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Evaluating the Quality and Value Dimensions of Information Graphics: A Comparative Analysis of Existing Models

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Abstract:

Purpose: *The objective of the article is a comparative analysis of existing models for evaluating information graphics in terms of their capabilities and effectiveness in assessing dimensions of quality and value, which have significant importance and influence on the information overload perceived by recipients.*
Design/Methodology/Approach: *The article uses a comparative analysis to analyze and asses selected models for evaluating information graphics from the point of view of information overload, based on the electronic survey (quantitative analysis), the usability testing and heuristic analysis (qualitative analysis) as well as the multi-criteria TOPSIS method.*
Findings: *The results of a comparative analysis of selected models for evaluating information graphics obtained in this study show, on the one hand, that each of the models is characterized by a similar level of effectiveness, which was confirmed in the received rankings. On the other hand, the obtained results for selected and examined information graphics, as visual communication tools, are characterized by a relatively high level of the message quality and value among the recipients. Consequently, this may reduce or even minimize the information overload effect, which is widely present in electronic media, as well as efficient and effective assimilation of information and knowledge contained in the content of the infographics.*
Practical Implications: *The research on the evaluation of the quality level and the value of the influence of infographics provides very important support in the processes of creating and developing information graphics for professional applications within various types of information systems, which may significantly decrease the information overload effect of the conveyed substantive content among recipients through different types of IT systems and visual tools.*
Originality/Value: *The use in this study a combination of various types of quantitative and qualitative methods in research and analysis of selected infographics, infographics evaluation criteria and infographics evaluation models made the obtained results can be considered original, reliable and useful in various fields and applications.*

Keywords: *Infographic, models for evaluating infographics, information quality and value, information overload, effectiveness, visual communication.*

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1. Introduction

In the current times of a developed information society, the media transmission via information systems is most often the main source of information about the world and surrounding phenomena. Unfortunately, as many studies show, despite a very long list of benefits for Internet users, the use of information systems is also associated with many issues, limitations and threats in accessing useful, good quality and therefore valuable information.

These issues are very often related to the insufficient usefulness of the provided information, which in turn is related to the lack or significant limitation of ability to achieve intended goals by recipients, such as making decisions or taking actions based on the obtained information.

The low level of information usefulness is primarily influenced by the inadequacy of the transmitted communication messages to the characteristics and criteria of information quality and value required by the recipients, which causes many phenomena to occur and one of the most common is information overload (Kai *et al.,* 2020; Nowakowski, 2020a).

Information overload, also known as noise, information accumulation or overflow, is a state in which the amount of incoming data at a specific moment in time exceeds the ability of the average person's brain to process it, which leads to difficulties in understanding, decision-making, a general decrease in efficiency, and even information stress.

The ubiquitous information overload is usually associated with new digital technologies such as the websites and social media applications and is one of the most problematic aspects of using information systems and electronic media, which severely limits users' ability to understand the message and make rational decisions based on it (Bawden and Robinson, 2020).

This ubiquitous information smog is a set of problems and phenomena related to a significant excess of information sources, which is a by-product of the dissemination and dispersion of information production, collection, processing and transmission processes, that is processes taking place in the information society (Tadeusiewicz, 1999).

On the one hand, the existing literature on information overload focuses mainly on the cognitive burden resulting from the excess of information while following and searching for it (e.g., browsing and searching for information on the Internet), too many messages to read (e.g., e-mail, social networking sites, etc.), situations of limited resources in terms of time and financial budget (e.g., limited access to resources only for selected users), or redundancy and inconsistency occurring within the available information (e.g., different and contradictory definitions and approaches to the topic depending on the source) (Eppler and Mengis, 2004; Roetzel, 2019; Sevinc and D'Abra, 2010; Swar *et al.,* 2017).

On the other hand, everyday activities related to the use of a computer and access to the Internet often lead to viewing information in larger amounts than it is possible to process, which leads to various forms of addictions and behavioral disorders, which in consequence also cause information overload (Griffiths and Pontes, 2014).

That is why it is so important that the widely available online information resources in the form of data, information and knowledge are properly prepared, designed and implemented in order to meet the highest possible standards of communication quality. These activities, in turn, improve the intelligibility, usefulness, availability and assimilation of information for various types of recipients and, consequently, minimize their information overload.

