Infographics for Educational Purposes: Their Structure, Properties and Reader Approaches

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ABSTRACT
Infographics are one of the new educational environments used to provide information to their readers in a visual way. Infographics are designed to provide information to their readers using various visuals such as texts, pictures, drawings, diagrams, graphs, etc. The use of infographics becomes increasingly widespread both in advertising activities of commercial organizations and educational environments. In this study, the views of those, who used infographics for educational purposes, towards educational effects of infographics are analyzed in addition to educational material, type of infographics, structure and use of infographics preferences. The participants of the study consist of students of Ataturk University, Kazim Karabekir Education Faculty. The study was conducted with a total of 64 participants including 37 female and 27 male students. All participants have the experience of reading infographics. According to the results of the study, participants find infographics instructive and prefer to use them in basic learning processes. In addition, infographics are considered as one of the basic instructional materials and it has been thought that these materials make learning more permanent.

Keywords: Information graphics, infographics, infographics' user preferences

INTRODUCTION

In the learning process, learning activities enabling transfer of the information in various educational environments and teaching materials used in these environments play an important role. Technological developments resulted in changes in the learning environments, formation of new environments and supporting learning processes through various means. The learning activities previously conducted in the classrooms have exceeded the walls of the classroom with technological advancements and moved to different learning environments. Learning environments generated by technology have enabled the realization of learning activities via the internet and computer. In this process, new learning activities compatible with the newly formed learning environments have emerged or existing activities changed their forms.

Technological developments have changed the use of web-based environments and the understanding towards sharing through these environments. In particular, Web 2.0 technologies and the changes in content development approaches enabled users to produce and web contents (Karaman, Yildirim and Kaban, 2008). Thus, users of web-based environments have also gained the identity of the person producing the data in these environments (Atici and Yildirim, 2010). Including web technologies and new environments in the learning process has contributed learning process to exceed the walls of classroom and to be conducted in different environments. This change has shown itself in the materials used for teaching purposes.

Materials used for educational purposes have different properties and various forms from special education software containing multi-media elements to an image showing a situation. In this way, information can be transferred to learners through different ways and alternative methods of presentation. Visuals are one of the most important forms of presenting information. Visuals allow a situation to be displayed and the information to be presented in an organized manner using visual components (Yildirim, Yildirim, Celik and Aydin, 2014). It is very important to visualize information, to use visuals in teaching environments and to make selections between different visuals presenting the same information. In this selection process, there are different dimensions such as properties of the information to be transferred, the intended use and learner preferences (Fleming and Levie, 1993).

Graphics are one of the visuals used for presentation of the information. Graphics allow performing comparisons between the information given and make it possible to present the information in a more visual way. In this way, information that can be presented on many pages can be transferred in an easy way. In general, graphs are used to visualize the specific information. However, today's learning approach reveals a more effective presentation of one-dimensional information presented by the classical graphs. These new materials defined as infographics provides the information to fit within a certain flow of scope (Krum, 2013). In this way, too much information can be presented with very little explanation. Infographics can be defined as presenting information within a certain flow with the help of various visuals and texts in a visual form. Infographics can contain many components such as pictures, graphs, charts, flow diagrams and texts (Krum, 2013). Information is presented in a logical sequence through its setup. They emerge as an alternative structure with these features to the texts giving information about a topic. Infographics, which contain many components used to visualize the information and allow information to be presented in different visual forms, have taken its place between the new trends of contemporary learning approaches (Williams, 2002). Well prepared infographics make it possible to present the information in an organized way. The strongest aspects of infographics can be listed as follows: Their flexible structure; allowing information to be visualized and they can be prepared in alternative forms (Schroeder, 2004). In addition, some components such as video and audio files can be used in the preparation of infographics.

Although infographics are so new among educational materials, in fact the components used to prepare them are not that new. While preparing an infographic, many components such as images, drawings, figures, symbols, graphics and texts are used either separately or together for the presentation of information. In this respect, the innovation brought by infographics is the use of visual components in the presentation of information and the way of building the content (Dick, 2013). Even though it is possible to create infographics by using popular image processing programs (Photoshop, Picasa, etc.), there are also software especially developed to create infographics (SmartDraw etc.). However, there are web sites, in which infographics can be created easily and quickly by using ready-made templates and tools (infogr.am, visual.ly, piktochart etc.). Thanks to these environments, the time spent on visual design is reduced and those, who prepare the educational content, spend more time to configure the information. Information should be well-organized and it should be easily remembered and can be compared with a proper flow in order to prepare and effective infographic (Lankow, Ritchie, Crooks, 2012). In this way, infographics providing the necessary information with a clear structure can be prepared.

Infographics can be used to serve different educational purposes. Since comprehensive information can be presented through infographics, they can be used for different purposes such as showing the relationship between different concepts, transferring processes and events, presentation of the content of the course and summarizing the subjects learnt (Meeusah and Tangkijviwat, 2013).

It is possible to prepare infographics in different ways. They can be classified as interactive, semi-interactive and non-interactive depending on the multimedia components they contain (Lankow, Ritchie, Crooks, 2012). Non-interactive infographics contain fixed text and visual components (Lankow, Ritchie, Crooks, 2012). In such infographics, the information is limited to the content presented. In addition, such infographics can be used by having print outs. Interactive infographics make it possible to use the information in the same or different media sources in addition to the features of the non-interactive infographics (Lankow, Ritchie, Crooks, 2012). For example, a relevant video, audio or animation relevant to the content can be used in these infographics. In addition, some other infographics allow their users to make selection and reach the information based on their selections are also in this group of infographics. This feature will enable the information to be presented as a whole and components to be used to meet the need for additional information.

