

**The effect of Infographics on the cognitive skills development
(Perception and Remembering information)
of Library and Information science Students in New Valley University:
An experimental study**

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The purpose of this paper is to report the findings of a study of utilizing Infographics for learning purposes among a group of library and information science students at New Valley University. The paper also explores the effect of different types of Infographics on students' cognitive skills.

To explore the effect of Infographics, the study employed an experimental approach and questionnaire as an assistant tool to collect data. A sample of (99) participants was selected to elucidate how Infographics affected their cognitive skills. The analysis of the data revealed that the participants had different levels of perception and remembering as a result of being exposed to different types of teaching materials. The data showed that motion Infographics had produced the best results in perception and remembering of information. The results also indicate that static Infographics have produced close results and ranked on the second level, while the text-only approach produced fewer levels of comprehension and recall of information.

This study was conducted with library science students to find the suitability of Infographics in the teaching process. However, the adoption of such an approach in other disciplines may produce different results. This study contributes to the field by expanding our understanding of how the modern teaching approach could help in achieving better results in library science.

Keywords: *Infographics; Visual Learning; Library and Information Science; cognitive skills.*



1. Introduction

There is no doubt that teaching using the Infographics does not replace the university book, but it does support it. The information contained in the scheduled book may be ambiguous and need clarification. Hence one of the tools that proved to be useful for educational purposes is Infographics, which use images and text to support the learning process by increasing the comprehension of the students. On the other hand, another key goal of the Infographic is to summarize the elements of the lesson for easy remembering and retrieval. The researcher believes that the library and information science courses are among the most complex academic courses on topics and elements, not to mention that letters, numbers, and symbols constitute a major content for some courses such as cataloguing, classification, programming, systems analysis and design, and some other courses need a visual representation of their content through preparing the Infographics to develop students' logical perception skills, thus the professor can present his lecture orally via the blackboard supported by a static or motion Infographic that summarizes the lecture elements, The so that the student can remember the content of the lecture easily. In addition to that graduates need to be familiar with the best approaches that can be used to enhance users' experience. There is no doubt that teaching using the Infographics does not replace the university book, but it does support it.

The information contained in the scheduled book may be ambiguous and need clarification. Hence one of the tools that proved to be useful for educational purposes is Infographics, which use images and text to support the learning process by increasing the comprehension of the students. On the other hand, another key goal of the Infographic is to summarize the elements of the lesson for easy remembering and retrieval. The researcher believes that the library and information science courses are among the most complex academic courses on topics and elements, not to mention that letters, numbers, and symbols constitute a major content for some courses such as cataloguing, classification, programming, systems analysis and design, and some other courses need a visual representation of their content through preparing the Infographics to develop students' logical perception skills, thus the professor can present his lecture orally via the blackboard supported by a static or motion Infographic that summarizes the lecture elements, The so that the student can remember the content of the lecture easily. In addition to that graduates need to be familiar with the best approaches that can be used to enhance users' experience; so librarians and academics constantly seek tools that make users and students understand the massive size of information.

Infographics have been defined as a tool that uses both textual and non-textual elements to communicate information to the users and were used mainly for marketing purposes (Taguchi and Ackerman, 2014). However, many studies found that using Infographics for teaching purposes may positively effect on education process (Nuhoğlu Kibar and Akkoyunlu, 2017; Basak et al., 2017; Alyahya, 2019). Hence, the integration of Infographics in the teaching process has become necessary and recommended practices.

In general, teaching using textual content (whether oral) from the textbook or through the explanation on the blackboard, is sometimes not interesting and not useful for some students. Therefore, it can be said that there is a need to identify other approaches or modern technical styles that would benefit Library science students to achieve a better understanding of these courses. Hence, visual teaching or Infographics are thought to be the best alternative to make students understand and absorb the information.

This study seeks to examine the usefulness of Infographics among some students in the library and information science department at New Valley University to determine if Infographics are useful for these students in the field; by measuring the impact of Infographics on their cognitive skills (perception and remembering information).

2. Literature review

2.1 Definitions and Terms

After reviewing the subject literature, the researcher found that Infographic was mentioned in various names, including Information Design, Cognitive Representation, Data Visualization, Mental Imagine, Educational Drawing, Visual Communication, Multimedia Learning, Information Architecture, Analysis Thinking, but Infographics remains the most common and used term in subject literature.