One of the methods of effectively conveying media messages that have been used for many years in information media systems is the increasingly common use of various graphical forms of data presentation and information visualization using information graphics, also known as infographics.

An infographic is a modern, pictorial and very attractive graphic form of transmitting information and knowledge, the purpose of which is to quickly convey information and tell stories using text content additionally supplemented with images, graphics, illustrations, diagrams or photographs.

Its popularity and applications are growing more and more due to the fact that visual messages are processed by the human brain much faster than text messages, and they can be conveyed in a concise and understandable way to every recipient, regardless of their language, culture or experience (Jennifer, 2014; Nowakowski, 2020b; Nowakowski, 2021; Smiciklas, 2012).

2. Literature Review

Information is a concept that has a very large number of definitions and various interpretations among others due to its original character. Features of information are selected aspects that describe it in more detail and include the following three characteristics: quality, value and usefulness.

The information quality consists of appropriate features that information should have, so that its quality is at a sufficiently high level. The most often desired quality features of information include: timeliness, accuracy, veracity, adequacy, completeness, readability, etc., (Nowakowski, 2020a; Nowakowski, 2020b; Piecuch, 2013).

The information value usually means a certain feature that determines the measure of its suitability, but this feature is also referred to as valuableness, usefulness, importance of information or utility value. In one of the most synthetic approaches presenting the useful information, it is said that this information should have the right content and be delivered at the right time and in the right form (Stefanowicz, 2008).

The information usefulness collected on the website is a number of different criteria that should be characterized by information content that is available, current or understandable to recipients. The evaluation criteria of information usefulness for their suitability for a user may be features such as: accuracy, veracity, timeliness, completeness, reliability, adequacy, form, frequency of use, scope, coherence, source, time horizon, etc., (Nowakowski, 2020a; Nowakowski, 2020b; Nowakowski, 2021).

The term "infographics" is a combination of two words, that is "information" and "graphics" and means the use of the simplest and most effective visual forms of communication in information transmission, that is text, image and attractive and eye-catching graphic design. Infographics by definition are designed to be hand-drawn or electronically created as well as they can be static (printed as a poster or static screen image), animated (animated screen image) or interactive (displayed on a screen with clickable links and other interactive elements) (Aydin *et al.,* 2019).

A typical infographic is a single static digital image presenting a selected thematic issue in a graphic form of any size adapted to the purpose (usually A4 format) and intended to convey data, information and knowledge in a visual form (Scott *et al.,* 2017; Smiciklas, 2012).

The main idea of the infographic message is to narrate a pictorial story and simplify a selected issue through a relatively short, easily assimilative, effective and understandable transfer of data, ideas and information content with a minimum number of words (Vital, 2018). Infographics are usually much more attractive to

read than an example long text and are considered as important tools for transmitting information in various fields and disciplines of science and knowledge (Jennifer, 2014; Lester, 2003; Nowakowski, 2014; Schiphorst *et al.,* 2016; Smiciklas, 2012).

Therefore, they are now widely used for commercial, public and private purposes, especially in online and social media, marketing, press, education, technology, health care and for scientific research and publications in scientific journals (Ashman and Patterson, 2015; Halabi and Brown, 2022; Kos and Sims, 2014; Lamb et al., 2014; McCrorie et al., 2016; Sroka, 2022).

As there is little research on the evaluation of aspects of the quality, value or usefulness of infographics as visual communication tools, the author of the article decided to explore this topic in order to show the importance that infographics have and can have as visual communication tools in various scientific areas and practical applications. The examples of information graphics evaluation models found in the literature on the subject usually focus on assessing their quality and value using a list of specific criteria and generally refer to one of the selected types of infographics: static, animated or interactive.

The first example (hereinafter referred to as "The model number I") of using a comprehensive infographic evaluation model to measure their value is the practical tool called "Short IGV Scale". This short scale is a simple tool to assess the implicit value of an explicit interaction with infographics in daily tasks, where value in use is crucial to measure the situated effectiveness of visual tools. This tool evaluates how infographics improve people's interactions with data and add value to their decisions and uses the following quality dimensions: usefulness, intuitiveness, clarity, informativity and beauty (Locoro *et al.,* 2020).