The use of visual design principles can be say easily to be ensuring the striking of infographics. In order to create infographics not only is an effective approach for presenting information needed but also is visual design. Therefore, it is important to find, analyze and use the relevant information to create infographics. It is also very important to activate instructional design models while preparing infographics. According to Davis and Quinn (2013), the points that should be considered when attempting to create good infographics are listed as follows:

- Identification of the purpose,
- Decide on the components that can be used in infographics,
- Determination of the type of infographic to be created,
- Presenting the information in a way that allows learners to understand the subject.

Infographics created for educational purposes allow information to be presented within a particular context. Davis and Quinn (2013) argued that good infographics are useful in supporting the development of students. In addition, infographics are considered to be an effective communication tool for communication with the information (Smiciklas, 2012). The instructional effects of visuals are on the upper level when they are prepared according to the scheme of learners (Fleming and Levie, 1993). Similarly, learning with infographics may allow learners to understand the information in an organized way and form the basis for schemes needed to be created in the minds of individuals. The preparation process of infographics includes the steps such as using the existing information, learning new information and presenting the information in an organized way. Therefore, creating infographics may help students to improve their critical thinking, analysis and making synthesis skills in addition to creating instructional design skills (Mol, 2011; Hart, 2013).

Today, infographics have become environments that are widely used to present a variety of information. There are a few studies outlining the understanding of users towards infographics that have become more attractive by visual design principles and have a wide audience. Determining the status of use of infographics is very important for revealing the reader preferences, using these tools in the educational environments and formation of the design approach. Under the light of this importance, the aim of this study is presenting the views of learners reading infographics for educational purposes and status of information graphics within their learning preferences. For this purpose, the following questions are tried to be answered:

1. What are the views of the participants for impact of infographics on their learning?
2. What are the views of the participants regarding their infographics preferences for reading?
3. What are the views of the participants for sharing infographics with others?
4. What are the views of the participants regarding presentation of basic information by infographics?
5. What are the views of the participants regarding permanence/remembrance level of the information obtained by infographics?
6. What is the place of infographics in the learning processes of participants?
7. In what order participants prefer using infographics among all instructional materials?
8. In what order participants chose types of infographics?
9. What are the preferences of participants towards layout of infographics?
10. Which infographic structure participants like the most?

11. What are the factors affecting the educational power of infographics according to participants?
12. What are the views of the participants regarding the reasons of creating infographics?
13. What are the characteristics of a good infographic according to participants?
14. What are the differentiated situations of the participants regarding infographics depending on their genders?

METHOD

In this study, it has been aimed to present the views of learners reading infographics for educational purposes and the place of infographics among learning preferences.

Population/Sample

The population of this study consists of a total of 64 students composed of sophomore (17 female, 15 male) and junior (20 female, 12 male) students of the Department of Computer Education and Instructional Technology, Ataturk University, Kazim Karabekir Education Faculty. Participants' age ranged from 19 to 27. The study was conducted during the fall semester of the 2014-2015 academic year. All participants had infographic reading skills. Since the participants were studying computer and instructional technologies, they were considered to have sufficient computer skills. In the study, the appropriate sampling strategy was used.

Limitations of the Study

This study is limited with Department of Computer Education and Instructional Technology' students. Furthermore, the study is limited with students with high level of computer literacy learners.

Research Model

In this study, one of the quantitative research designs; the instant case study design was used. In this design, measurements are conducted after the administration to a single group is done (Creswell, 2014). In the study, a 20-week program was carried out including introduction of infographics to the participants, using them in learning activities and placing these infographics among their learning preferences. All participants were informed about types and features of infographics as well as ways of achieving them and their design processes. Then, the participants were given some learning tasks during 20-week training program and asked to prepare verbal and non-verbal presentations. Each student has prepared five presentations. They were set free in terms of reviewing the literature. The preferences of the participants regarding infographics were collected through a questionnaire.

Data Collection Tools

Infographic Reader Survey, which was developed by the researcher, was used as the data collection tool. Data collection tool is composed of 3 parts. The first part consists of 4 questions collects the demographics of the participants. The aim of the second part, which consists of a total of 23 5-points Likert type questions, is collecting the views of participants regarding infographics. The infographic reader survey developed by Yildirim, Yildirim and Celik (2015) was used in the second part. The reliability coefficient of this part containing 6 factors is 0.837. The factors of the survey are as follows: Informativeness, Selection Preferences, Sharing, Basic Presentation Structure, Retention-Memorability, Role in Learning Process (reliability coefficients of these factors are 863, .749, .750, .754, .679 and .678, respectively). In the last part of the survey, there were six questions asking participants to list their preferences towards infographics and other instructional materials.

Collection and Analysis of Data

Data was collected from sophomore and junior students of Ataturk University, Kazim Karabekir Education Faculty, Department of Computer Education and Instructional Technology in the fall semester of the 2014-2015 academic year. Surveys were printed and handed out to the participants. The data was analyzed by SPSS 18 package program. Percentage and t-test, which are descriptive statistical methods, were used to analyze the data. In the descriptive evaluations, the categorization of (1.00 - 1.80: I Strongly Disagree, 1.81 - 2.60: I Disagree, 2.61 - 3.40 I Rarely Agree, 3.41 - 4.20: I Agree and 4.21 - 5.00: I Strongly Agree) was used.

The participants were asked to state their views on various features of infographics and on various design components, ranking their order of importance based on their own preferences. The number of rankings was equal to the number of views solicited. For example, in a list in which 6 different views were presented, the first one received 6 points, and the forth view received 2 points. In this way, the actual score was calculated by taking the average of total ranking scores. Participants' preferences were determined based on their ranking of actual scores.

FINDINGS

In this study, the views of infographics users were discussed. The age of participants ranged from 19 to 27. A total of 64 participants including 37 females and 27 males were included in the study. Computer and literacy levels of all participants were high. The findings were organized in accordance with the questions asked with the scope of the study.

