

Systematic Literature Review on Infographic Acceptance Factors in Facilitating Teaching and Learning among Students in Higher Education

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Abstract

Infographics are visual representations of information in such a way that information can be easily understood at a glance. Infographics are a form of the most powerful stimulator of visual communication in the digital era, and it is gaining popularity among educators. The creation of teaching and learning materials has become critical for students at all levels of education. However there are still insufficient studies that have systematically reviewed the existing literature on infographic acceptance in higher education. Therefore, this article is intended to conduct a systematic literature review on infographic acceptance in facilitating teaching and learning among students in higher education. The current study has combined multiple research designs, and the review was based on the ROSES publication standard (RepOrting standards for Systematic Evidence Syntheses). This study selected papers using two of the most prominent databases: Scopus and Science Direct, and it used Google Scholar as the secondary database. A thematic analysis was implemented and 4 main themes were produced, namely 1) Presentable and efficient; 2) Understandable, 3) Visual literacy, and 4) Facilitating teaching and learning. The study made several significant contributions to the body of knowledge and for practical purposes. The findings have explained the importance of visual communication specifically infographics as a tool for facilitating teaching and learning process and for providing information on specific research areas and content that should be the focus of future studies.

Keywords: Infographics, Visual Literacy, Higher Education, Teaching and Learning

Introduction

As the demand the rapid analysis of visualization grows, there is an increasing requirement to design visualization tools, which can improve students' understanding in learning. The

development of teaching and learning materials has become crucial for learners in every level of education. In almost every teaching and learning session, the instructors will use all the facilities and teaching tools provided to further enhance the learners' interest and understanding. It has been integrated into the component of classroom visual literacy which substantially contributes to the transfer of information (Ozdamli et al., 2016).

Visual literacy is essential for educators, which requires the ability to implement visual aids to enhance information transfers. The ability to locate, vet, and apply information quickly and effectively is referred to as information literacy. For the learner, using infographics can shorten the development time and allow them to present information to their peers, educators, or future employers. The development of computer technology has been bringing forth numerous applications and media for instructors to apply in their teaching sessions. Most of the instructors have realized that they need to be in line with the fast-changing technology to adapt to the positivism of technology in the classroom.

The term "infographics" refers to a visual representation of data that effectively and plainly conveys complicated information. It is composed of numerous components, including maps, charts, graphics, and photographs. Visual depiction of data enables an efficient flow of information, which aids in data interpretation (Rahim et al., 2016). Infographics, a tool for visual communication, is the most effective stimulant of the visual communication in the digital era today, which continues to gain popularity among the educators (Afify, 2018). Typical implementations can be observed from information communication media, such as newspapers, television broadcasts, websites, etc., where they are used to convey enticing and perpetual ideas (Naparín & Saad, 2017). The visual representation helps to portray ideas or the information in a prescribed contextual manner. Infographics, as visual information including images and graphics, are combined with other modes of meaning making, such as language, color, typography, layout, in complex multimodal compositions. Research studies on the integration of the infographics as an effective tool for facilitating students' learning and conducting their assessment were difficult to find (Dunlap & Lowenthal, 2016). Reflecting upon the increased usage of infographics, the instructional designs are required to instigate infographics for enhancing the educational prospects. Though the use of technology has expanded, the application of infographics in classroom teaching remains limited (Fadzil, 2018). Their emphasis on visual characteristics and multimodality closely relates them with the creation of content and interactive communication during learning and teaching activities. In such a context, infographics can provide a functional and aesthetic presentation of information which could mirror the value of the information/content included as well as the user's understanding of all the infographic elements. Previous studies have assessed whether students prefer infographics to text-only formats, and evaluated their impact on increasing online dissemination. As such, the brief statements and images found in infographics could potentially be easier for working memory to process which could lead to improved information retention. Furthermore, the Dual-Coding Theory suggests that graphics are more likely to be encoded in long-term memory as both verbal and visual traces, and thus the image components of infographics could allow for enhanced retention and improved information retrieval (Martin et al., 2019). Combining data with visual embellishments, infographics can efficiently convey more messages in an interesting and memorable manner than raw data alone.

Research gap-the existing studies towards infographic acceptance in facilitating teaching and learning in higher education.

Scholars are attracted to how infographics have been used and implemented in the education aspect and have examined it from multiple perspectives such as the function and effectiveness of infographics in education. Although there are many studies that focused on implementation, functionality, and effectiveness of infographics in education, there have still been an insufficient number of scholars who have reviewed systematically the existing studies. A systematic review of previous studies is important because it is rarely comprehensive, highly susceptible to reviewer bias, and rarely takes into account differences in the quality of studies (Shaffril et al., 2020). The present paper has attempted to contribute to the existing body of knowledge by developing a systematic literature review on the infographic acceptance factors in facilitating teaching and learning among students in higher education.

A systematic literature review is one of the systematic ways to review existing literature. In addition, the SLR is a method that organizes, chooses, and provides a critical analysis of the earlier studies in order to provide an answer to the question that was formulated (Mohamed Shaffril et al., 2020). