages of using cognitive graphics over other teaching aids.

For the purpose of the author to create infographics, she offers her students a number of steps: 1) choose with students image editor; 2) invite students to explore types of visuals; 3) create a rough example in a notebook; 4) go to a draft on a computer; 5) tell students about creative communities; 6) gather students to create asserts; 7) teach students to use colors; 8) teach students to use fonts correctly; 9) give the idea of the plan – layout of the infographic structure; 10) acquaint students with the organizational model. Infographics from Schrock's point of view should be agreed on the following points: location, time, categories discussed, the audience for which the infographic model is made. Tell the student about the availability of infographics. Accessibility requires that everyone can see all types of disabilities when designing course materials, any design features or technologies must be used correctly, any information should be reliable and accurate, it should have links by which the reader can learn more about the issue that interests him; 11) summarize your creative work; 12) make the work simple and clear; 13) add humorous content if you can and the topic of your research allows you to do it; 14) determine the color scheme; 15) explore interesting facts or some statistics on the chosen topic; 16) be sure that the arguments hold the readers' attention and are convincing; 17) if you have a lot of complex information, simplify it as much as possible; 18) draw conclusions in an accessible humorous form if it's possible; 19) cite sources used; 20) after students complete their work, organize special classes where everyone will be able to show the graphic structure, students will exchange comments and will be able to ask questions, make a comparative description of the work, choose the best examples, draw conclusions, concerning the further visual models.

R. Ribeiro who teaches English to adults, shares his experience with other teachers. His example of practical English lesson with infographics was the lesson on topic "Friendship". The reference to infographics was made in the form of QR-code, so the students could just download it right away and search possible answers.

Infographics provided students with specific links to start a conversation and expand vocabulary during communication. The teacher believes that the use of infographics in practice gave students the opportunity to access the contextual information in more attractive categories; to use their own gadgets more productively; to share devices with students who at the time of their lesson did not have them; to widen the vocabulary on the current topic of conversation, share the material with the students who were absent from class; have the support of the conversational starter, replace the handouts, easily return to any of the electronic examples.

From Ribeiro's point of view the use of infographics increases the motivation to learn, helps to save the time and more deeply reveal the topic of problematic issues. However, if a teacher does not have a wireless internet, the use of infographics is considered to be impossible or problematic (Ribeiro, 2018).

C. Millington, a senior lecturer of Business school at Brighton University at the conference in the UK entitled "The Future of Business School" shares his experience in using infographics as a means of assessing students.

C. Millington thinks that infographics are an effective method of presenting complex ideas clearly and concisely. In other words, it is a method of compressing boring numbers and percentages in a visually attractive way. In the age of information overload, cognitive graphics use the data based on evidence and practice easily readable fonts; complements the data with color schemes, simple charts, tables and diagrams for fast sharing the information, its processing and comprehension. C. Millington identified the types of assessment including traditional portfolio, essay, exams, etc. She offered some classifications on how to mark a graph in a better way using 12 categories. The scientist encouraged her colleagues at the conference to start using infographics to assess the creative potential of students. She created a special training module for business school students, called "Operations and system management", during which students were armed with the necessary information on how to work and develop infographic literacy, students were provided with the basic principles of info-design. C. Millington is sure that introduction of infographics for assessing students in high schools was successful. It gave the opportunity to reduce the time, to make clear conclusions, to better evaluate the work of each student both during the semester and during each day.

D. Russel, a teacher from the UK, insists on the use of video infographics. She believes that infographic structures brightly and humorously decorated, following the examples of Holme's info-design will look more attractive and deeper reveal the topic if they become a part of the video, D. Russel prepared video infographics on the topic "The professions of the future".

D. Russel conducted a research and collected infographics of 20 thousand students from around the world. College students depicted in their diagrams which professions they consider to be the most popular and which they would take in the nearest future. Summarizing the work of the students, D. Russel identified the most popular professions and the difference between the choice of students from different countries. After conducting analytics and the relevant technical processing, the teacher presented the results of the study in an interesting video, in which there was a logical connection between the graphic designs and musical accompaniment was added. Video infographics allowed the teacher to quickly collect and present the work of students from 20 different countries and draw conclusions about the most popular professions of today. D. Russel admits that that the teacher have to master the infographics literacy in order to be modern and meet the needs of contemporary students. The state must provide each teacher with the necessary technical means to achieve the outlined goals. In one of her infographic works, D. Russel writes that the teaching profession requires stability and lifelong commitment to teaching and improving practice. To prepare an infographic video is a long process but it is worth doing (Russel, 2019).

J. Pieratt, a founder and a president of the CraftED organization, involved in the implementation of problem-based learning (California, USA) in her article "Using infographics to drive deeper learning" shares her own experience in the use of infographics in high school. J. Pieratt offers infographics as a means not only of immersing students in the process of learning, but also as a way of publishing its results. Info-design contributes to the development of students' research competences. Infographics can develop the ability to understand the basic principles and relationships in a particular area of knowledge and organize this information into a conceptual field.

Students' research activity consists of the following stages: 1) problem formation; 2) determination of the resources necessary for solving the problem; 3) review of data obtained from these resources; 4) summarizing and formulating conclusions. According to J. Pieratt the use of infographics allows to streamline the research process, it becomes its visual basis or "skeleton". Creating info-designs encourages students to highlight the most important ideas, statistics and the brightest issues and show them in the most interesting and accessible way for the audience. Once the students have formed their findings in the conceptual field, infographics can facilitate students' further immersion in the learning process by identifying visual representations of their ideas.

**Conclusion.** This process requires the ability to analyze information and connect with the context of the real world. So gradually infographics can move students to a higher level of evaluation and creativity. Visual storytelling is considered by many authors, mentioned above, to be significant for the formation of students' ability not only to analyze existing images but also to create their own ones. When the research conducted by the student independently, the level of mastery of the work is higher and it encourages the student to share his experience with others and infographics can help him to do it.

There is no doubt that in today's world of a new society with a visual type of thinking, it is impossible not to understand the relevance of the practical implementation of the theory of cognitive visualization as a way of learning, processing and interaction with information.

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