



Harnessing the Power of Infographics in Education

Sobhana, Nandyal Panduranga

Department of English, Samtah University College,
Jazan University, Jizan, KSA

ABSTRACT

Infographics are visual representations of knowledge or data meant to present complex information quickly and clearly. They use pictures, diagrams, maps, charts, graphs, and statistics to present information. They often prove effective in educational contexts as they use imagery to highlight, explain, or enhance text-based information. They capture attention, convey information, and encourage data retention among learners. This study was an ardent effort towards using static infographics in English linguistic contexts to know the students' perceptions and attitude as infographics is still a new trend in education. The sample comprised 70 female undergraduate students of the Department of English, Samtah University College, Jazan University. A structured questionnaire was adapted to meet the requirements of the study. The results revealed that using infographics as a teaching strategy motivates students to become active participants in the classes to comprehend the relationship between the graphics and data. Using infographics as a learning strategy inspires students to learn from their peers and as an assessment tool, drives them to introspect themselves to improve their oral presentations/assignments/course projects. The students develop critical thinking, analytical ability, logical reasoning, collaborative learning, and information analysis. Summing up this study, it is recommended that university students should enhance digital awareness and willingness to use infographics in learning contexts. It is suggested that if the teachers support, facilitate, and encourage the Saudi students to use infographics they would become autonomous learners and be successful in their academic endeavours.

Keywords: Infographics, Perceptions, Attitude, Autonomy, Education.

INTRODUCTION

Joern, L (2018) states that “digital age” is the period in which change is through digitalization and digital transformation has progressed so far that digital technologies have a formative influence on people's lives. The 21st century is referred as the “digital age”. In this digital age the ways in which information is presented and accessed have changed. Using technology has gained momentum to convey information visually to attract the attention of different kinds of audience be it whether business, marketing, media, and education. Ozdamli and Ozdal, (2018) feel that infographics won popularity in the education field. Hassan (2016) opines that they present a substantial amount of information in a fluent and easy-to-comprehend format. They are effective in enhancing the success of students in school when used as alternatives to traditional texts. Infographics are used as a powerful tool to make people understand information through the use of visual data, charts, graphs, statistics, maps, diagrams, and pictures. With the proper use of color and proportion, information can be

transformed into memorable and attention-grabbing graphics. Davidson et al., (2014), Ismaeel & Al Mulhim, (2019a) aver that this led to call for new methods of teaching and learning strategies that are more learner-centred in education. In the 21st century classrooms, teachers are facilitators of students learning and creators of productive classroom environments, in which students should develop the skills for present and also future. The 21st century teachers should instil creativity among students, enable them to maximize their potential of formal and informal learning experiences and facilitate learning in multiple modalities. So, the teachers need to find varied ways to present content to facilitate information processing among the students and stimulate them to actively participate in the teaching and learning process.

Infographics are visual representations of information/data that are systematically organized to explain specific topics or present complex information clearly, quickly, and visually in an interesting way which makes them one of the ideal tools to be used in the classrooms to capture the individuals' minds. Shaltout & Fatani, (2017) opine that static infographics combine images and texts to represent concepts in visuals, such as maps, charts, and graphics. The static infographics serve as fixed resources, as they do not require interaction from users. The interactive infographics depend on the readers who are required to give user input by watching videos, selecting visual elements, or selecting answers.

Research Significance

With the advance of the internet and changing technology, teachers are finding it difficult to find effective systems to manage their classrooms. The emphasis nowadays is on the effective use of technology in order to create new learning opportunities and nurture students' achievements. Infographics is a tool in the 21st century to captivate learners listening attention span, as classroom teaching is a potential challenge for effective teaching. One of the most significant advantages of using infographics is that it enhances knowledge retention and recall. People remember visual charts, images, and other infographic elements more effectively than text-based content. Anne Trafton (2014) states that neuroscientists from MIT found that the brain can process an entire image in about 13 milliseconds, making visuals an ideal learning aid to boost comprehension and retention among the students. Generally, teachers use infographics to illustrate data, present statistics, facts and figures visually using charts, graphs, simplify a complex subject, explain difficult concepts with the help of illustrations and visual cues.

Purpose of the Study

Infographics can be used in a classroom to brainstorm, share data, make comparisons, explain concepts, present processes, and provide more information other than the textbook. Implementing infographics in teaching, enables meaningful learning faster and transferring knowledge to other contexts. Infographics use both images and text in a visual format to explain difficult and different concepts. English teachers can create and use them to help students understand complex linguistic concepts effectively. Using infographics in teaching and learning contexts such as vocabulary, grammar, productive skills, and functions of language helps English students to communicate easily and make oral presentations effectively. Therefore, this study is to ascertain the impact of static infographics as a teaching, learning and assessment tool on female undergraduate students to know students' perceptions, their attitude towards using infographics in teaching, learning and assessment process and to motivate them to use infographics in their assignments/course projects.

Research Questions

1. What are the students' perceptions towards using infographics in teaching and learning process?
2. What is the students' attitude towards using infographics in teaching and learning process?

Limitations of the Study

The current study is limited to:

1. use static infographics and not interactive infographics.
2. the female undergraduate students in the Department of English, Samtah University College, Jazan University during the academic year 2022-2023.

METHODOLOGY

Descriptive and prescriptive methods of quantitative research was used to examine the students' perceptions and their attitude towards using infographics in teaching, learning and assessment processes. The students were also motivated to use infographics in their assignments/course projects.

Sample of the Study

The sample constituted 70 female undergraduate students of the Department of English, Samtah University College, Jazan University. The researchers made use of quota sampling which required the representative individuals who were between the ages of 25-30.

Data Gathering Instrument

The data gathering instrument was an online survey questionnaire. It was designed to know the students' perceptions on infographics. It consisted of 6 question items related to infographics on a 5-point scale as shown in the Results section. Attitude is a point of view or feeling among the students on the different ways of using infographics in the teaching and learning process. The questionnaire also consisted of 5 question items related to attitude on a 5-point scale as shown in the Results section. The students were asked to express their perceptions and attitude towards using infographics in the teaching and learning process.

Data Collection

An online survey questionnaire has been administered to collect the data from 70 female undergraduate students of the Department of English, Samtah University College, Jazan University. The participants have been informed about the significance of the study. The data collected was analyzed as shown in the Results section and the responses of the students in the questionnaire have been reported in Table 1 and Figure 1 below.

RESULTS

The students' responses/perceptions in the questionnaire have been reported in Tables 1, 2 & 3 and Figures 1, 2 & 3 below.