The second example (hereinafter referred to as "The model number II") of using the model of evaluating infographics to measure their impact on the assessment of the value of information and the recipients' reactions is the use of statistical analysis for results of three different types of interactions: functional, emotional and no interaction.

The purpose of examining this model was to confirm the communication effect of infographics, which have been gaining popularity through increased usage of social media and mobile devices and to verify the influence of design elements on information acceptance.

This tool first takes into account the impact of infographics on the assessment of the value of information in such quality dimensions as entertainment, reliability and informativeness, and then checks the relationship between the assessment of value and the user's reaction in dimensions such as user attitude, cognitive effects and acceptance intentions (Won, 2018). The third example (hereinafter referred to as "The model number III") is using an exploratory model called "Overall quality of an

infographic" to assess the overall quality of static and interactive infographics, based on information, interaction and design quality dimensions.

The purpose of examining this model was to measure whether the quality of infographics affects the perception of information and the users' interaction as well as to check of how people perceive data and get information through the fruition of rich data visualizations using the Visualization Wheel construct. This model is based on the information quality dimensions, such as: intuitivity, elegance, attractiveness, sinteticity, clarity and informativity and also on the interaction dimensions, such as: usability and ease of use (Locoro *et al.,* 2017).

3. Research Methodology

The main research problem of the article is the analysis and verification of the importance of information graphics for recipients in the context of media messages and the related information overload.

Therefore, the main research goal is a comparative analysis of existing models for evaluating information graphics in terms of their capabilities and effectiveness in assessing, represented by information graphics, dimensions of quality and value, which dimensions have significant importance and influence on the information overload perceived by recipients.

The main research goal is complemented by the conducted analysis and evaluation of various types of information graphics using the analyzed models for evaluating information graphics and selected quantitative and qualitative methods in order to determine the criteria that have the greatest impact on minimizing information overload.

The implementation of the research goal was prepared, developed and conducted on a group of selected respondents, using the electronic survey (quantitative analysis) and the results of the activities, behaviors and opinions of respondents carried out using the usability testing additionally combined with the heuristic analysis (qualitative analysis).

The results obtained from the survey were analyzed using the multi-criteria TOPSIS method in order to show the impact of infographics, as a visual communication tools, on the way recipients perceive selected aspects characterizing this tool, such as generally understood quality, value, usefulness, assimilation and methods of presenting information and knowledge.

The evaluation of information graphics in terms of quality and value dimensions was focused mainly on available informational content and various forms of information presentation and visualization, such as: text, text headers, text boxes, images, drawings, graphics and graphic icons.

The object of the evaluation were media messages containing selected information content in the form of 3 different information graphics, for which the scope of the evaluation included a total list of 19 criteria examined, including 10 different criteria.

In order to analyze and evaluate various types of information graphics using the 3 different analyzed models of information graphics evaluation, the criteria were selected and assigned from the study conducted on respondents, which were most similar in meaning and appeared in the same quantitative configurations as the criteria creating and describing existing models.

Symbols of the criteria (*C-I-01*, …, *C-I-05*; *C-II-01*, …, *C-II-06*; *C-III-01*, …, *C-III-08*), a list of individual criteria with names of criteria according to three analyzed models of infographics evaluation (*The model number I*, *The model number II*, *The model number III*) and names of criteria selected and assigned to criteria for models based on the study conducted on respondents are presented in the following Table 1.

Table 1. *The structure of criteria according to analyzed models of infographics evaluation and the criteria assigned to them based on the study conducted on respondents*

Symbols of criteria	Names of criteria according to analyzed models of infographics evaluation	Names of criteria selected and assigned to criteria for models based on the study conducted on respondents
	The model number I	
C-I-01	Usefulness	The usefulness of the entire content of the infographic in the future
C-I-02	Intuitiveness	The information assimilation of textual and graphic content in the infographic
C-I-03	Clarity	The substantive quality of textual and graphic content in the infographic
C-I-04	Informativity	The message intelligibility of textual and graphic content in the infographic
C-I-05	Beauty	The quality of the information presentation forms for textual and graphic content in the infographic
	The model number II	
C-II-01	Entertainment	The message attractiveness of textual and graphic content in the infographic
C-II-02	Reliability	The occurrence of various errors and shortcomings within the infographic
C-II-03	Informativeness	The message intelligibility of textual and graphic content in the infographic
C-II-04	User attitude	Feelings/emotions evoked by the infographic and the contained content
C-II-05	Cognitive effects	The information assimilation of textual and graphic content in the infographic

C-II-06	Acceptance intentions	The usefulness of the entire content of the infographic in the future
	The model number III	
C-III-01	Sinteticity	The justification of the data contained in the infographic
C-III-02	Clarity	The substantive quality of textual and graphic content in the infographic
C-III-03	Informativity	The message intelligibility of textual and graphic content in the infographic
C-III-04	Intuitivity	The information assimilation of textual and graphic content in the infographic
C-III-05	Elegance	The quality of the information presentation forms for textual and graphic content in the infographic
C-III-06	Attractiveness	The message attractiveness of textual and graphic content in the infographic
C-III-07	Usability	The usefulness of the entire content of the infographic in the future
C-III-08	Ease of use	The justification of the total image size of the infographic

Source: *Author's study.*

The research entity survey conducted in 2022 was 34-persons group of respondents, which was selected for the study by the targeted selection method and represented people with secondary education and higher education. The sample size was considered as statistically representative due to the specificity of the studies related to the presentation of different information forms in electronic version, as in the case of the website's and infographic's usability evaluation.

Most of respondents were students from some form of high school (68%) and a smaller fraction graduated higher education (32%). The vast majority of the respondents were citizens of Polish nationality (91%), and the others (9%) were citizens of other countries. Among the respondents, the majority were men (71%), and the remainder of women (29%).

The research object were three different Polish-language information graphics with the possibility of content reading and browsing as well as knowledge expanding. To the study there were selected the infographics with informative and practical character based on the following aspects: different types and perspectives of information graphics, various dominant functions of infographics, different selected topics and content, various layouts and compositions, different sizes of infographics vertically, various forms of information presentation in the information graphics, the time needed to read and browse textual and graphic content, and the length of the infographic's total content counted in the number of screens to scroll.

The common characteristics of all selected infographics were the following elements: independence from the medium of presentation and accompanying

content, presentation and browsing of information entirely in the form of static content, portrait orientation, using a palette of different colors, and downloading the analyzed infographics from publicly available Internet sources.

The research thematic scope there was a group of three multi-thematic information graphics, which individually formed one textual and graphic message. To the study there were selected the following infographics in terms of characteristics such as: title, topic, form, perspective and function.

The Infographic number 1 (hereinafter referred to as "*IG-1*"): the title: "The roe deer is not 'the wife' of the deer"; the topic: "The comparison of species and environmental habits of deers and roe deers"; the height as number of screens: 1; the form: color comparative images; the perspective: comparative; the function: informative and education.

The Infographic number 2 (hereinafter referred to as "*IG-2*"): the title: "Differences between a man and a woman invisible to the eye"; the topic: "Intellect and personality traits, senses and strengths"; the height as number of screens: 4; the form: color comparative table; the perspective: comparative; the function: informative and entertainment.

The Infographic number 3 (hereinafter referred to as "*IG-3*"): the title: "New rules for waste segregation from 2019"; the topic: "A description of the category of waste and waste segregation, a description of the principles of waste segregation and a list of waste of a specific category"; the height as number of screens: 6; the form: collection of iconographies with description; the perspective: process; the function: informative and utility.

The multi-criteria TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) is one of the popular methods of MCDM/MCDA (Multiple-Criteria Decision Making/Multiple-Criteria Decision Analysis) used to solve real and multi-criteria decision problems.

The main goal of the TOPSIS method is to indicate the best alternative to choose from several decision variants, which at the same time has the shortest distance from a positive ideal solution and the furthest distance from a negative ideal solution. A positive ideal solution is a solution, that tries to maximize profit criteria and minimize cost criteria, while a negative ideal solution is exactly the opposite of the previous one (Behzadian *et al.,* 2012; Wang *et al.,* 2007; Yoon and Hwang, 1985).

The procedure for the TOPSIS method is similar to other multi-criteria methods and consists of the following steps performed in a specific order (Hwang and Yoon, 1981; Trzaskalik, 2014).

1. Determining the decision matrix: $X = (x_{ij})$.

2. Calculation of the normalized decision matrix: $R = (r_{ij})$.
3. Calculation of the standardized decision matrix taking into account the weights of individual criteria: $V = (v_{ij})$, where $v_{ij} = r_{ij} * w_j$.
4. Determining the ideal solution: $A^+ = (v_1^+, v_2^+, \ldots, v_n^+) = (\max v_{i1}, \max v_{i2}, \ldots, \max v_{in})$ and the anti-ideal solution: $A^- = (v_1^-, v_2^-, \ldots, v_n^-) = (\min v_{i1}, \min v_{i2}, \ldots, \min v_{in})$.
5. Calculation of the distance for each of the considered alternatives from the ideal solution: $d_i^+ = \text{sum}_{j=1}^{n} d(v_{ij}, v_j^+)$ and the anti-ideal solution: $d_i^- = \text{sum}_{j=1}^{n} d(v_{ij}, v_j^-)$.
6. Calculation of the relative proximity of each of the alternatives to the ideal solution: $RC_i = d_i^- / (d_i^+ + d_i^-)$.
7. Sorting alternatives in order from the largest to the smallest relative proximity to the ideal solution, and then selecting a specific number of the most favorable ones.

The interpretation of the results obtained in the procedure for the TOPSIS method consists in determining the individual values of the relative proximity of each of the alternatives to the ideal solution, and then selecting the highest obtained value as the optimal solution. In case of the solution is to be more than one decision variant, it is necessary to consider the alternatives, which obtained the highest values of relative proximity to the ideal solution.

4. Research Results and Discussion

The research procedure applied in the article consisted of the following stages:

1) selection of 3 different and representative infographics as the object of the study and defining the list of 19 criteria for evaluating infographics,
2) creation of the electronic survey, selection the group of respondents as the entity of the survey, conducting the survey on respondents for selected infographics and collecting data using the usability testing and the heuristic analysis,
3) data analysis and determining the ranking of infographics as decision variants and dimensions of quality and value as decision criteria using the multi-criteria TOPSIS method,
4) drawing out conclusions from the performed data analysis and final interpretation of the obtained results.

In order to collect data from respondents, electronic survey was created using free of charge *Google Forms* online survey system (Google Forms website). Survey study was based on browsing and reading the information content of selected information graphics and then evaluating the selected criteria, which were presented using internet browser application.

All of the criteria were evaluated by respondents on a slightly extended Likert scale

for values from 0 (lack or lowest rating) to 5 (highest rating), based on the level of satisfaction and usability fulfilment of specific qualitative, value, usefulness, impression and cognitive criteria for content on selected infographics (Likert, 1932).

Then, data analysis was performed for the selected main research problem. For this purpose, three structures of criteria were built, the first for the criteria assigned to the model number I, the second for the criteria assigned to the model number II and the third for the criteria assigned to the model number III, which contained a list of individual criteria and the resulting values for them.

The analysis of data obtained in the study for individual criteria consisted in calculating the arithmetic mean value for individual criteria, and then normalizing the data thus obtained. Similar mathematical operations were performed in relation to the weight values for individual criteria, which were obtained from respondents during the initial part of the survey.

The resulting values obtained in this way for individual weights and criteria were analyzed using the multi-criteria TOPSIS method. The final result of the data analysis was two rankings: ranking of infographics (based on the results obtained for the TOPSIS method) and ranking of criteria for infographics within the selected models (based on the average values obtained from the results for individual infographics).

The next step was the presentation of the results of the data analysis carried out for the selected main research problem and research goals. Symbols of the criteria (*C-I-01*, …, *C-I-05*; *C-II-01*, …, *C-II-06*; *C-III-01*, …, *C-III-08*), a list of individual criteria with names of criteria sorted from the best to the worst rated for three analyzed models of infographics evaluation (*The model number I*, *The model number II*, *The model number III*), the ranking of infographics for each of the models, obtained weight values for these criteria and values obtained from the survey after the data analysis using the multi-criteria TOPSIS method for three analyzed information graphics (*IG-1*, *IG-2*, *IG-3*) are presented in the following Table 2.