Hsiao et al. (2019, p.26) defined Infographics as “compelling visual formats that can be quickly comprehended and used for presenting complex information”. This definition is consistent with other definitions that described Infographics as a visual display of information that is difficult to understand in order to produce knowledge (Fadzil, 2018), and that described Infographics as graphic work that bring together data visualizations, illustrations, text, and images into a format that easy to understand and give information (Krum, 2013). The Arabic literature in the field of library and information science discussed the terms. A study by Elgallab (2016) argues that Infographics is a technical term designed to facilitate the understanding of complex information through illustrations without having to read much text. Other researchers argued that Infographics is a technological innovation, which provides a visual representation of knowledge and ideas, which facilitates the learning

process. Additionally, it is a tool to build knowledge, ideas, understand the relationships and links between concepts through drawings, shapes, and images that help to establish knowledge in the mind of the learner (Gebre and Polman, 2016). Interestingly, a study by Zayed (2017) argued that the Infographics is not recent educational art, but has existed since ancient times (3000 BC), where the first Infographics in the history when the ancient Egyptians recorded information on the walls of temples and animal skins and clay tablets as a medium for the preservation of information. For example, the artifacts on the walls of Egyptian temples (Fig. 1) contain images and symbols of religious, cultural, and social significance.

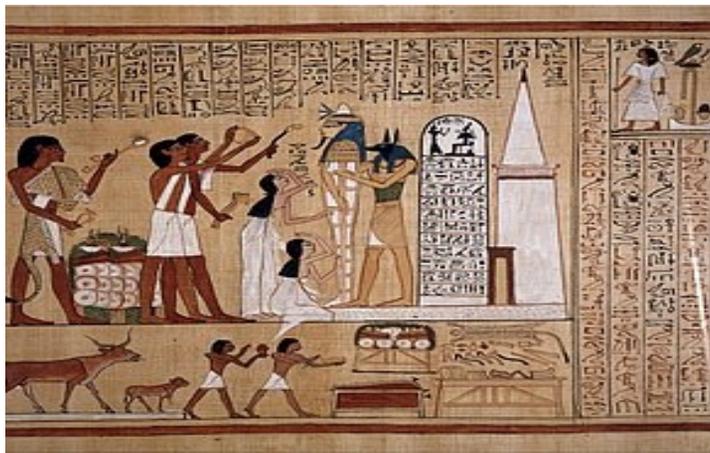


Figure 1 Book of the Dead

However, some studies date the history of the Infographics about 3200 years before the Web, where in ancient times found illustrations (Infographics) in the paintings engraved on the walls of caves and temples, while other studies mention similar illustrations in South America as illustrations that have identical characteristics as Infographics (**Gioglio and Walter, 2014**) (**Magnuson, 2016**).

2.2 Application of Educational Infographics

In the last few years, technological changes have led libraries, especially academic libraries, which is considered the main engine of the educational process in universities, to adopt modern tools that show their services and activities to users in an attractive way. One of the pioneering cases in this regard, Griffith University, which provided Infographics in the libraries in order to motivate students to read and research at the library. This showed a positive impact on students' academic success (**Yamaguchi and Howarth, 2016**). On other hand The Ohio State library launched an initiative called libraries by the numbers by using of Infographics; to advertising about its holdings and services it provides to the public, also

provided an intelligent online tool that enables other libraries to enter their statistics resulting from the services and activities they provide to beneficiaries, and then obtain an Infographics in a manner Curated and attractive, as free service **Enis, M. (2018)**. A study by **Yuvaraj (2017)** argues that this tool (Infographics) has become a major in the dissemination of statistics of library activities. Moreover, it is used as a service of telling or storytelling, i.e., the presentation of the contents of the novel or short story in the form of a concise visual Infographics containing the most important events in the novel or the story to be a catalyst for access to the full sources and browsing. From the researcher's point of view, Infographics can be used in libraries by offering view content (VC) service where the contents of books and scientific journals can be displayed in the form of an Infographics to attract the users to read her collections. **Martin et al. (2019)** noted the physicians prefer browsing abstracts and reviews of medical literature in the form of an Infographics. The study explained that this behavior is a result of trying to avoid “cognitive load”, which is defined in the context of this study as the mental effort of the reader to absorb the information, which can be overcome by summarization, this process can be used in library activities and services as appropriate. One of the successful Arab experiments that the researcher has monitored using Static and motion Infographics in libraries is King Fahd National Library, Where they used the fixed Infographics to provide summaries of the books that it had recently acquired and to provide general advice and advice to beneficiaries such as how to use the library's automated catalogue and how to deposit or request items, also The Northwestern University Library in Qatar has stored 10 million data cells in a single interactive Infographic; this data represents activities and reports related to the library **Ritchie, J. (2018)**. Similarly, **Stoerger (2018)** conducted a study at Rutgers University in the United States. The study aimed to provide students with visual communication skills and creative thinking through digital Infographics projects, which the author referred to as "writing without words" the study trying replaced traditional methods in exams at the end of each course from the “Scantron” test, which is based on multiple-choice and shading, to creative thinking through digital Infographics, Where each student was tasked with converting the written texts into an expressive picture bearing the same idea of the text. One of the most important results of this study is that students were able to show scientific thinking and to mix facts with theories using Infographics. **Fadzil (2018)** designed a study aiming to use Infographics technology to support the educational process at the University of Kuala Lumpur, Malaysia. The sample of the study consisted of (17) males and (23) females. The study concluded that the use of Infographics offers opportunities for development and innovation in teaching and learning in addition to enhancing the understanding of theoretical knowledge through the visual representation of information. Interestingly, all the studies that were reviewed and conducted