Table 1: Students Perceptions on Infographics

	Students Perceptions on Infographics	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
#	Statements	5	4	3	2	1
1	Infographics is a collection of visuals such as images, illustrations, graphics, and minimal text that help to understand an overview of a topic clearly than plain text	35	30	1	2	2
		50%	42.85%	1.43%	2.86%	2.86%
		92.85%				
	35 students (50% of the sample) strongly agree, and 30 students (42.85% of the sample) agree that infographics are a collection of visuals. 1 student (1.43%) responded neutral, 2 students (2.86%) disagreed, and 2 students (2.86%) strongly disagreed with the statement. An infographic is a collection of imagery, data visualizations viz., pie charts and bar graphs, and minimal text that gives an easy-to-understand overview of a topic. Infographics don't use long sentences but show the direct point. The students are aware of infographics as linguistic teachers are using infographics to teach linguistic concepts.					
2	Infographics use distinct, engaging visuals to communicate information easily and quickly	32	33	2	2	1
		45.71%	47.14%	2.86%	2.86%	1.43%
		92.85%				
	32 students (45.71% of the sample) strongly agree, and 33 students (47.14% of the sample) agree that infographics use visuals to communicate information easily and quickly. 2 students (2.86%) responded neutral, 2 students (2.86%) disagreed, and 1 student (1.43%) strongly disagreed with the statement. Infographics is a visual representation of information or data and is easy to understand. The students are aware that infographics are visuals.					
3	Visuals in infographics help to remember/retain the information for a longer time	30	35	2	2	1
		42.85%	50%	2.86%	2.86%	1.43%
		92.85%				
	30 students (42.85% of the sample) strongly agree, and 35 students (50% of the sample) agree that using infographics in teaching helps them to retain information. 2 students (2.86%) responded neutral, 2 students (2.86%) disagreed, and 1 student (1.43%) strongly disagreed with the statement. Visual data helps to memorise the information. The use of imagery in infographics can aid not only comprehension and aesthetic appeal, but also in forming visual memories, thus reinforcing the process of memory recall.					
4	Infographics help to develop critical thinking skills	25	40	3	1	1
		35.71%	57.14%	4.29%	1.43%	1.43%
		92.85%				
	25 students (35.71% of the sample) strongly agree, and 40 students (57.14% of the sample) agree that using infographics in teaching helps them to develop critical thinking skills. 3 students (4.29%)					

	responded neutral, 1 student (1.43%) disagreed, and 1 student (1.43%) strongly disagreed with the statement. Creating infographics involves higher level thinking skills to teachers for determining the essential content for inclusion in the limited space of an infographic, as students must analyse and synthesize multiple pieces of information, Today, teachers are beginning to fully embrace visual learning as a way to help students incorporate critical thinking into every facet of their education. Visual learning has grown exponentially, as technology has improved, and access has increased. This makes it easier for teachers and students alike to create, use visuals to show, share, and interpret information in creative ways.					
5	Infographics are used in teaching linguistic courses	35	30	3	1	1
		50%	42.85%	4.29%	1.43%	1.43%
		92.85%				
	35 students (50% of the sample) strongly agree, and 30 students (42.85% of the sample) agree that infographics are being used to teach linguistic concepts. 3 students (4.29%) responded neutral, 1 student (1.43%) disagreed, and 1 student (1.43%) strongly disagreed with the statement. Overall, infographics are useful tools in the world language classrooms and can lead to multiple opportunities for students to advance their language proficiency and to broaden their cultural knowledge. Infographics are visually appealing, culturally rich, and allow the teacher to differentiate tasks with more ease. Linguistic teachers are using infographics to teach linguistic concepts.					
6	Infographics help to do project assignments in an effective way	31	34	3	1	1
		44.28%	48.57%	4.29%	1.43%	1.43%
		92.85%				
	31 students (44.28% of the sample) strongly agree, and 34 students (48.57% of the sample) agree that infographics in teaching helps them to do their course projects effectively. 3 students (4.29%) responded neutral, 1 student (1.43%) disagreed, and 1 student (1.43%) strongly disagreed with the statement. Infographics can encourage students to let their creative side come out by giving them a platform to design and create visual representations of information. Creating infographics allows them to express themselves in innovative and exciting ways. This can be a fun and rewarding way to learn and develop novel skills among the students.					

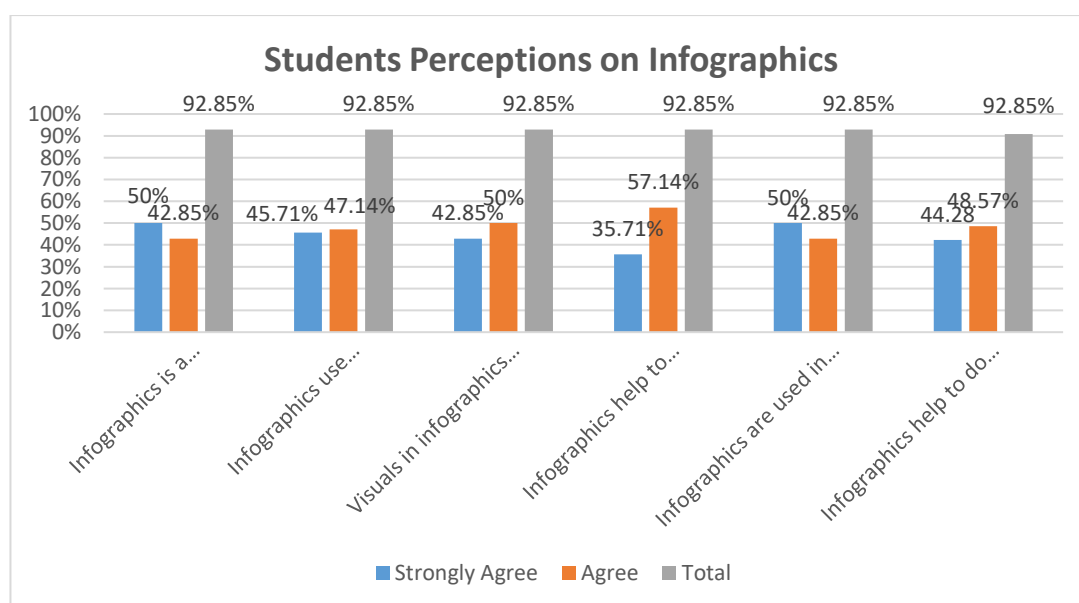


Figure 1 - Students Perceptions on Infographics

From the above Table 1 and Figure 1 - it can be deduced that:

- 92.85% of the sample acknowledge that they are aware of infographics
- 92.85% - admit that infographics are visuals and easy to understand
- 92.85% - accept that infographics help to retain information for a longer time
- 92.85% - concur that infographics develop critical thinking skills
- 92.85% - confirm that infographics are being used by the teachers in linguistic courses
- 92.85% - agree that infographics helped them to do their assignments/course projects effectively.
- based on the students' perceptions on infographics, majority of the sample are willing to use infographics and expressed (+)ve opinion.