1. What are the views of the participants for impact of infographics on their learning?

The views of the participants for impact of infographics on their learning are given in Table 1.

Table 1. The Views of the Participants for Informativeness of Infographics

Q	Statement	Male			Female			General		
		N	$\bar{X}$	Std.	N	$\bar{X}$	Std.	N	$\bar{X}$	Std.
1	Visual representations used in infographics facilitate learning.	27	4.30	.775	37	4.59	.551	64	4.47	.666
2	I think infographics are more instructive compared to long texts.	27	4.26	.903	37	4.49	.651	64	4.39	.769
3	In infographics, presentation of information within a context facilitates learning.	27	4.07	.385	37	4.38	.639	64	4.25	.563

As shown in Table 1, participants think whether infographics had an impact of on their learning. They stated that since information is presented within a scope ($\bar{X}$=4.25) and visuals are used, infographics better facilitate their learning compared to plain text documents ($\bar{X}$=4.39). In addition, while the female participants strongly agreed that infographics provided within a scope facilitated their learning, the male participants agreed on this.

2. What are the views of the participants regarding their infographics preferences for reading?

Participants paid attention to certain points while selecting infographics, whether they provide similar or different information, to read. Participants' views on infographics preferences were determined by 5 questionnaire items. Their infographics preferences for reading are given in Table 2.

Table 1. The Views of Participants Regarding Their Infographics Selection Preferences

Q	Statement	Male			Female			General		
		N	$\bar{X}$	Std.	N	$\bar{X}$	Std.	N	$\bar{X}$	Std.
4	I look at the title of the subject when choosing an infographic to read.	27	4.15	.770	37	4.22	.821	64	4.19	.794
5	I look at the visuals used in the content when choosing an infographic to read.	27	4.19	.681	37	4.11	.966	64	4.14	.852
6	I look at the content when choosing an infographic to read.	27	4.15	.770	37	4.08	1.064	64	4.11	.945
7	I look at the person or organization that prepared it when choosing an infographic to read.	27	3.85	.818	37	3.97	.897	64	3.92	.860
8	I prefer that it has social media sharing tools when choosing an infographic to read.	27	3.78	.974	37	4.00	1.106	64	3.91	1.050

As it can be seen in Table 2, the most important criterion while choosing infographics to read is title of the infographic ($\bar{X}$=4.19). The other two criteria are the visuals and content of infographics. The least important criteria paid attention are information of those prepared the infographic and social media sharing links ($\bar{X}$= 3.92; 391, respectively).

3. What are the views of the participants for sharing infographics with others?

The important situations for participants while sharing infographics are analyzed. The views of participants regarding infographics sharing were determined by 4 items. The responses given by participants to these items are given in Table 3.

Table 2. The Views of Participants Regarding Infographics Sharing

Q	Statement	Male			Female			General		
		N	$\bar{X}$	Std.	N	$\bar{X}$	Std.	N	$\bar{X}$	Std.
9	Among the different sources of learning with visual representations, I especially recommend infographics to people around me.	27	3.74	.764	37	3.78	.866	64	3.76	.817
10	I share the infographics, which I liked, to my friends who may be interested.	27	3.56	1.155	37	3.64	.961	64	3.63	1.047
11	I share infographics that are prepared in compliance with copyrights.	27	3.59	.694	37	3.61	1.076	64	3.63	.934
12	I share the infographics that I like on social media platforms.	27	2.93	1.174	37	3.42	1.052	64	3.23	1.137

As shown in Table 3, the views of the participants regarding sharing are mostly positive. The highest average value of the views belongs to "I mostly recommend infographics to people around me among all visual-based learning materials" ($\bar{X}$=3.76). Participants state that they share infographics with their friends if they like them and they care about being respectful to the copyrights ($\bar{X}$=3.63; $\bar{X}$=3.63, respectively). According to the responses of participants regarding that they share infographics on social media sites, they are neutral ($\bar{X}$=3.23).

4. What are the views of the participants regarding presentation of basic information by infographics?

Within the scope of the study, the views of the participants regarding presentation of basic information by infographics were investigated. Their views were obtained by 4 items. The responses of participants are given in Table 4.

Table 3. The Views of the Participants Regarding About Basic Presentation Structure of Infographics

Q	Statement	Male			Female			General		
		N	$\bar{X}$	Std.	N	$\bar{X}$	Std.	N	$\bar{X}$	Std.
13	I do not interested in infographics taking too much time to read.	27	4.04	1.091	37	3.92	1.339	64	3.92	1.276
14	I do not trust infographics whose references are not indicated.	27	3.67	.734	37	3.75	.967	64	3.71	.869
15	I do not read an infographic if the information presented is not up-to-date.	27	3.70	.953	37	3.58	1.339	64	3.61	1.190
16	I do not understand the message given by infographics that have too much visuals.	27	3.37	1.079	37	3.42	1.228	64	3.38	1.162

As it can be seen in Table 4, participants stated that they don't prefer infographics taking too much time to read ($\bar{X}$=3.92). In addition, they stated that they don't trust infographics that don't provide references of the sources ($\bar{X}$=3.71). Participants also don't prefer information is not up to date ($\bar{X}$=3.61). The views of participants, who have concerns about the amount of visuals used in infographics that may get ahead of the message given by infographics, are neutral ($\bar{X}$=3.38).

5. What are the views of the participants regarding permanence/remembrance level of the information obtained by infographics?

The views of the participants regarding permanence/remembrance level of the information obtained by infographics are investigated. The views regarding permanence/remembrance level of the information obtained by infographics were collected by three items. Their views are given in Table 5.