The interpretation of the data obtained in the study was carried out in order to draw conclusions regarding the main research problem, that is verification of the importance of information graphics for recipients in the context of media messages and the related information overload.

Therefore, the main and secondary research goals were defined, which aimed to interpret the obtained results in terms of three different areas, the impact of infographics on information overload, such as:

- the comparative analysis of 3 information graphics selected for the study,
- the comparative analysis of 19 criteria of information graphics evaluation

selected for the study,

- the comparative analysis of 3 models of information graphics evaluation selected for the study.

Table 2. *The ranking of infographics and criteria for each of the models and obtained results from the survey after the data analysis using the multi-criteria TOPSIS method*

Symbols of criteria	**Names of criteria**	**Weights of criteria**	**Data from survey study**			**Ranking of criteria**
			Thematic infographics			
	Evaluation criteria of infographics according to the analyzed models for value and quality dimensions		**IG-1**	**IG-2**	**IG-3**	
	The model number I					
C-I-04	The message intelligibility of textual and graphic content in the infographic	0.2203	0.13	0.12	0.13	**1**
C-I-03	The substantive quality of textual and graphic content in the infographic	0.1986	0.11	0.11	0.12	**2**
C-I-05	The quality of the information presentation forms for textual and graphic content in the infographic	0.1957	0.11	0.11	0.12	**3**
C-I-02	The information assimilation of textual and graphic content in the infographic	0.1957	0.12	0.11	0.11	**4**
C-I-01	The usefulness of the entire content of the infographic in the future	0.1899	0.10	0.10	0.12	**5**
	The total for all and relative proximity of each of the infographics to the ideal solution	**1.1247 (113%)**	**0.2469 (25%)**	**0.1185 (12%)**	**0.7593 (76%)**	
	The ranking of infographics for the model number I		**2**	**3**	**1**	
	The model number II					
C-II-03	The message intelligibility of textual and graphic content in the infographic	0.1856	0.11	0.10	0.11	**1**
C-II-01	The message attractiveness of textual and graphic content in the infographic	0.1832	0.10	0.11	0.11	**2**
C-II-05	The information assimilation of textual and graphic content in the infographic	0.1648	0.10	0.09	0.09	**3**
C-II-06	The usefulness of the entire content of the infographic in the future	0.1600	0.08	0.09	0.11	**4**
C-II-02	The occurrence of various errors and shortcomings within the infographic	0.1587	0.09	0.09	0.09	**5**
C-II-04	Feelings/emotions evoked by the infographic and the contained content	0.1477	0.09	0.09	0.08	**6**
	The total for all and relative proximity of each of the infographics to the ideal solution	**1.3131 (131%)**	**0.3634 (36%)**	**0.2483 (25%)**	**0.7014 (70%)**	
	The ranking of infographics for the model number II		**2**	**3**	**1**	

	The model number III					
C-III-03	The message intelligibility of textual and graphic content in the infographic	0.1398	0.08	0.08	0.08	**1**
C-III-06	The message attractiveness of textual and graphic content in the infographic	0.1380	0.08	0.08	0.08	**2**
C-III-02	The substantive quality of textual and graphic content in the infographic	0.1260	0.07	0.07	0.08	**3**
C-III-05	The quality of the information presentation forms for textual and graphic content in the infographic	0.1242	0.07	0.07	0.07	**4**
C-III-04	The information assimilation of textual and graphic content in the infographic	0.1242	0.08	0.07	0.07	**5**
C-III-01	The justification of the data contained in the infographic	0.1224	0.07	0.06	0.07	**6**
C-III-07	The usefulness of the entire content of the infographic in the future	0.1205	0.06	0.07	0.08	**7**
C-III-08	The justification of the total image size of the infographic	0.1049	0.07	0.05	0.06	**8**
	The total for all and relative proximity of each of the infographics to the ideal solution	**1.2916 (129%)**	**0.5529 (55%)**	**0.0928 (9%)**	**0.6459 (65%)**	
	The ranking of infographics for the model number III		**2**	**3**	**1**	

Source: *Author's calculations.*

The conducted comparative analysis of 3 different types of information graphics selected for the study was aimed at determining the degree of effectiveness of specific types of information graphics in the context of determining the impact of these types and characteristics related to them on minimizing information overload perceived by recipients.