Table 2: Students Attitude on Infographics

	Students Attitude on Infographics	Str. Agree	Agree	Neutral		Disagree		Str. Disagree	
#	Statements	5	4	3		2		1	
	Attitude	(+) ve att.		%	(N) att.	%	(-) ve att.		%
1.	I believe that infographics give an opportunity to acquire new knowledge	32	33	92.85%	2	2.86%	2	1	4.29%
	32 students strongly agreed, and 33 students agreed that infographics give them an opportunity to acquire new knowledge. 2 students responded neutral, 2 students disagreed, and 1 student strongly disagreed with the statement. 92.85% of the sample had (+)ve attitude, 2.86% of the sample had neutral attitude and 4.29% had (-)ve attitude. Infographics can be great tools to help people think creatively and learn new ways to apply their skills and knowledge to tasks. It is important for the students to be aware of infographics, develop self-interest and avail all opportunities to acquire new knowledge in the learning process.								
2.	I believe that infographics help to summarize key concepts	20	35	78.57%	10	14.29%	3	2	7.14%
	20 students strongly agreed, and 35 students agreed that infographics help them to summarize key concepts. 10students responded neutral, 3 students disagreed, and 2 students strongly disagreed with the statement. 78.57% of the sample had (+)ve attitude, 14.29% of the sample had neutral attitude and 7.14% had (-)ve attitude. Infographics can be created by the teachers after every unit to provide students with a summary of key information.								
3.	I believe that infographics enhance learning experiences	31	34	92.85%	3	4.29%	1	1	2.86%
	31 students strongly agreed, and 34 students agreed that infographics enhance their learning experiences. 3 students responded neutral, 1 student disagreed, and 1 student strongly disagreed with the statement. 92.85% of the sample had (+)ve attitude, 4.29% of the sample had neutral attitude and 2.86% had (-)ve attitude. Infographics can help to stay focused, make learning more interesting and retain information. Infographics can help students remember information more efficiently as it engages both the visual and verbal parts of the brain.								
4.	I believe that infographics support content retention	25	30	78.57%	10	14.29%	4	1	7.14%

	25 students strongly agreed, and 30 students agreed that infographics support content retention. 10 students responded neutral, 4 students disagreed, and 1 student strongly disagreed with the statement. 78.57% of the sample had (+)ve attitude, 14.29% of the sample had neutral attitude and 7.14% had (-)ve attitude. Infographics is a highly graphical visualization tool, being an innovative way of displaying content that can attract the attention of the targeted audience, instead of using narration. Visuals like infographics in the content not only increases learning and retention by 78%, but also develops reading skills by 80%.								
5.	I feel confident in using infographics in future	20	35	78.57%	10	14.29%	3	2	7.14%
	20 students strongly agreed, and 35 students agreed that they developed confidence to use infographics in future. 10 students responded neutral, 3 students disagreed, and 2 students strongly disagreed with the statement. 78.57% of the sample had (+)ve attitude, 14.29% of the sample had neutral attitude and 7.14% had (-)ve attitude. This study used experiential learning approach. Hence, the students improved their confidence level to learn a new technological tool independently. It is crucial for the university students to develop their level of confidence if they have any plans to improve their performance and pursue higher studies.								

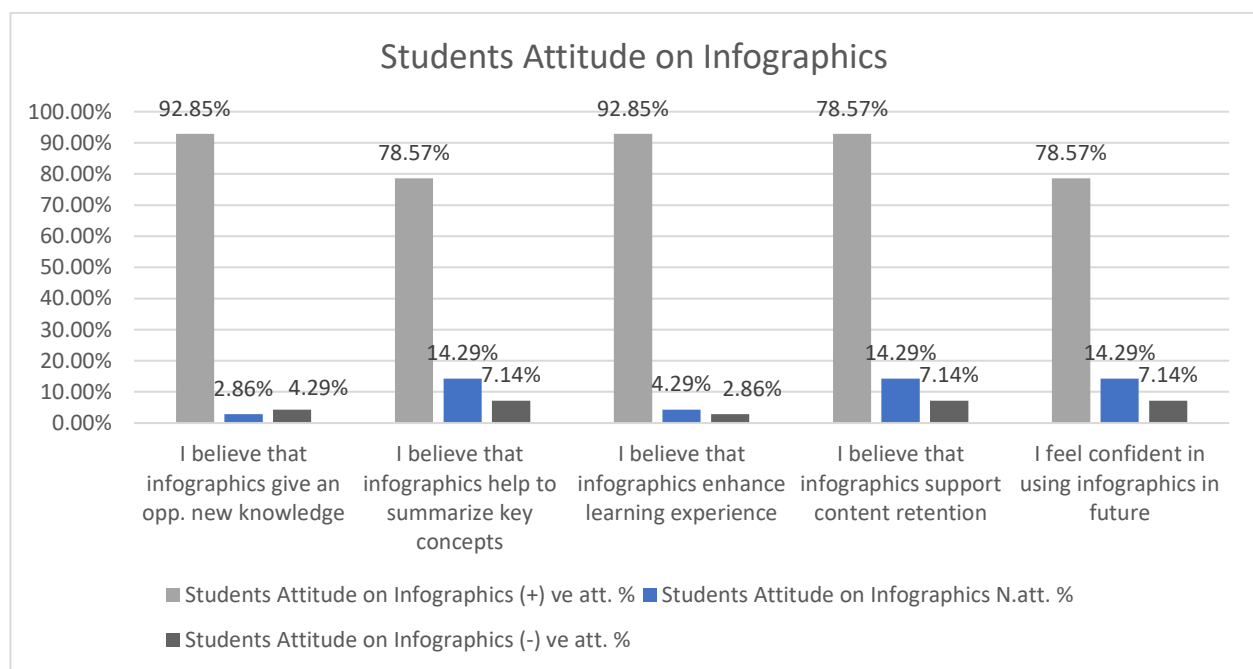


Figure 2 – Students Attitude on Infographics

From the above Table 2 and Figure 2 - it can be concluded that:

- 92.85% of the sample confirm that infographics give them an opportunity to acquire new knowledge
- 78.57% - agree that infographics help to summarize key concepts
- 92.85% - accept that infographics enhance learning experiences
- 78.57% - believe that infographics support content retention
- 78.57% - feel confident to use infographics in future i.e., willing to use infographics to do their assignments/course projects effectively.

- based on the students' responses on infographics, majority of the sample expressed (+)ve attitude and are willing to use infographics to do their assignments/course projects.