similar experiments reached similar results, e.g., (Al-Mohammadi, 2017; Hassan, 2016; Ozdamli et al., 2016; Yildirim, 2016). Mainly, these studies found that Infographics is the best tool to simplify complex topics (Yuvaraj, 2017), encourage analytical thinking (Al-Mohammadi, 2017), enhance creativity (Fadzil, 2018), and encourage creative learning (Gover, 2017).

2.3 The adoption of Infographics in the Arabic literature

Exploring the Arabic literature in the topic showed that there is a lack of Arabic studies in the field of library and information science that focused on the role of Infographics in the teaching process. Most of the retrieved studies focused heavily on the use of Infographics in the field of media, advertising, and marketing. However, three studies were found to discuss the role of the Infographics as a learning tool in library science (Elgallab, 2016; Kenawi, 2019; Abu Dahab, 2018). Kenawi (2019) presented an attempt to develop new tools in the teaching process in the Department of Libraries at Minia University. The study justified the use of Infographics because of its capability in facilitating the process of understanding and increasing concentration and perception. The researcher used the experimental method to detect the impact of the use of Infographics in the teaching of programming. According to the study, 84% lacked the ability to absorb the information in the traditional form, while Infographics succeeded in improving the level of understanding. In a similar study, Elgallab (2016) tried to improve library users' experience at Shaqra university by using the Infographics in training them on how to use the library. The study concluded that the use of the Infographics had made a significant improvement in users' skills as they were able to understand the information provided to them. Another study by Salem (2017) attempted to use the visual Infographics in the educational process. The study reached several results, the most important of which is the effectiveness of Infographics in developing positive thinking skills among students. It recommended that efforts should be made to establish training courses for teachers and students on how to design an Infographics with the need to conduct experimental studies to use different types of Infographics and use them in the development of students' knowledge and skills.

3. Evaluation of Infographics

A study by Siricharoen and Siricharoen (2015) has mentioned that there are five characteristics of the Infographics that should be used for evaluation; clarity, the hierarchy of elements, accuracy, relevance, and finally integrity. On the other hand, the University of Mary Washington (UMW) identified four key features of an effective Infographics (UMW, 2011):

- Usefulness: The Infographics should be easy to understand, and has a clear purpose, contains reliable data, and the viewer can learn from it.
- Legibility: Effective Infographics is characterized by the consistency of colours in order to not obstruct the process of reading; moreover, it should be characterized by clarity of the size of the font and colors. Additionally, the title of the Infographics should reflect the content.
- Design: The design should reflect the purpose of the Infographics, the consistency of the elements so as not to distract the reader; the space used should be reasonable and not leave many spaces.
- Aesthetics aspect should be easy-to-follow. Data and the overall design should be organized in a way that attracts the viewer's attention.

4. The research methodology

The study used the experimental approach as it is believed to be the best approach that suits the nature of this study, and questionnaire as an assistant tool to collect data. The experiments provided a stable working environment to measure the impact, and then the researcher can formulate interpretations on an integrated basis of methodological honesty. The study adopted a pre-prepared measure of perception and remembering used in **EI-Shahawy (2016)**, where the study used the Infographics in the field of communication and media. However, the current study made some amendments that are appropriate to the nature of the study sample. The questionnaire also came as a supporting tool to measure the effect of Infographics on the process of recall and perception among students.