This analysis consisted in conducting the research procedure and creating three separate rankings for three models selected for the study from among all three types of examined information graphics. As the data analysis shows, the individual rankings for each of the three analyzed models are identical in terms of the order of rating infographics from the highest to the lowest rated by respondents. The first place in the ranking for each of the analyzed models was obtained by The Infographic number 3 (*IG-3*) with the average value obtained within all models at the level of 70.33%.

This infographic was characterized by the highest height, among the evaluated infographics, equal to 6 screens, presented substantive content in the form of a set of iconographies with description, in the process perspective and performed informative and utility functions. The second place in the ranking for each of the analyzed models was obtained by The Infographic number 1 (*IG-1*) with the average value obtained within all models at the level of 38.66%.

This infographic was characterized by the lowest height, among the evaluated

infographics, equal to 1 screen, presented substantive content in the form of some color comparative images, in the comparative perspective and performed informative and education functions. The third place in the ranking for each of the analyzed models was obtained by The Infographic number 2 (*IG-2*) with the average value obtained within all models at the level of 15.33%.

This infographic was characterized by the average height, among the evaluated infographics, equal to 4 screens, presented substantive content in the form of a color comparative table, in the comparative perspective and performed informative and entertainment functions. As can be seen in the obtained results, there is a very large discrepancy in the ratings of each infographic within the individual models in terms of the assessed dimensions of quality and value.

As it results from the conducted comparative analysis, the infographic with the highest quality and value dimensions as well as related to this the lowest possible level of information overload turned out to be the infographic (*IG-3*) with a relatively large image size, presenting substantive content in the form of text descriptions and graphic icons in an exhaustive manner, the content of which also turned out to be very interesting for the recipients.

In turn, the infographic with the lowest quality and value dimensions as well as related to this the highest level of information overload turned out to be the infographic (*IG-2*) with a medium image size, presenting substantive content in the form of a comparative table in a way that was not very attractive and understandable, the content of which turned out to be much less interesting for the recipients.

The conducted comparative analysis of 19 criteria of information graphics evaluation selected for the study was aimed at determining the degree of significance of the assessed dimensions of quality and value in the context of determining the impact of these criteria on minimizing information overload perceived by recipients.

This analysis consisted in conducting the research procedure and creating three separate rankings for three models selected for the study from among all nineteen examined criteria.

According to the data analysis, the criteria rated highest by respondents included the following dimensions: „The message intelligibility of textual and graphic content in the infographic" (the 1-st place in three rankings for: *The model number I*, *The model number II* and *The model number III*), „The message attractiveness of textual and graphic content in the infographic" (the 2-nd place in two rankings for: *The model number II* and *The model number III*), „The substantive quality of textual and graphic content in the infographic" (the 2-nd place for *The model number I* and the 3-rd place for *The model number III*) and „The quality of the information presentation forms for textual and graphic content in the infographic" (the 3-rd place for *The model number I* and the 4-th place for *The model number III*). As can be

seen, all of these criteria are very closely related to the aspects of quality, comprehensibility and presentation methods of the substantive content provided within infographics, which at the same time means the lowest possible level of information overload in the case of all of the analyzed information graphics.

The conducted comparative analysis of 3 models of information graphics evaluation selected for the study was aimed at determining the degree of capability and effectiveness of models for assessing dimensions of quality and value in the context of information overload perceived by recipients.

This analysis consisted in conducting the research procedure and using the results obtained from the created rankings for the examined information graphics and the criteria related to them. As the data analysis shows, the individual rankings of information graphics for each of the three analyzed models are identical in terms of the order of infographics evaluation from the highest to the lowest, which means high effectiveness and comparability of each model.