Table 3: Infographic Applications Enlisted by Students

#	Which infographic software/app did you use to do your course project?	Frequency	%
1.	Word	1	1.42%
2.	Power point	2	2.86%
3.	Easelly	15	21.43%
4.	Canva	24	34.29%
5.	Xmind	27	38.58%
6.	Piktochart	1	1.42%
	Total	70	100.00%

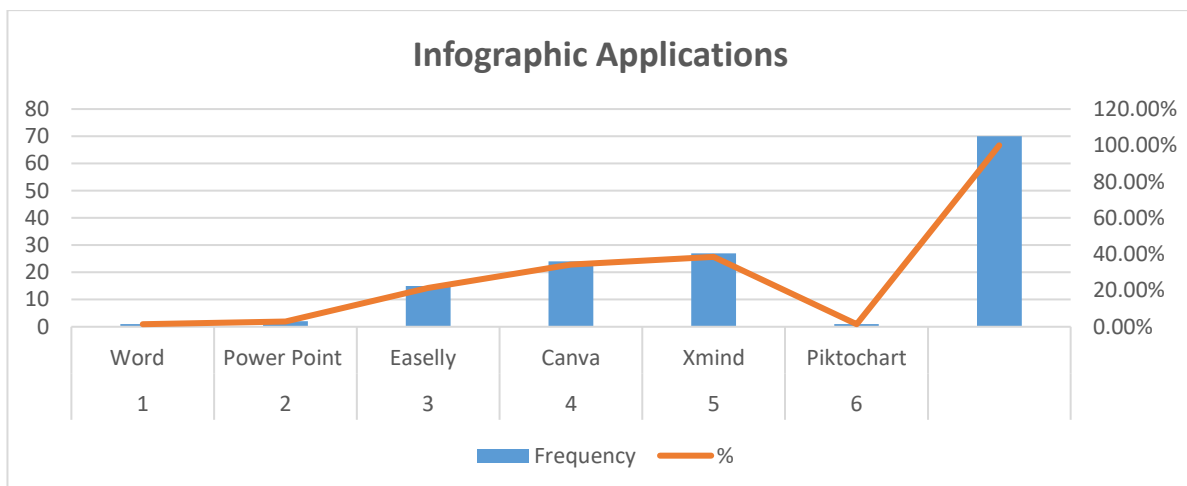


Figure 3 – Infographic Applications enlisted by Students.

The researchers adapted steps recommended by Midori Nediger (2023) and suggested guidelines to the students on how to create static infographics and present the assignments/course projects.

Guidelines to Create Infographics:

1. Collecting information for infographics.
2. Making visualizations for infographics.
3. Creating a layout using an infographic template.
4. Using appropriate colour proportions for infographics.
5. Adding style to infographic design to make it stand out.

From the above Table 3 and Figure 3 - it can be figured out that:

1. 38.58% of the sample used Xmind infographic application.
2. 34.29% used Canva infographic application.
3. 21.43% used Easelly infographic application.
4. majority of the students are interested to use infographic applications.

Xmind and Canva were among the top choices of the students, followed by Easel.ly as they offer free infographic templates that students could employ to build their own content. Some of the students used a combination of two different applications (Xmind and Canva) to create the infographics.

DISCUSSION

Theories Underpinning Infographics

Infographics in the educational context are supported by Clark and Paivio's (1991) Dual Coding Theory (DCT) Sweller, Ayres & Kalyuga's (2011) Cognitive Load Theory (CLT), Mezirow's (2009) Transformational Learning Theory (TLT) and Miller's (1956) Information Processing Theory (IPT).

- i. Dual coding theory (DCT) assumes that human memory consists of two cognitive systems for coding information i) verbal representations and ii) non-verbal (imagery) representations. Vanichvasin (2013) asserts that dual coding helps draw the attention of learners into various visual kinds of information. Yildirim (2016) stresses that infographics facilitate learning and perceived as more instructive than text. Shafipoor et al., (2016) express that incorporation of infographics into the classroom setting, facilitates learning processes, data retrieval, and memorisation.
- ii. Anderson (1977), Atkinson & Shiffrin (1968), Baddeley (1983) opine that Cognitive load theory (CLT) assumes that human memory can be divided into working memory and long-term memory. The information is stored in the long-term memory in the form of schemas; and the processing new information results in 'cognitive load' on working memory, which can affect learning outcomes. Sweller et al.'s (2011) theory states that learning occurs when a learner receives different information symbols through two different reception channels, so that the information is processed through one of the two independent channels. one of them processes verbal information (written and audio text) and the other, processes non-verbal information (pictures and graphics). The use of verbal and non-verbal information together, facilitates learning and increases the number of elements of retrieval information, as one uses two types of mental representations (verbal and non-verbal). Thus, infographics are assumed to present information to students through graphics and texts in a simple, organised, and attractive way which allows students to concentrate on the most important information, thereby reducing the cognitive load. This is supported by Korbach et al. (2017), who claim that excluding irrelevant information and focusing on relevant information can reduce the cognitive load. The ability of infographics to reduce the cognitive load has been discussed and verified by various researchers, such as, Afify (2018), Dunlap and Lowenthal (2016), Martin et al. (2019), and Mohamed (2020). Hassan (2016) compared infographic types - static versus animated, to determine the most effective one and used static as a teaching-aid framework in sciences. The results revealed that using well designed infographics could help in teaching complex science subjects that involve spatial and temporal data. Both infographic types have a significant impact on improving students' comprehension. Static infographics are more effective when compared to animated, in communicating the subject and easy to understand with important information only. Mayer et al. (2005) agreed with these findings and preferred static type over animated infographics. Peters (2013) confirmed that the motion in animated infographics may inhibit students from comprehending the content fluently. In static infographics, they could read and decipher the information at their own pace. She

- suggested that the static type of infographics could be more effective when learning conceptual processes and asserted that static infographics allow students to visually navigate all the components at the same time. This enables students to discover relationships between the components and leads to improve learning conceptual processes which decreases cognitive load, leading to simpler cognitive tasks and information processing.
- iii. Transformational Learning Theory (TLT) says, transformative learning has two basic focuses - instrumental learning and communicative learning. Instrumental learning focuses on task-oriented problem solving, and evaluation of cause-and-effect relationships. Communicative learning focuses on how people communicate their feelings, needs, and desires. Wolfe's (2009) view, based on Mezirow's transformational learning theory, causes a change in thinking after grasping the information. Students are triggered to have interest in their learning, instead of, being spoon-fed pieces of information to memorize. The students should be able to transform information into infographics and vice versa or transform the textual language into a visual one and vice versa, or to transform the visual language from one content to another.
 - iv. Information Processing Theory (IPT) asserts, information processing in humans involve gathering and representing information (encoding), holding information (retention), and getting at the information when necessary (retrieval). Miller (1956) presented the idea that short-term memory could only hold 5-9 chunks of information, where a chunk is any meaningful unit. A chunk could refer to digits, words, chess positions, or people's faces. Baglama et al., (2017) state that in information processing model, learning takes place when an individual's attention is attracted by external stimuli. The information is recorded in short-term memory, stored in long-term memory and in turn added to the existing fund of knowledge. Riding et al., (1997, p 219) affirms that, the ways of information processing is not same in all individuals even if it is the same information and depends on their cognitive styles. It is highly challenging for the teachers to present content in varied modes in an interesting, flexible, and interactive way to facilitate information processing based on the students' individual preferences. Marabella, (2014) & Willis et al., (2008) stress that deep processing of information increases its recall and improves memory. When learners are exposed to visual language (infographics) more cognitive webs and mental models are generated and accelerate learning.