The sample of the study consisted of **(99)** students in Library and Information department at New Valley University. The sample was divided into three equal groups to measure the impact of the use of Infographics on the process of perception and understanding on their part. The Open Source Systems Marketing Report 2018 was translated into Arabic and then presented to the students divided into three groups. Each group consisted of **(33)** students', as shown in the following figure.

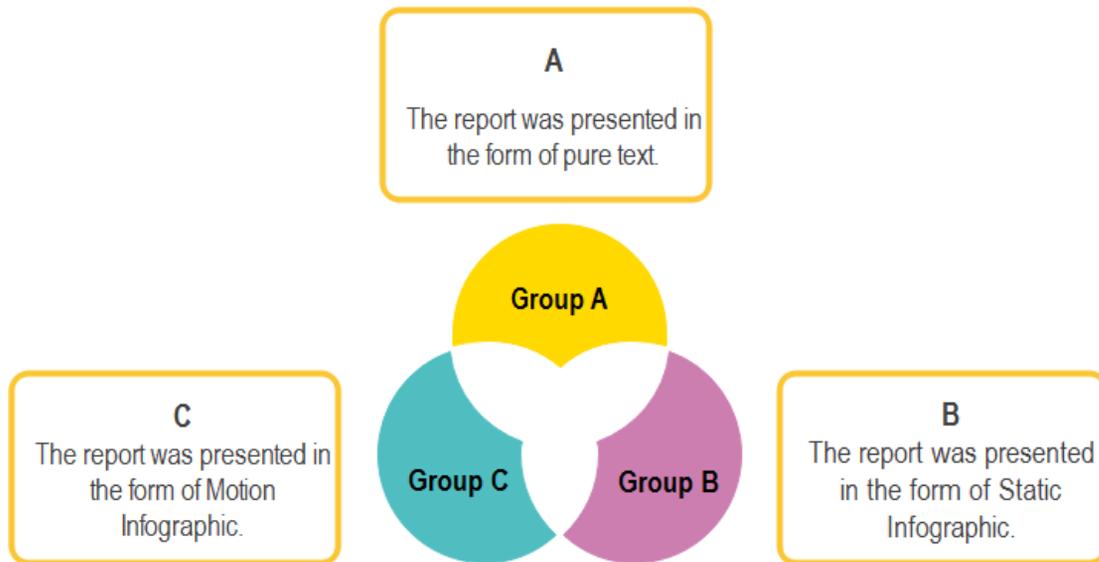


Figure. 2 Sample distribution

To ensure the constancy and reliability of the experiment to reach accurate results, the researcher has developed four main determinants:

1. Standardize the time of conducting the experiment, which is seven minutes for all participating groups (A, B, C) to read the displayed content and then answer the questionnaire.
2. Distribute the same questionnaire among the three groups.
3. To avoid having prior knowledge of the topic which would affect the results of the study, the researcher chose a subject that has not been discussed in the educational process in the department, which is the open-source software marketing report.

5. Research objectives

The main objective of this study is to measure the effect of the use of Infographics in cognitive skills (Perception and remembering information), to determine if it is suitable in the teaching process for libraries and information students. The study utilized three forms of educational item, as follow the pure text, Static Infograph, and motion Infograph. Additionally, the study aimed to design a proposal for the use of Infographics for educational purposes.

6. Data analysis

6.1 Students' remembering level

Free-recall - The impact of the displayed content (Text - Static Infographics - Motion Infograph) was measured on the study sample. This was done by asking a question that requires them to write what they remembered from the content they were offered, "Write what you remember." The answers were represented in four levels; the first level (no recall) means that the respondent does not remember any information presented in the content of the report or the information he wrote is wrong. In the second level (low recall), in this case, the respondent may remember only one piece of the total information included in the report.

The third level (intermediate recall), When the respondent remembers more than one information and is correct, and the fourth level (high recall) is given to the respondent who answered most of the information in the report. The responses of the respondents were as shown in the following table:

Table 1 Free recall levels

Level Content Type	Free recall levels							
	No recall		Low recall		Intermediate recall		High recall	
	Number	%	Number	%	Number	%	Number	%
Text	0	0	13	39.40	11	33.33	9	27.27
Static Infographics	0	0	7	21.21	12	36.36	14	42.42
Motion Infographics	0	0	6	18.18	10	30.30	17	51.51

As outlined in table (1), there is a degree of variation in the levels of free recall in the three groups (Text - Static Infograph - motion Infograph). Notably, the number of participants who showed a low recall level in the text material presented was high (39%), which represents (13) members of the sample. Expectedly, the participants who revealed high recall of the text was (27.27%), this percentage represents (9) of the sample. It is believed that this result is because the Static text lacks interactivity and attractiveness that would make the sample focus and remember, as well as random organizing information, which loses sample members the ability to focus and remember information.