Table 4. The Views of the Participants Regarding Retention-Memorability Level of the Information Obtained by Infographics

Q	Statement	Male			Female			General		
		N	$\bar{X}$	Std.	N	$\bar{X}$	Std.	N	$\bar{X}$	Std.
17	I think visualizations in infographics make more memorable what I learn from them.	27	4.26	.712	37	4.27	.693	64	4.27	.696
18	I remember information that I learned from infographics easier compared to plain text materials.	27	4.19	.834	37	4.24	.796	64	4.22	.806
19	As infographics present critical information required to be learnt on a subject, I learn the conveyed information in a better way compared to other learning materials.	27	3.85	.770	37	4.03	.957	64	3.95	.881

As shown in Table 5, the views of the participants think that information obtained from infographics is permanent ($\bar{X}$=4.27). Similarly, they state that they remember the information obtained from these infographics easily ($\bar{X}$=4.22). In addition, they have stated that they learn better from infographics compared to other teaching materials since they provide critical information ($\bar{X}$= 3.95).

6. What is the place of infographics in the learning processes of participants?

The views of participants regarding the place of infographics in the learning processes are obtained by 4 questionnaire items. Their responses are given in Table 6.

Table 5. The Role of Infographics in the Learning Processes of Participants

Q	Statement	Male			Female			General		
		N	$\bar{X}$	Std.	N	$\bar{X}$	Std.	N	$\bar{X}$	Std.
20	I prefer to read an infographic rather than reading a plain text to learn same subject.	27	4.15	1.027	37	4.30	.740	64	4.23	.868
21	Before checking other sources concerning a subject I am trying to learn, I prefer reading infographics, if there are any.	27	3.48	.893	37	3.84	1.118	64	3.69	1.037
22	To gain an idea about a subject I will be learning, I first investigate/examine the infographics on the subject.	27	3.59	.971	37	3.65	1.033	64	3.63	1.000
23	While making a search to learn about a given subject, I am able to find a	27	2.89	1.155	37	3.16	1.344	64	3.05	1.265

	sufficient number of infographics prepared in my native language.									

As shown in Table 6, participants state that they prefer infographics to learn instead of reading plain texts ($\bar{X}$=4.23). They also state that they prefer infographics to learn a new information and they search for such documents ($\bar{X}$=3.69; $\bar{X}$=3.63, respectively). However, they seem neutral in terms of finding sufficient number of infographics related to the subject that they are looking for in Turkish ($\bar{X}$=3.05).

7. In what order participants prefer using infographics among all instructional materials?

Within the scope of the research, participants were asked to put in what order they use infographics among all instructional materials based on their preferences. The results regarding order of instructional materials in the categories such as interactive instructional materials, infographics, videos, books and article/report are given in Table 7.

Table 6. Order of Preference of Educational Materials

Instructional material type	1.Row 6 point	2.Row 5 point	3.Row 4 point	4.Row 3 point	5.Row 2 point	6.Row 1 point	Real Row	Total Point
Video	28	14	14	3	2	1	1	308
Infographic	13	18	13	10	5	2	2	262
Interactive instructional materials	11	13	15	9	10	3	3	241
Book	4	10	6	22	16	4	4	200
Article-Report	3	6	10	15	20	6	5	179

As it can be seen in Table 7, the most preferred instructional materials are videos. Infographics are the second and interactive instructional materials are the third channels preferred by participants. The printed sources such as books and article/reports are the last two items rarely preferred by participants.

8. In what order participants chose types of infographics?

Within the scope of the study, order of preferences of participants regarding infographic types is investigated. They were asked to put their preferences in an order among 6 different infographic types as follows; static, zoomable, clickable, animated, video and interactive infographics. Results are given in Table 8.

Table 7. Order of Preference of Infographics Types

Infographic Type	1.Row 6 point	2.Row 5 point	3.Row 4 point	4.Row 3 point	5.Row 2 point	6.Row 1 point	Real Row	Total Point
Interactive	27	6	9	6	7	6	1	266
Animated	9	16	25	6	4	2	2	262
Video	8	20	13	14	4	3	3	253
Clickable	4	14	7	22	11	2	4	212
Zoomable	3	7	7	6	26	12	5	163
Static	12	1	1	6	8	32	6	147

As shown in Table 8, interactive infographics are the most preferred types among the participants. In addition, animated and video infographics are also preferred followed by clickable, zoomable and static infographics, respectively.

9. What are the preferences of participants towards layout of infographics?

Within the scope of the study, the preferences of participants towards layouts of infographics were analyzed. Layouts of infographics were categorized as follows; horizontal standard paper size, proper size for horizontal presentation, vertical standard paper size and proper size for vertical presentation. The views of participants are given in Table 9.

Table 8. Order of Preference of Layouts of Infographics

Infographic Type	1.Row 4 point	2.Row 3 point	3.Row 2 point	4.Row 1 point	Real Row	Total Point
Vertical Layout suitable for Presenting Information	36	17	2	9	1	208
Vertical- Standard Paper Sizes	19	30	9	5	2	189
Horizontal- Standard Paper Sizes	6	7	29	19	3	122
Horizontal Layout suitable for Presenting Information	3	9	22	28	4	111

As it can be seen in Table 9, the most preferred infographics were the ones with vertical layout and suitable for vertical presentation, while the least preferred infographics were the ones with horizontal layout and suitable horizontal presentation.

10. Which infographic structure participants like the most?

In the study, the structures of the most preferred infographics were analyzed. Their structures contained more than one feature. Their preference components were categorized as single or serial, printed or electronic, color or black and white, horizontal or vertical, interactive or non-interactive, zoomable, animated or video. Participants had to respond to questions by selecting one or more of these categories. Participants' responses were analyzed while taking gender variable into account. The results are given in Figures 1 and 2, respectively.