Infographics in Education

Researchers like Afify, (2018), Ozdamli & Ozdal, (2018), Yildirim, (2016) propound that infographics are graphic visual representations of knowledge, data, and information such as graphs, maps, and signs to present complex information clearly and quickly in the fields of education, technical writing, journalism, and others. Yildirim (2016) asserts that teaching materials play a key role, as learning involves information processing and transfer among students. Therefore, infographics as tools, are significant to assist learning, as they enhance the knowledge transfer in the students. Afify (2018) states that infographics have been used in e-learning environments, such as web-based learning, mobile learning, and social media platforms, which enable learning to take place at any time and place.

Challenges in Using Infographics:

Lin et al., (2018) emphasizes that the effectiveness of using infographics is proved as one of the digital information presentation modes in education, but it is ultimately the cognitive styles that

influence the level of learning among the students. Çifçi (2016), Ozdamli & Ozdal (2018) assert that infographics are desirable when both students and teachers have positive perceptions. Çifçi (2016), Mahmoudi et al., (2017), Vanichvasin (2013) opine that positive opinions will lead to the development of learning environments which will in turn lead to positive performance and higher academic achievement. Hassan (2016) and Yildirim (2016) emphasise the value of properly designed infographics for teaching complex science subjects that involve temporal and spatial data. One challenge with the use of infographics in education is that it requires accurate designs based on scientific standards, otherwise, audience may not get the best information out of the tools. Yulia Radchenko (2018) concludes that the use of cognitive-visual technology and info posters can be considered as an effective tool in teaching a foreign language to non-linguistic high school students. Infographic design techniques can be implemented in designing a good infographic application for teaching and learning purposes. She suggested that they provide a wide range of free programs and applications to create an info poster, give a possibility of multiple use of the created info poster and does not require any technical equipment in the classroom and can be used even offline. She cautioned that there is a need to spend a lot of time/effort/money to master the methodology for using it while working in the classroom to use the advanced service functions/problems with copyright.

Shedding light on the contribution of some previous research is fundamental since it will help to suggest and propose solutions concerning the research problem. Infographics serve a variety of purposes as they can be used as a teaching technique. Lamb and Johnson (2014) proposed five uses of infographics. Teachers can:

1. organise ideas coherently,
2. illustrate biographical, historical, sociological, and scientific concepts visually,
3. compare and contrast information effectively,
4. present plain data meaningfully by providing analogies, themes and examples and speak as a narrative with visuals and words in an exciting way.

Sudakov et al. (2015) defined infographics as an educational tool for:

1. teaching (when introducing new topics or giving a broad overview of new subjects, providing discussion starters, reflecting on a specific subject material provided, or explaining new concepts),
2. learning (when receiving a visual representation of a specific material, communicating information in a quick and clear way), and
3. assessment (when asking students to create infographics in order to visually show that they have grasped what has been taught to them).

Meeusah and Tangkijviwat (2013) opine that infographics can be used for different educational purposes such as, showing the relationship between different concepts, transferring processes and events, presentation of the content and summarizing the subjects learnt. Borucu (2015) states that if visuals are used persistently in teaching, they will make a large difference on students' comprehension and gain importance in the field of education. Gaille (2016) advocates that infographics can help a person to remember more than 70% of the data that they have seen on an average. Mol, L (2011) asserted that infographics are a part of information visualization and do what visualization does. They possess clarity, accuracy and reliability which enable to comprehend data. Adams (2011), Mol (2011), Smiciklas (2012), Costill (2013), McCartney (2013), Rossow (2013) and Willmer (2015) support that infographics are graphic visual

representation of data, information and knowledge intended to present complex information clearly and quickly. Veszelszki (2014) examines the relationship between information visualization and linguistics from a linguistic point of view and suggested two directions: (a) the manner and the reason behind visualizing information in linguistics, and (b) the mode of integrating visuals and texts. Fernandez (2014) followed the two paths and recommended infographics as a teaching strategy. It should be used for teaching specific grammar points like vocabulary and language functions to develop critical and creative thinking. Wooten and Jernigan (2015) took a linguistic path when defining infographics. They believe that infographics is similar to the writing process that has sub-processes: generating ideas, drafting, revising, edition, and then publishing. Reitz (2014) states infographics as a visual way of conveying data, information ideas and concepts, in a quick, easy, and exciting way, being an effective communication tool. Lema (2012) asserts that infographics can also be used as a presentation tool in an educational setting. Matrix and Hodson (2014) stress that the use of infographics is a pedagogical approach or a pedagogical strategy in which learners, especially the visual ones, communicate information, retain, and remember it effectively. Infographics can be a sharing information tool that helps learners communicate information in different ways, which in turn, can inspire what it can be called peer-to-peer critique. Students, therefore, will be able to have valuable reflections and insights on what their peers have provided. McCartney (2013) avers those infographics can be an effective teaching tool either while planning the lesson or delivering it in the classroom. Through a guided discovery process, students could identify if information provided is reliable, discover relationships between different pieces of information, and conclude how well the information is categorized.

Dewantari, F., et. al (2021) study shows that infographics can be used as a medium to teach English for independent learning. It implied that teachers' technology-based teaching skills can be assisted by developing infographic teaching media. Tatyana (2020) defined infographic features such as scalability, structure-based, visual simplicity, and emphasis on the relationship between elements. The study concluded that the designers need to use a cognitive approach to infographics for creating effective educational products. Ali M. AlShehri (2017) addresses how infographics can be used to develop different language skills in EFL classes and proposes a conceptual framework for using infographics. Gede Krisna Meialldy Putra, I (2021), reviews previous studies related to utilization of infographics to enhance the EFL students' reading interest and designed a scenario of utilizing the infographics in the classroom. It was found that the utilization of infographics enhances the students' reading interest since the development of technology nowadays can help teachers to design the infographic using software and online platforms easily. Use of infographics reduces the students' boredom, increases their will to read, and develop their ability to think critically and organize ideas. Tamer Ibrahim and Ameerchund Maharaj (2019) examine the effectiveness of vector infographics on ESL students' acquisition of grammar, especially the use of tenses. The results suggested that infographics, as a cognitive educational tool, improves student learning outcomes. Lam Ky Nhan and Phuong Hoang Yen (2021) evaluate the impact of infographics-based learning on students' motivation in English language grammar course.