The level of recall of the static Infograph was better than the level of recall of text. The number of students who showed a high recall level was (14) students (42.42%). The high rate of students remembering Static Infographics is likely because of several factors. These factors can be summarized in (1) the organization of information,(2) presenting the information in a sequential form, and (3) replacing the text with the image which attracted the attention of the sample. Overall, the previous factors lead to a high recall percentage and

achieving better understanding. Compared to the previous two experiments (text - static Infograph), the low recall level decreased when motion Infographics implemented to **(18.18%)** as only 6 of the respondents showed low recall level of the information, while the accurate recall rate increased to **(51.51%)** which represents **(17)** members of the sample; thus, the motion Infographics becomes the most remembered form of the sample.

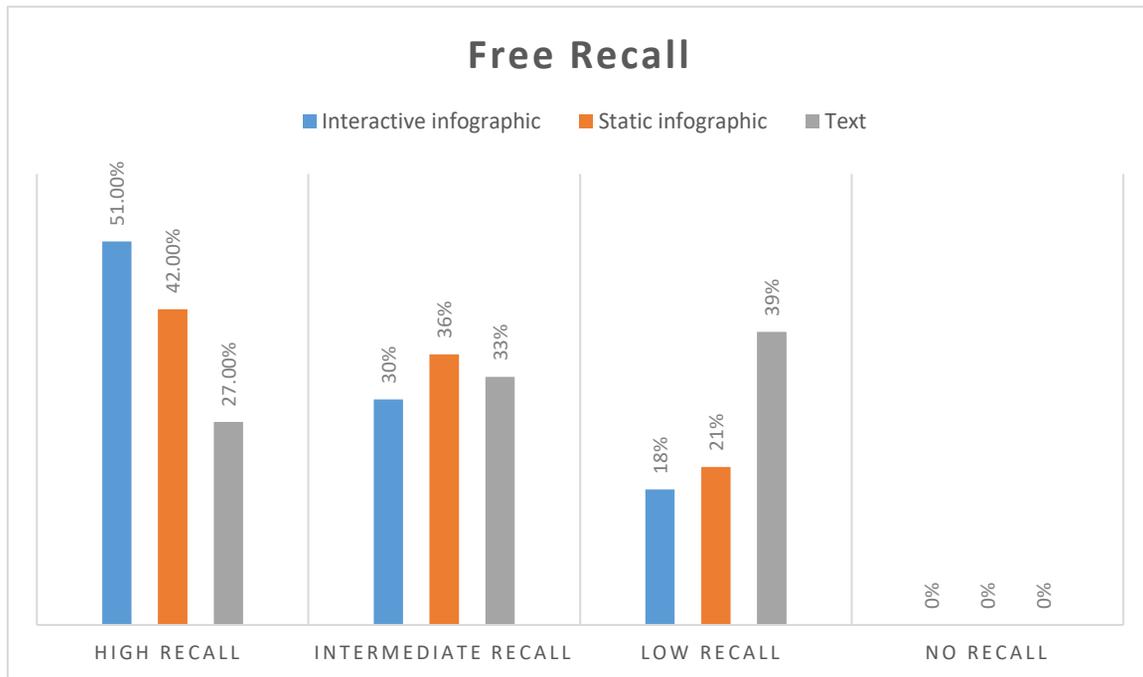


Figure 3 Free recall levels

Accurate recall - The level of accurate recall was measured by asking four predetermined questions to be answered by the respondents. These questions are linked to the most popular content management systems, as shown in table (2):

recall levels 2 Table

Question	Recall levels				Answers showed in the content
	No-recall	Low	Intermediate	High	
Q1	0	1	2	4-3	4 systems
Q2	0	1	2	4-3	4 Statistical reports
Q3	0	2-1	3	5-4	5 Historical events
Q4	0	2-1	4-3	7-5	7 Web sites

The report presented the names of (4) content management systems, and the usage statistics for each system. Additionally, the report presented (5) historical events from the oldest to the newest, which represent the timeline for the emergence of content management

systems. The names of sites using these systems were also stated in the report. The data included seven websites that were also presented in the report. Thus, the responses were given quantitative and numerical values according to the report, as shown in the previous table.