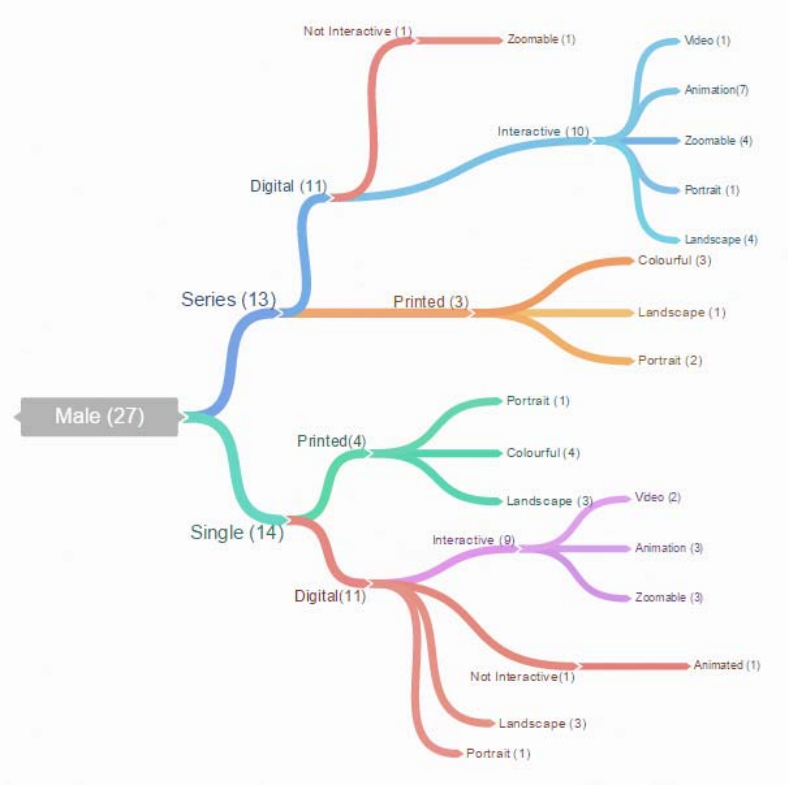

Figure 1. Infographics Preferences of Male Participants

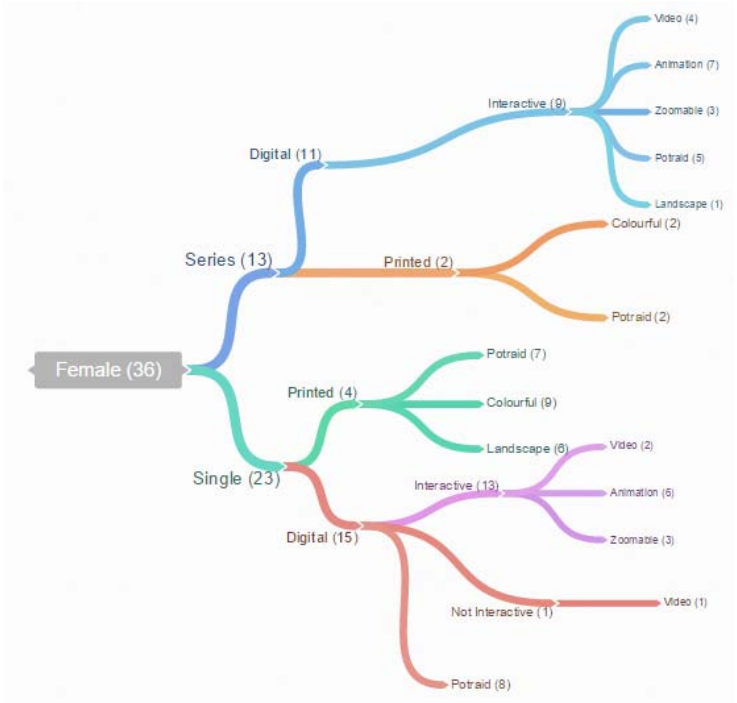

Figure 2. Infographics Preferences of Female Participants

As seen in the figures, the participants preferred infographics in a single form (37). Infographics with electronic form (48) were preferred more among both single and serial infographics. Participants stated that they would like to have infographics with a vertical layout (27). They also preferred electronic infographics to have an interactive structure (41). They preferred printed infographics be in color (18).

11. What are the factors affecting the educational power of infographics according to participants?

In the study, participants were asked to list the factors affecting the educational power of infographics and level of effectiveness of each factor. The factors affecting the educational power of infographics are categorized as information-visual adaptation, information quality, quality of the visualization, quality of the visuals and design approach. Results are shown in Table 10.

Table 9. Factors Affecting the Educational Power of Infographics

Factor	1.Row 5 point	2.Row 4 point	3.Row 3 point	4.Row 2 point	5.Row 1 point	Real Row	Total point	Level of Effectiveness
Information-Visual consistency	8	16	6	9	2	1	142	4.35
Information quality	10	9	8	7	7	2	131	4.41
Quality of information visualization	12	5	9	4	11	3	126	4.41
Visual quality	3	8	12	14	4	4	115	4.5
Design concept	8	2	6	7	17	5	97	4.33

As shown in Table 10, the adaptation of visuals and information provided by infographics is in the first place among factors affecting the educational power of infographics (Level of effectiveness, $\bar{X}$= 4.35). The quality of information comes second (Level of effectiveness, $\bar{X}$= 4.41) followed by quality of the visualization of information (Level of effectiveness, $\bar{X}$= 4.41), respectively. Quality of the visuals comes fourth with an effectiveness level of $\bar{X}$= 4.5. Design approach is the last factor affecting the educational power of infographics (Level of effectiveness, $\bar{X}$= 4.33).

12. What are the views of the participants regarding the reasons of creating infographics?

Within the scope of the study, the views of the participants regarding the reasons of designing infographics were obtained. The reasons were categorized as performing the education, sharing information, establishing an understanding, advertisement and increasing the number of visitors who visit the website. The views of the participants are given in Table 11.