As stated earlier, the first research question was to know the students' perceptions towards using infographics in teaching and learning process. It is apparent from Table 1 & Figure 1 that majority of the sample are willing to use infographics and expressed (+)ve opinion. The second research question was to identify the students' attitude towards using infographics in teaching

and learning process. It is clear from Table 2 & Figure 2 that a majority of the students do have (+)ve attitude to use infographics in teaching, learning and assessment process. It is evident from Table 3 & Figure 3 that students are enthusiastic to use infographic applications to do their assignments/course projects.

Sudakov et al. (2015) defined infographics as an educational tool for teaching, learning and also assessment which inspired the researchers to undertake this research endeavour. The research studies of Bin Dahmash (2017), Nwosu (2018) and Adetunmbi (2022) helped the researchers to design the question items for the questionnaire to meet the requirements of the study. Husni Naparin and Aslina Binti Saad (2017) investigate infographics application in the field of education. The analysis showed that 30 articles discussed the infographics, 18 articles elaborated infographics in education field, and 7 articles explained infographic designs. Nwosu Ebere Hope and Williams Cheta (2018) studied the effect of infographics on academic performance, attitude, and class size of undergraduate students on media systems. They recommended teachers to use infographics and encourage students to develop positive attitude in using infographics in various courses. Huseyin Bicen and Mobina Beheshti (2017), assert that teaching by infographics helps students to interpret visual knowledge and provide a broader and extensive body of learning. Serkan, Embiya, Gürkan, Abdullatif Kaban (2016), used infographic reader questionnaire to seek students' opinions. The students opined that infographics are highly instructive and perceived that they ensure a lasting learning experience. Adetunmbi L. Akinyemi, Owolabi P. Adelana, Oluwakemi D. Olurinola (2022), examine pre-service teachers' knowledge and readiness to use infographics as teaching and learning tools. The results recommended that the teacher education curriculum needs to be upgraded and incorporate training in teaching and learning through modern digital technologies, with change in the 21st Century education system. Bin Dahmash, A., Ashwag Al-Hamid, A., & Alrajhi, M. (2017) investigate the impact of using infographics in teaching of linguistics to Saudi students. The findings showed that the students had positive attitude towards use of infographics. The participants through constant practice of using infographics got benefitted in higher thinking skills, collaborative learning, and information analysis.

It is noteworthy to mention that the findings of the present study overlap with what have been examined by earlier researchers. The findings of the study are that a majority of the sample: i) have (+)ve perceptions on infographics. ii) have (+)ve attitude on infographics and are willing to use infographics to complete their assignments/course projects. It has been inferred that there is an impact of infographics on students in the teaching, learning and assessment process. This finding has been in line with the research studies of Meeusah and Tangkijviwat (2013), Borucu (2015), Gaille (2016), Nwosu (2018), Yulia (2018), Huseyin (2017) and Serkan et.al., (2016). It is significant to state that in the finding, the sample expressed (+)ve attitude towards the use of infographics which is supported by Tatyana (2020), Dewantari, F., et. al (2021), Adetunmbi L(2022), Bin Dahmash, (2017), Ali M. AlShehri (2017), Gede Krisna (2021), Tamer and Ameerchund (2019) and Lam and Phuong (2021). It is indicated that static infographics were used in this study and found significantly effective in linguistic concepts learning, as students could visually navigate the information. This finding is in line with Hassan (2016), Mayer et al. (2005) and Peters (2013).

CONCLUSION

The present study was an ardent effort to accomplish the impact of static infographics as a teaching, learning and an assessment tool on female undergraduate students to know students' perceptions, their attitude towards using infographics in teaching, learning and assessment process and to motivate them to use infographics in their assignments/course projects. The results revealed that using infographics as a teaching strategy motivates students to become active participants in the classes to comprehend the relationship between the graphics and data, develop critical thinking, analytical ability, and logical reasoning. Using infographics as a learning strategy inspires students to learn from their peers/collaborative learning and as an assessment tool, drives them to introspect themselves, develop information analysis to improve their oral presentations and assignments/course projects. Summing up this study, it is recommended that university students should enhance digital awareness and willingness to use infographics in learning contexts. It is suggested that if teachers support, facilitate, and encourage the Saudi students to use infographics they would become autonomous learners and be successful in their academic endeavours.

References

1. Adams, D. (2011). What are infographics and why are they important? Retrieved from: www.instantshift.com/2011/03/25/what-are-infographics-and-why-are-they-important/.
2. Afify, M. K. (2018). The effect of the difference between infographic designing types (static vs. animated) on developing visual learning designing skills and recognition of its elements and principles. *International Journal of Emerging Technologies in Learning (IJET)*, 13(9), 204-223. <https://doi.org/10.3991/ijet.v13i09.8541>
3. Akinyemi, A., Adelana, O., & Olurinola, O. (2022). Use of infographics as teaching and learning tools: Survey of pre-service teachers' knowledge and readiness in a Nigerian university. *Journal of ICT in Education*, 9(1), 117-130. <https://doi.org/10.37134/jictie.vol9.1.10.2022> <https://doi.org/10.37134/jictie.vol9.1.10.2022>
4. Ali M. AlShehri (2017), Can Infographics be Pedagogically Used in EFL Classes?*, *Occasional Papers in the Development of English Education* 63(2):5-30, DOI:10.21608/opde.2017.88007
5. Anne Trafton (2014), MIT News Office, Psychonomic Society, <https://www.psychonomic.org/news/296289/MIT-neuroscientists-find-the-brain-can-identify-images-seen-for-as-little-as-13-milliseconds..htm>
6. Baglama, B., Yucesoy, Y., Uzunboylu, H., & Özcan, D. (2017). Can infographics facilitate the learning of individuals with mathematical learning difficulties. *International Journal of Cognitive Research in Science, Engineering and Education*, 5(2), 119-128. <https://doi.org/10.5937/IJCRSEE1702119B>
7. Bin Dahmash, A., Ashwag Al-Hamid, A., & Alrajhi, M. (2017). Using Infographics in the Teaching of Linguistics. *Arab World English Journal*, 8 (4). DOI: <https://dx.doi.org/10.24093/awej/vol8no4.29>
8. Borucu, A. (2015). Contribution of infographics for teaching technique in fine arts high school during the graphic lesson. URL: <http://library.sdu.edu.tr/veritabanlari/Tezler>
9. Çifçi, T. (2016). Effects of infographics on students' achievement and attitude towards geography lessons. *Journal of Education and Learning*, 5(1), 154-166. <https://doi.org/10.5539/jel.v5n1p154>
10. Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3(3), 149-210. <https://doi.org/10.1007/bf01320076>