Table 3 Accurate recall levels

Level Content	Accurate recall levels							
	No recall		Low recall		Intermediate recall		High recall	
	Number	%	Number	%	Number	%	Number	%
Text	2	٪6	13	٪39.3	10	٪30.3	8	٪24.2
Static Infographics	1	٪3	7	٪21.2	9	٪27.2	16	٪48.4
Motion Infographics	1	٪3	5	٪15.1	7	٪21.2	20	٪60.6

It is clear from table (3) that motion Infographics is the most form of content that achieved a high rate of accurate recall, where (20) respondents of the questions addressed them accurately and directly; the motion Infographics is characterized by expressive movements that help to present it in a creative way, fun, and attract the attention of viewers during the presentation. The motion Infographics can draw a scenario in the viewer's mind, as it combines text (information), motion picture, and sometimes sound, thereby it contributes in increasing their focus and ability to remember.

On the other hand, the static Infographics ranked in the second place in achieving a high percentage in the level of accurate remembering. Sixteen of the respondents of the sample answered the questions accurately. This is because static Infographics combines two main elements that can affect the process of understanding and remembering: text (information) and image; therefore, it can be said that the static Infographics with an attractive view makes it easier for the student to absorb the information and increase their ability to remember it when needed.

6.2 Students' perception level

In order to measure the level of perception (understanding or comprehension), the researcher presented six multiple-choice questions and five other questions in the form of true or false regarding the information that was presented in the experiment (text - Static - motion Infographics) as shown in the following table (4):

Table 4 Perception levels

	Perception levels
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Level Content	No Perception		Low Perception		Intermediate Perception		High Perception	
	Number	%	Number	%	Number	%	Number	%
Text	4	٪12.12	7	٪21.21	14	٪42.42	8	٪24.24
Static Infographics	2	٪6.06	5	٪15.15	12	٪36.36	14	٪24.42
Motion Infographics	3	٪9.09	5	٪15.15	9	٪27.27	16	٪48.48

After analyzing the responses of the participants, it was found that, the highest level of perception achieved by the motion Infographics, as there are **(16)** participants representing **(48.48%)** indicated the ease of understanding the displayed content without the need for clarification. The Interactive influencer of the Infograph helped the participants to retrieve information and remember it for a long time. Followed by Static Infographics, which depends mainly on the sense of sight, and perhaps one of the main reasons for the high percentage of remembering by using this type is that the mind processes pictorial information 60,000 times faster than text information **(Gaber, 2018)**.

This result is consistent with many of the studies outlined in the literature, as it achieved a high percentage of the recall by the sample's 14 members, who represent **(24.42%)**. While the text showed the lowest percentage of high perception, where **(8)** of the respondents indicated this represented **(24.24%)**. The reason for this is that the (verbal) textual information confuses the recipient as well as the difficulty of perceiving the information contained in the content, and then some may resort to memorizing these concepts without understanding and awareness of the meaning.