Moreover, each of the models of information graphics evaluation selected for the study proved to be effective enough in assessing the quality and value dimensions of the infographics selected for the study, regardless of the different number of criteria used within the various models. The highest total score in the study for the relative proximity of each of the infographics to the ideal solution was obtained by The model number II with a result of 131%, which was composed of 6 criteria.

The second best model, with a slightly lower total score of the relative proximity of each of the infographics to the ideal solution, was The model number III with a score of 129%, which was composed of 8 criteria. The last in the ranking, with the total score of the relative proximity of each of the infographics to the ideal solution at a much lower level, turned out to be The model number I with a score of 113%, which was composed of 5 criteria.

It follows that the most effective model for evaluating the dimensions of quality and value of information graphics turned out to be The model number II, which used the optimal structure and number of 6 criteria for the assessment and which turned out to be sufficient to obtain the highest level of effectiveness in comparison to other models and thanks to which this model enabled minimizing the level of information overload.

5. Conclusions and Proposals

The main research goal of the article was a comparative analysis of existing models for evaluating information graphics in terms of their capabilities and effectiveness in assessing dimensions of quality and value, which have significant importance and influence on the information overload perceived by recipients. The additional research goal was the analysis and evaluation of various types of information

graphics using the analyzed models for evaluating information graphics and selected quantitative and qualitative methods in order to determine the criteria that have the greatest impact on minimizing information overload.

The research described in the article concerned selected information graphics as visual communication tools and was conducted on a group of 34 respondents, using the electronic survey (quantitative analysis) as well as the usability testing and heuristic analysis (qualitative analysis).

The results obtained from the survey were analyzed using the multi-criteria TOPSIS method in order to show the impact of infographics on the way recipients perceive selected aspects characterizing this tool, such as generally understood quality, value, usefulness, assimilation and methods of presenting information and knowledge.

For the purposes of the research, media messages containing selected information content were analyzed and evaluated in the form of 3 different information graphics using 3 existing models for evaluating information graphics, which the scope included a total of 19 criteria. The final result of the study was the data analysis and the rankings created on this basis for the examined information graphics, information graphics evaluation criteria and information graphics evaluation models.

Thanks to the full implementation of the intended goals, it was possible to demonstrate that the selected to the study and evaluated infographics as visual communication tools, were characterized by a relatively high level of the message quality and value among the recipients.

As a consequence, this may result in reducing or even minimizing the information overload effect, which is widely present in electronic media as well as efficient and effective assimilation of information and knowledge contained in the content of the infographics.

The various types of information graphics selected for the study, in terms of the attractive topics to the respondents, ways of content communication, performed functions or used graphic layouts and compositions, made the research results current, interesting and practical in use. Moreover, the application of a combination of various types of quantitative and qualitative methods in research and analysis made the obtained results can be regarded as credible, realistic and useful in different areas and applications.

The research presented in the article makes a significant contribution to the existing literature on the subject, both from a methodological and methodical perspective, as there are few studies evaluating the quality and value of media messages in the form of infographics using various models of information graphics evaluation, qualitative criteria and the multi-criteria methods.

This is therefore one of the first studies on the analysis and evaluation of the quality and value of infographics, as visual communication tools used in electronic media, using a combination of various types of quantitative and qualitative methods in the research process and data analysis.

Therefore, the article fills the research gap in the discussion on possibility of evaluating the quality and value of the influence of infographics on recipients and the impact of various types of infographics on their effectiveness, using the multi-criteria TOPSIS method instead of using only statistical methods for these purposes, as is usually practiced.

In conclusion, it can be clearly stated that research on the evaluation of the quality level and the value of the influence of infographics provides very important support in the processes of creating and developing information graphics for professional applications within various types of information systems, which may significantly decrease the information overload effect of the conveyed substantive content among recipients through IT systems and visual tools.

Therefore, further research should be conducted on the evaluation of the quality and value of substantive content provided by information graphics, towards creating and implementing further effective models for their assessment, using various data analysis methods, expanding the list of assessed criteria that have a significant impact on minimizing information overload or looking for ways to accurately calculate the information overload effect for various forms of media messages (Nowakowski, 2021; Nowakowski and Porębski, 2022).

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