11. Costill ,A. (2013). 6 benefits of using infographics. Retrieved from: www.searchenginejournal.com/6-benefits-using-infographics/70917/.
12. Davidson, R. (2014). Using infographics in the Science classroom: Three Investigations in which students present their results in infographics. *The Science Teacher*, 18(3),38.
13. Dewantari, F., Utami, I. G. A. L. P., & Santosa, M. H. (2021). Infographics and independent learning for English learning in the secondary level context. *Journal on English as a Foreign Language*, 11(2), 250-274. <https://doi.org/10.23971/jefl.v11i2.2784>
14. Dunlap, J. C., & Lowenthal, P. R. (2016). Getting graphic about infographics: Design lessons learned from popular infographics. *Journal of Visual Literacy*, 35(1), 42-59. <https://doi.org/10.1080/1051144X.2016.1205832>
15. Fernandez, A (2014). Using Infographics in EFL Classroom. <https://learnerfirstdiary.wordpress.com/2014/05/06/using-infographics-in-the-efl-classroom/>
16. Gaille, B. (2016). 18 Pros and Cons of Infographics. Retrieved from <https://brandongaille.com/18-pros-and-cons-of-infographics/>
17. Gede Krisna Meialldy Putra, I.(2021) The Use of Infographic to Enhance EFL Students' Reading Interest, *Journal of Educational study*, Volume 1 Issue 1 2021, DOI: 10.36663/joes.v1i1.154
18. Harris, S. (2013). 5 important principles of effective infographics. *Search Engine Journal: Alpha Brand Media*. Retrieved from : searchenginejournal.com/5-important-principlels-of-infographics/65085
19. Hassan, H. G. (2016). Designing Infographics to support teaching complex science subject: A comparison between static and animated Infographics (master's thesis). Iowa State University, IA. <https://doi.org/10.31274/etd-180810-5344>
20. Huseyin Bicen and Mobina Beheshti(2017), The Psychological Impact of Infographics in Education, *BRAIN – Broad Research in Artificial Intelligence and Neuroscience*, Volume 8, Issue 4 (December, 2017),ISSN 2067-8957, <https://www.researchgate.net/publication/335137517>
21. Husni Naparin and Aslina Binti Saad (2017), Infographics in Education: Review on Infographics Design, *The International Journal of Multimedia & Its Applications (IJMA)* Vol.9, No.4/5/6, December 2017, DOI: 10.5121/ijma.2017.9602, <https://www.researchgate.net/publication/322334733>
22. Ismaeel, D. A., & Al Mulhim, E. N. (2019a). Impact of e-learning strategies to design e-portfolio on achievement motivation and product quality. *International Journal of Distance Education Technologies (IJDET)*, 17(2), 59-73. <https://doi.org/10.4018/ijdet.2019040104>
23. Ismaeel, D. A., & Al Mulhim, E. N. (2019b). Influence of augmented reality on the achievement and attitudes of ambiguity tolerant/intolerant students. *International Education Studies*, 12(3), 59-70. <https://doi.org/10.5539/ies.v12n3p59>
24. Ismaeel, D. A., & Al Mulhim E. N. (2021). The influence of interactive and static infographics on the academic achievement of reflective and impulsive students. *Australasian Journal of Educational Technology*, 37(1), 147-162. <https://doi.org/10.14742/ajet.6138>
25. Joern, Lengsfeld. (2018). Digital Age. <https://joernlengsfeld.com/en/definition/digital-age/>
26. Korbach, A., Brünken, R., & Park, B. (2017). Measurement of cognitive load in multimedia learning: A comparison of different objective measures. *Instructional science*, 45(4), 515-536. <https://doi.org/10.1007/s11251-017-9413-5>

27. Lamb, A., & Johnson, L. (80.8, April). Infographics part .: Invitations to inquiry. *Teacher Librarian*, 8.(8), 68–62. Retrieved from <http://scholarworks.iupui.edu/bitstream/handle/.206/2620/tl880.8.pdf?sequence=.&isAllowed=y>
28. Lam Ky Nhan and Phuong Hoang Yen (2021), The Impact of Using Infographics to Teach Grammar on EFL Students' Learning Motivation, *European Journal of Foreign Language Teaching*, ISSN: 2537 - 1754 ISSN-L: 2537 - 1754 , Vol.5, Issue 5 www.oapub.org/edu, Doi: 10.46827/ejfl.v5i5.3919
29. Lema, C. (2012). Presentations using infographics. Retrieved from: <http://chrislema.com/wp-content/uploads/2012/05/stickyTeachingPoster.pdf>.
30. Lin, C. C., Huang, I., & Wu, S. H. (2018). Effects of dietary infographics and cognitive styles on learners' information processing. *Proceedings of the 7th International Congress on Advanced Applied Informatics*, Yongo, 358-361. <https://doi.org/10.1109/IIAI-AAI.2018.00077>
31. Mahmoudi, M. T., Mojtahedi, S., & Shams, S. (2017). AR-based value-added visualization of infographic for enhancing learning performance. *Computer Applications in Engineering Education*, 25(6), 1038-1052. <https://doi.org/10.1002/cae.21853>
32. Marabella, A. (2014). Communication theories: An infographic development project. Master of Arts in Professional Communication.
33. Matrix, S. and Hodson, J. (2014). Teaching with infographics: Practicing new digital competencies and visual literacies. *Journal of Pedagogic Development*, 4(2), 1-19. Retrieved from: <https://www.beds.ac.uk/jpd/volume-4-issue-2/teaching-with-infographics>
34. Mayer, R. E., Hegarty, M., Mayer, S., & Campbell, J. (2005). When static media promote active learning: Annotated illustrations versus narrated animations in multimedia instruction. *Journal of Experimental Psychology: Applied*, 11(4), 256. <https://doi.org/10.1037/1076-898x.11.4.256>
35. McCartney, A. (2013). How to turn infographics into effective teaching tools. Blog Home. Retrieved from: blog-visual.lu/how-to-turn-infographics-into-effective-teaching-tools/
36. Meeusah, N., & Tangkijviwat, U. (2013). Effect of data set and hue on a content understanding of infographic. *ACA2013 Thanyaburi: Blooming Color for Life*, December 11-13, 2013, 272-275. <http://www.repository.rmutt.ac.th/xmlui/handle/123456789/1263>
37. Midori Nediger (2023), How to Make an Infographic in 5 Easy Steps — Fast (2023 Guide), <https://venngage.com/blog/how-to-make-an-infographic-in-5-steps/>
38. Miller (1956) Information Processing Theory, SUNY Cortland, <https://web.cortland.edu/~frieda/Idtheories>
39. Mol, L. (2011). The potential role for infographics in science communication. Master Thesis Communication Specialization. Vrije Universiteit Amsterdam.
40. Mohamed, A. A. E. F. (2020). A website based on infographic for developing students' reading comprehension of economic issues. *International Journal of Engineering Research & Technology*, 9(2), 434-442. <https://doi.org/10.17577/ijertv9is020138>
41. Nwosu Ebere Hope, and Williams Cheta, "Effect of Infographics on Academic Performance, Attitude and Class Size of Undergraduate Students' on Media Systems." *American Journal of Educational Research*, vol. 6, no. 1 (2018): 83-87. doi: 10.12691/education-6-1-13.
42. Ozdamli, F., & Ozdal, H. (2018). Developing an instructional design for the design of infographics and the evaluation of infographic usage in teaching based on teacher and student opinions. *EURASIA Journal of*