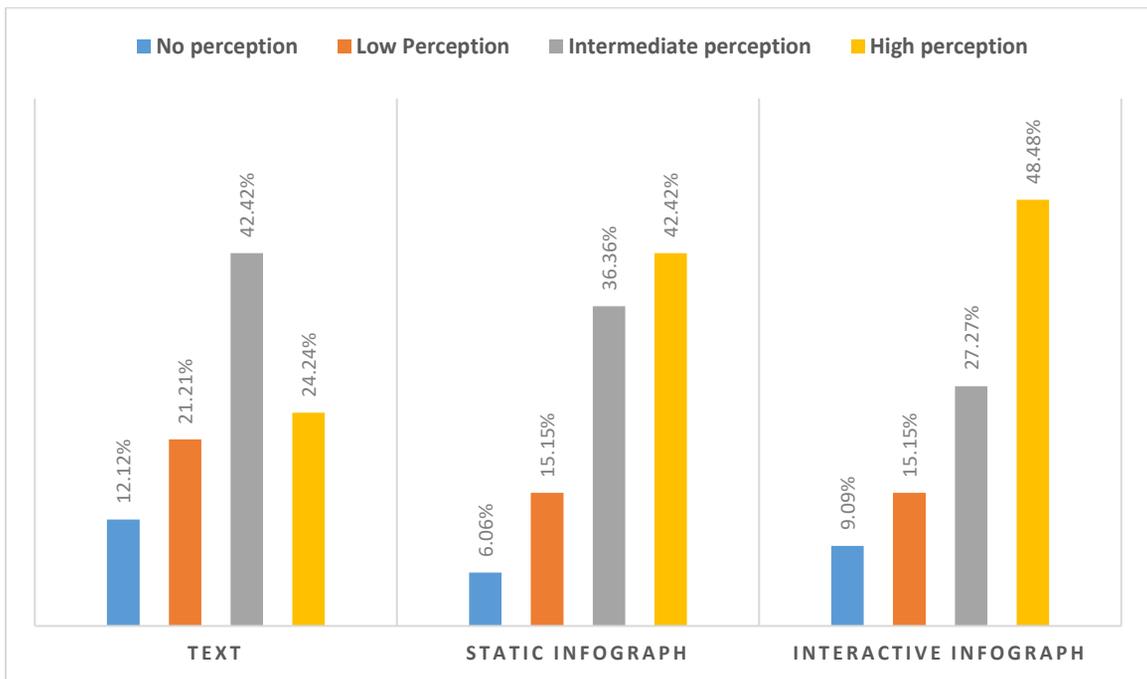


Figure 4 Perception levels

7. Discussion (proposed model)

A Proposed concept of Infographics design stages for educational purposes:

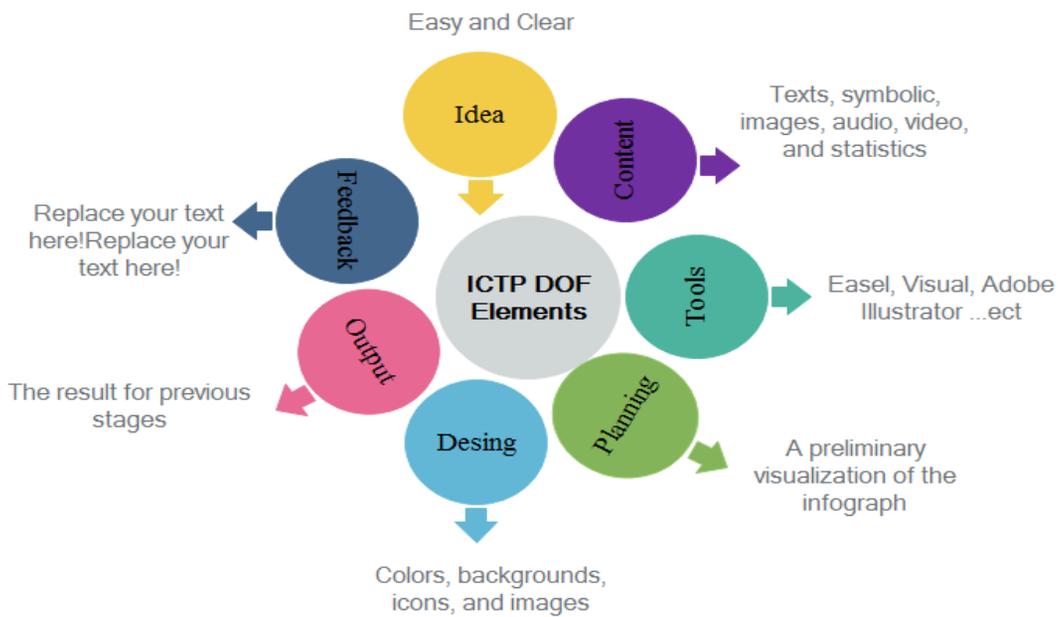


Figure 5 Stages of Educational Infographics Design (ICTP DOF)

The study proposes a model called (ICTP DOF), the initials of the stages of the design of educational Infographics, which can be adopted by the faculty staff for the educational process. This model consists of seven main stages, as shown in the following figure (5):

- **Idea:** is the focus of the Infographics, and It should be taken into account while designing an Infographics that the idea should be clear, not having many interpretations, easy to understand, and can be implemented in the form of an Infographics.
- **Content:** It is a representation of the idea of Infograph through texts, images, and statistics, to reduce the texts in the content; this is considered the main objective of the Infograph is to make it free from the limitations of the text and represent them in an interesting and simplified way that reflects the content. It should be noted before proceeding with the processing of the content, it is necessary to make sure that the information is correct and up-to-date, in addition to checking the spelling and grammatical mistakes. Moreover, the information should be double-checked to make sure that the information is credible.
- Tools:

A - design tool: When designing Infographics for educational purposes, there is a need for a tool to design, and it is worth mentioning that there are many tools available for free design to Infographics, such as Easel, Visual, Motion, and etc..