Table 10. The Views of the Participants Regarding the Reasons of Creating Infographics

Reason	1.Row 5 point	2.Row 4 point	3.Row 3 point	4.Row 2 point	5.Row 1 point	Real Row	Total Point
Perform teaching	31	18	6	1	3	1	250
Sharing information	18	23	13	3	2	2	229
Creating understanding	3	9	24	15	8	3	161
Advertising	4	7	10	24	14	4	140
Increasing the number of visitors for the site	3	2	6	16	32	5	105

As shown in Table 11, the first reason why infographics are created was stated as performing education in any subject by the participants. Sharing information is in the second place followed by establishing an understanding, advertisement and increasing the number of visitors who visit the website, respectively.

13. What are the characteristics of a good infographic according to participants?

Within the scope of the study, the participants were asked to list the characteristics of a good infographic and level of these characteristics in terms of making infographics better. Characteristics were divided into 9 categories as follows; purpose, quality of the visual, level of visualizing the information, quality of information, association between visuals and information to be presented, information-visual consistency, typographic features, utilized resources and person or organization created the infographics. The views of participants are given in Table 12.

Table 11. The Characteristics of a Good Infographic

Features	1.Row 9 point	2.Row 8 point	3.Row 7 point	4.Row 6 point	5.Row 5 point	6.Row 4 point	7.Row 3 point	8Row 2point	9.Row 1 point	Real Row	Total Point	Degree of Influence (effect)
Aim	15	5	5	4	0	0	0	6	4	1	252	4.47
Visual Quality	3	12	6	9	1	2	0	3	3	2	239	4.63
Visualization level of information	2	3	13	4	1	6	2	2	6	3	237	4.68

Information quality	5	6	1	8	4	4	3	3	5	4	225	4,47
Association of information visualization	1	2	2	2	12	8	7	1	4	5	202	4.47
Information – Visual consistency	2	2	1	2	8	3	12	4	5	6	196	4.74
Typographic features	4	4	1	3	2	6	6	6	7	7	165	3.97
Utilized resources	4	2	4	1	6	5	3	10	4	8	124	4
Prepared by a person or organization	3	3	6	6	5	5	6	4	1	9	115	3.97

As it can be seen in Table 12, according to participants, purpose of infographics is the most important characteristic. This is followed by quality of the visual, level of visualizing the information and quality of information. The sources used and person or organization created the infographics are the last two factors concerned for a well-prepared infographic.

14. What are the differentiated situations of the participants regarding infographics depending on their genders?

In the study, he differentiated situations of the participants regarding infographics depending on their genders were analyzed. The views stating that providing the information within a concept in infographics facilitates my learning differentiate depending on gender of the participants (Male– $\bar{X}$ =4.07; Female $\bar{X}$=4.38). There is significant difference between t-test results regarding this statement (t=2.198 p<.05). This may be caused by that female participants prefer visual materials to learn something.

Another differentiated situation between male and female participants is sharing the infographics liked on social networking sites. Male participants responded as being neutral while female participants agreed on sharing infographics on these sites ($\bar{X}$=2.93; $\bar{X}$=3.42, respectively). The views of participants regarding sharing infographics on social media sites were analyzed by t-test. No significant difference was found between these two groups in the results of t-test (t=1.891 p>.05).

DISCUSSION

This study reveals the views and various preferences of infographic readers. All the participants were capable of reading infographics. According to the findings, infographics facilitate learning and they are considered more instructive compared to plain texts. Vanichvasin (2013) implies that infographics provide awareness and they facilitate to remember the subjects. This situation may be due to the teaching capacity of visuals which are well-organized and giving a message. Well-prepared infographics are considered to be one of the effective instructional materials (Davis and Quinn, 2014). Fleming and Levie (1993) state that visuals are more permanent and well-prepared visuals have positive impacts on the cognitive learning processes of the learners. In addition, since students spend less time to learn the information presented by infographics and they are exposed to less amount of cognitive load, the thought that infographics are more instructive may be established. Due to the excessive information provided through different delivery tools of multimedia items that contain multiple components, limited capacity and the level of information that can be processes, the learning becomes more difficult (Mayer and Moreno, 2003). The important points presented as ready in the information presented and representation of the relationship between them may have created less cognitive load and enhance the satisfaction. As stated in the literature, excessive cognitive load makes it difficult to learn and detect the content links (Sweller, 1994). In addition, it may be due to the more interesting structure of infographics compared to classical learning materials and using different presentation tools in educational processes in a more effective form.

Readers first look at the title of infographic, then visuals and content to determine which infographic they choose to read. This may be due to that the title and visuals allow readers to quickly understand what information is provided by infographics at first glance (Fleming and Levie, 1993). Krum (2013) states that the title of infographics is important for readers and they pay attention to them to not to waste time and review a non-relevant infographic. Since they look through the content after checking the title and visuals of infographics first, title and visuals seem quite important for readers before starting to read an infographic. Readers prefer to read infographics, which provide name of the person or institution prepared the infographic, rather than those without any name. According to Fleming and Levie (1993), reliable information should be presented to the reader. This can be explained by that the confidence of the reader is transmitted to infographics created by either persons or institutions. In infographics providing the name of their creators, the perception of that these infographics are prepared more seriously may occur.

Infographics, which have visual features, are the most recommended materials among instructional materials to prospective readers. In addition, readers share infographics with those who may be interested in them. These two situations may be associated with high level of instructiveness of infographics and sharing them easily. Davis and Quiin (2014) states that infographics are easy to share and they allow its readers to learn in collaboration and support the communication. In addition, they consider copyrights while sharing the content of infographics. This may be associated with they would like to share more secured content. Similarly, Fleming and Levie (1993) state that sources with higher reliability are more convincing.