- Mathematics, Science and Technology Education, 14(4), 1197-1219.
<https://doi.org/10.29333/ejmste/81868>
43. Peters, D. (2013). *Interface design for learning: Design strategies for learning experiences*. Pearson Education.
 44. Riding, R. J., Glass, A., Butler, S. R., & Pleydell-Pearce, C. W. (1997) Cognitive style and individual differences in EEG alpha during information processing. *Educational Psychology*, 17(1-2), 219-234.
<https://doi.org/10.1080/0144341970170117>
 45. Riding, R., & Rayner, S. (2013). *Cognitive styles and learning strategies: Understanding style differences in learning and behavior*. Routledge. <https://doi.org/10.4324/9781315068015>
 46. Reitz, E. (2014). *Infographics in the classroom*. Retrieved from:
<http://opiuno.wordpress.com/author/erinkingreitz/page3/>.
 47. Rossow, P. (2013). *A Primer on Infographics in the classroom*. Retrieved from:
www.teachthought.com/literacy-2/a-primer-on-infographics-in-the-classroom/
 48. Serkan, Embiya, Gürkan, Abdullatif Kaban (2016), A Study on the Development of an infographic reader questionnaire and reader opinions, *SHS Web of Conferences* 31, 01009 (2016), ERPA2016, DOI: 10.1051/shsconf/20163101009
 49. Shafipoor, M., Sarayloo, R., & Shafipoor, A. (2016). Infographic (information graphic): A tool for increasing the efficiency of teaching and learning processes. *International Academic Journal of Innovative Research*, 3(4), 39-45. <https://www.iaiest.com/data-cms/articles/20191107034716pmlAJPL1510004.pdf>
 50. Shaltout, M., & Fatani, H. (2017). Impact of two different infographic types “interactive static” on developing mathematical concepts among female students at second grade intermediate in the Kingdom of Saudi Arabia. *International Journal of Research and Reviews in Education*, 4, 1-8.
https://www.researchgate.net/publication/320961540_Impact_of_two_different_infographics_types_interactive-static_on_developing_mathematical_concepts_among_female_students_at_second_grade_intermediate_in_the_Kingdom_of_Saudi_Arabia
 51. Smiciklas, M. (2012). *The power of infographics. Using pictures to communicate and connect with your audiences*. Indiana: Pearson Educational Inc.
 52. Sudakov, I.; Bellsky, T.; Usenyuk, S. and Polyakova, V. (2014). *Mathematics and climate infographics: A mechanism for interdisciplinary collaboration in the classroom* [phics.edu.ph]. Retrieved from:
arxiv.org/pdf/1405.6435.pdf
 53. Sweller, J.(1994). Cognitive Load Theory, learning difficulty and instructional design . *Learning & Instruction*, 4, 295-312.
 54. Sweller, J. (2002). *Visualisation and instructional design*. *Proceedings of the International Workshop on Dynamic Visualizations and Learning*, Tübingen: Knowledge Media Research Center, 1501-1510.
<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.325.3783>
 55. Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive load theory*. Springer. <https://doi.org/10.1007/978-1-4419-8126-4>
 56. Tamer Ibrahim and Ameerchund Maharaj (2019), *The impact of Infographics on Language Learning*, *International Journal of Computer Science and Network Security*, VOL.19 No.12, December 2019

57. Tatyana Bystrova, (2020), "Infographics as a Tool for Improving Effectiveness of Education" in Convention 2019 "Modernization and Multiple Modernities", KnE Social Sciences, pages 152–158. DOI 10.18502/kss.v4i13.7710
58. Vanichvasin, P. (2013). Enhancing the quality of learning through the use of infographics as visual communication tool and learning tool (pp. 135-142). In the Proceedings ICQA 2013: The International Conference on QA Culture: Cooperation or Competition. Bangkok: Offset Plus. Retrieved December 13, 2014, from http://www.icqa2014.com/downloads/Proceeding_29.pdf.
http://www.onesqa.or.th/upload/download/file_652389fe995da641ccd9bc686b72df3d.pdf#page=136
59. Veszelszki, A. (2014). Information visualization: Infographics from a linguistic point of view. Personal contact (email: veszelszki.agnes@gmail.com)
60. Willmer, R. (2015). Making data more engaging using infographics. Safe States Annual Meeting, EDC: Learning Transforms Lives.: ChildrenSafetyNetwork.org
61. Wolfe, C. (2009). Mezirow's transformational theory. Retrieved from: www.Associatedcontent.com/article/1584683/mezirows-transformational-learning.html
62. Yildirimi, S. (2017). Approaches of designers in the developed educational purposes of infographics' design processes. European Journal of Education Studies, 3 (1), 248-284.
63. Yildirim, S. (2016). Infographics for educational purposes: Their structure, properties, and reader approaches. Turkish Online Journal of Educational Technology, 15(3), 98-110.
<https://eric.ed.gov/?id=EJ1106376>
64. Yulia Radchenko (2018), Functions of Infographics in Teaching a Foreign Language in High school, The European Proceedings of Social & Behavioural Sciences, <http://dx.doi.org/10.15405/epsbs.2018.12.02.111>.
65. Wolfe, Cindy (2009). Mezirow's Transformational Learning Theory. Available from: www.associatedcontent.com/article/158463/mezirows-transformational_learning.html (March 31, 2009).