B- Communication Tool: In order to provide students with an Infographics that is prepared by the professor in advance as an explanatory aid. The communication tool should be provided to send the Infographics to students for later use during the study, such as WhatsApp, Facebook, Twitter, Instagram, and other tools.

- **Planning:** the Initial visualization of what the Infographics will look like in terms of form, categories, and sub-categories. To achieve the success of this process, it can be carried out manually by drawing the Infographics manually on a paper, And which is called Sketch Draw, Where this process will save time and effort in the actual design stage of the Infographics. so this process depends on art and creativity on the term of the design.
- **Design:** the design process is the product of the previous stages and is the translation of the layout to the digital form. It should be noted that when

designing the Infographics that it is characterized by simplicity and interdependence of the components, as well as the selection of colours, backgrounds, and icons and images, and choose a distinctive title of the Infographics attract attention.

- **Output:** is the final form of the Infographics, the success of which depends on the correct representation of information as outlined in the previous stages.
- **Feedback:** It is a test of the clarity and integrity of the Infograph, by presenting it to students and receiving their comments.

Conclusion

The study has found that Infographics have proved to be a useful tool in teaching in library science. also study was done by measuring free recall, accurate recall, and comprehension level. In the three stages of the study, it was found that both Static and motion Infographics have affected the level of information understanding and perception by students. the results of the current study were found to be consistent with studies that were conducted in other fields, e.g. (Elgallab, 2016; Kenawi, 2019; Falk, 2016; AL-MOHAMMADI et al., 2017). It is important to mention that the sample of the study consisted of Arab language speakers' students, and the Infographics were presented in the Arabic language, which proved that Infographics could be utilized successfully in other languages than English and achieve similar results.

Despite the difference in the structure of the language and the type of information, Infographics helped the students to remember and comprehend information.

However, one of the limitations that are associated with the current study is that Infographics were designed to cover only one subject and did not include more subjects in library science, which may affect the results of the study.

The study also proposed a model that would help in designing the Infographics for educational purposes, consists of seven elements altogether contribute in producing Infographics that would be used to help in ingesting information. However, to design the Infographics there should be a clear idea of what the Infographics seek to achieve as it should not be produced consistently without a narrative or a purpose.

It is necessary of training students and faculty members in designing Infographics and integrating them into the educational process to facilitate the process of understanding and remembering information. On the other hand, We must announce Infographics and their

benefits in the educational process through workshops, conferences, scientific seminars, and also research papers.

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تأثير الإنفوجرافيكس في تنمية المهارات المعرفية (فهم وتذكر المعلومات) لدى طلاب قسم المكتبات والمعلومات بجامعة الوادي الجديد: دراسة تجريبية

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المستخلص

تهدف الدراسة الحالية إلى معرفة مدى تأثير الرسوم المعلوماتية (الإنفوجرافيكس) على تنمية المهارات المعرفية (الفهم والتذكر) لدى طلاب قسم المكتبات والمعلومات بجامعة الوادي الجديد بالمرحلة الدراسية الأربعة، والبالغ عددهم (99) طالبًا، استخدمت الدراسة المنهج التجريبي مصحوبًا بالاستبيان كأداة مساعدة لجمع البيانات، تعرضت عينة الدراسة لثلاثة أنواع من المحتوى: (النص – الإنفوجراف الثابت – الإنفوجراف التفاعلي)، وتوصلت نتائج الدراسة إلى تأثير الإنفوجراف التفاعلي في المهارات المعرفية لدى طلاب القسم، حيث حقق أعلى معدل للفهم والتذكر، كما أوصت الدراسة بضرورة تدريب الطلاب وأعضاء هيئة التدريس على تصميم الإنفوجرافيكس ودمجها في العملية التعليمية لتسهيل عملية فهم وتذكر المعلومات، ومن ناحية أخرى يجب الإعلان بالشكل الكافي عن الإنفوجرافيكس وفوائدها في العملية التعليمية من خلال ورش العمل والمؤتمرات والندوات العلمية وأيضًا الأوراق البحثية.

الكلمات المفتاحية: الإنفوجرافيكس؛ التعلم المرئي؛ علم المكتبات والمعلومات؛ المهارات المعرفية.