Infographics taking too much time to read are not preferred in learning processes. This situation may be due to that readers feel that the power of providing fast and effective information by infographics compared to other educational materials is reduced. Similarly, Krum (2013) states that infographic readers expect to see more visuals for a faster learning process and they would like to have less amounts of text. Fleming and Levie (1993) indicate that short texts should be preferred in order to ensure the confidence of learners and attract their attention. The reliability level of infographics with no references given for the information provided is low. In addition, the reading level of infographics that don't provide up to date information is also low. These two situations may be caused by the necessity of that infographics should be equipped with reliable and trustworthy information. It can be said that excessive visualization doesn't make it difficult to notice the information presented. This can be interpreted that readers believe in educational power of the visuals.

It is believed that the visualization in infographics increase the durability of learning. Zinonyev (2010) states that visualization used in infographics facilitate the analysis of message and allow its readers to remember this message given in the content. Since visuals allow readers to add new information to their existing schemas and facilitate to create new schemas, they may think that visuals increase the durability of learning. Fleming and Levie (1993) state that the visuals fit the existing schemas of readers facilitate the perception. In addition, this may be caused by that learning processes are performed by activating more than one channel. Sweller and Chandler (1994) indicate that for a successful learning, excessive cognitive load shouldn't be created and both audio and visual channels should be used within their capacities.

It is also believed that it is easier to remember the information learnt from infographics compared to texts. This may be due to that infographics use both audio and visual channels during learning processes. The information organized with stronger relationships can be more easily remembered. It can be said that presenting critical information by infographics facilitates the learning process. This may be due to that the participants think that the information provided by infographics is well-organized and important points are emphasized. In addition, spending less time for learning and learning without making any selections may lead readers to feel that they learn more effectively from infographics.

Readers preferred to use infographics rather than plain texts to learn. Readers prefer visuals rather than creating new schemas or improving existing schemas. Infographics are preferred before other instructional materials and infographics are searched for the subject to be learnt. This can be explained by the fact that infographics are very ideal because they ensure that readers to learn the important points of the subject quickly and reach similar information within a concept. In addition, infographics offer a learning environment that provides basic information about the subject and allows individuals to learn at their own pace.

Videos, infographics and interactive materials with high visual features are preferred first by people instead of traditional materials such as books prepared for the same subjects. Although these three materials have different features, their visual levels are high. Allen and Seaman (2014) states that faculty members prefer materials with high visual and interactive features for open educational activities and nearly half of them use infographics in educational activities. The reason why readers prefer materials with high visual features may be their desire to learn from alternative materials. Their high computer skills may have caused readers to prefer electronic learning materials. In addition, since these materials are easy to update, the confidence of readers and rate of preferring them can be increased.

The preference of reader can be affected by additional information offered by infographics. Most preferred infographics are interactive, animated, video and clickable infographics, respectively. This may be due to that readers would like to see additional information offered by infographics within the same concept along with basic information already offered. In addition, this can be also considered as a strategy readers choose to transfer the information more easily. Similarly, Fleming and Levie (1993) argued that the quality of visuals and visualization is important in the transfer of the information. This is supported by that the least preferred infographic types are the ones that are zoomable with static structures.

The most preferred infographics are those that have vertical layouts whose size for sufficient to presenting information intended to be given to the reader. The selection of vertical layouts of sufficient size for presenting information may be due to participants reading habits, their desire to read faster and presenting the information in that layout. Similarly, Krum (2013) stated that infographics with vertical layout are preferred more preferred by the readers. In addition, vertical scrolling may be easier than horizontal scrolling. This is supported by the fact that infographics presenting information in a horizontal layout are the least preferred infographics by the readers.

Considering the multiple features, the most preferred infographics are monolithic ones. This may be caused by the desire of learning the information as a whole within a context. Infographics with digital form are preferred. This may be due to that digital materials can be accessed independently from tools and environment. The dynamic structure of digital infographics may be another reason why they are preferred by readers. Interactive ones are preferred among digital infographics. This may be due to that additional information can be obtained from interactive infographics if needed. In addition, the motivation for learning with spending more cognitive effort can be another reason. Similarly, Fleming and Levie (1993) argued that more cognitive effort affect learning in a positive way. Printed infographics are preferred to be colored. This can be interpreted as that information is desired to be obtained without losing anything from its actual form and the power of visualization in learning shouldn't lose anything. In addition, infographics with vertical layout are preferred. This can be explained by reading habits and easy scrolling when the page is vertical.

The adaptation of information and visuals is the main factor determining the quality of infographics. It is possible to associate this with that infographics are perceived as a whole and consistency of all components forming infographics positively affect the instructiveness of infographics. Fleming and Levie (1993) state that visuals used in infographics and the information given should

be consistent with each other when they are used together. The quality of information and visualization are two main factors affecting the quality of infographics. Since presenting the information through visual components is basic philosophy of infographics, it may be thought that the quality of these components directly affect the quality of infographics. The quality of visuals affects the quality of infographics as much as visualization. This may be caused by that high-definition visuals create a feeling of quality. According to Fleming and Levie (1993), the quality of visuals has a positive impact on the motivation of learner. In addition, the visual quality may lead to an understanding that infographics are created professionally. The design concept of infographics is among quality indicators. This may be associated with understanding that presenting the information and visuals within a relevant concept increase the quality. In addition, since the design concept is not in the last place, this may be due to that this component is not directly associated with presentation of the information. Fleming and Levie (1993) argued that additional factors such as typographic features should also be considered.

Infographics are mostly prepared to teach a subject. This can be interpreted as that infographics have become one of the basic instructional materials. Information sharing is one of the main reasons for preparation of infographics. This can be interpreted as that infographics are considered as information transfer tools. Lamb, Polman, Newman and Smith (2014) revealed that infographics can be preferred as much as other instructional materials by building educational activities on infographics. It is quite obvious that infographics are prepared to deliver a message and understanding to their readers. This may be interpreted as that infographics can be used to establish awareness on a subject. The last two reasons with least importance to create infographics are advertisement and increasing the number of visitors who visit the website. This may be caused by that the readers think that infographics have also some side effects along with their educational power. Lankow, Ritchie and Crooks (2012) stated that infographics are prepared for purposes such as presentation of the information, attracting attention and promotion.

Purpose is the main feature of a good infographic. Since purpose affects many features of an infographic from level of information to its extent, it may be considered as the most important feature of a good infographic. Visual quality and level of visualizing the information are also considered as basic features of a goo infographic. This shows that visuals are considered to be the basic information transfer tools of infographics. In addition, this also shows that the ability of good presentation of the information and expressing the information by a visual language is considered as basic features of infographics. Information quality and information-visual consistency are also seen among the features of a good infographic. This shows that information quality and consistency between visuals and information offered are important for a good infographic. In addition, typographic features should be considered while presenting the information and sources and person or institution prepared the material should also be provided to the reader.

CONCLUSION AND RECOMMENDATIONS

As a result;

- Infographics facilitate learning. Infographics can be used to teach basic information about a subject, present new information or confirm the information currently available.
- Infographics are perceived as more instructive compared to text materials. Therefore, infographics can be used as supporting elements in the books and as an alternative to plain text materials.
- While reading infographics; the readers reviews the material's title, visuals and content. Infographic designers should find a catchy title that reflects the information offered by the infographic. The best visuals reflecting the content should be used and contents consistent with the aim of the material should be prepared.
- The confidence level of infographics increases if the person or entity, who prepared the infographic, is known by the reader. The names of creators and designers should be provided while preparing infographics. In this way, the information either needed or wanted to see by readers would be provided.
- Infographics are the most recommended materials among visual educational materials to potential readers. Therefore, the components needed to share these materials should be included (for example: social networking buttons).
- Infographics paying attention to copyrights seem more reliable. Therefore, while creating infographics and sharing these materials, necessary attention should be paid to the copyright regulations.
- The confidence level for infographics, which don't provide the sources used, is low. All sources utilized in the preparation of infographics should be presented to the reader in the infographics. In this way, the reliability and validity of the information can be checked and readers can easily reach the original source of the information presented.
- Infographic, which don't provide up to date information, are not preferred. Infographics should be kept up to date and updated if necessary to ensure readers achieve the most accurate and latest information.
- Infographics taking too much time to read are not preferred. Therefore, the context should be determined very well for an effective infographic and putting useless information to these materials should be avoided.
- Visualizations facilitate learning. Infographic designer should plan visualizations well and visualizations should be designed as offering consistent information with the content in order to prepare an effective educational material.
- It is easier to remember the information learned from infographics compared to plain text materials. In order to use this feature of infographics, contents should be prepared by paying attention to the message design guidelines for the use of a combination of text and visuals. In addition, the content should be supported by some techniques such as using memory nails to make it easier to remember.
- Infographics contain the critical information that should be learned about the subject. In order to provide this understanding, content should be well-analyzed and basic components should be provided while preparing infographics. In addition, additional information should be provided for those who may need to learn more about the topic.

- Infographics are the main materials used to learn an unknown subject. It is important to take this into consideration while preparing the content of infographics within a structure that can deliver more detailed information if requested by the reader.
- Infographics in digital form are preferred more by readers. In order to provide learning independent from environment and tools, infographics in digital form should be designed.
- Infographics offering the possibility of receiving additional information are preferred more by the readers. Interactive infographics are the most preferred infographic types in digital form. In this respect, while creating infographics, links leading readers to external information should be given and alternative information presentations should be planned and integrated into infographics by considering readers who may have different knowledge levels.
- The vertical layout suitable for presenting the information should be preferred for infographics. Infographics can be designed by considering this layout in order to maintain the proper design structure and support the habits of readers.
- Single infographics are preferred instead of serial ones to deliver a subject. Infographics should be designed in a single structure to provide information as a whole to the reader without causing any distraction and making reader to spend any effort to find the next phase of the information offered.
- Printed infographics are preferred to be colored; because infographics are more powerful in terms of delivering their messages and information to their readers when the visuals are colored.
- For a good quality infographic;
    - The consistency between information and visuals should be provided.
        - Designers should pay attention to the consistency of content of information, taxonomic level and layout that are provided by visualizations.
        - Decorative images that may cause cognitive load and visuals that are not instructive should be avoided.
    - Information and visualization of the information should be top quality.
        - Presenting information without errors should be provided.
        - Unnecessary, irrelevant information and visuals that don't conform to the logical structure of the material must be excluded.
    - The visual quality should be top level.
        - The use of colors should be appropriate to the context.
        - The quality of visuals must be done so as not to arouse discomfort and must be prepared so as to contribute to the integrity.
    - Design concept should be appropriate to the purpose
        - Visual structure should be prepared as being associated with the subject and should be at a level to express itself.
        - Typographic features should be prepared in a consistency.
- Infographics are defined in instructional materials. They are considered as fast and engaging instructional materials and they should be designed as rigorous and systematic as other instructional materials to make them effective educational tools.
- In order to have infographics with good features and power of perception:
    - The purpose is the basic component of a good infographic. Since the purpose affects all components from visuals to level of presenting the information in the infographics, the purpose should be determined very well and considered in all phases of the design process.
    - Visual quality and visualizing the information are basic properties of a good infographic. Since they are two basic properties of an infographic, visuals should be prepared very well and they should reflect the information offered properly. Visuals should be in high quality.
    - The quality of information and consistency with visuals should be provided.
    - Attention must be paid on typographic components. Typographic structure should be decided during the design phase to avoid distractions and ensure consistency and this standard structure should be applied to entire infographic.

This study was conducted with a group with high ability of educational material design and computer skills. It is recommended to conduct similar studies on different groups. The study can be repeated with individuals from different educational levels. Design experiments can be prepared to determine the characteristics of a good infographic.

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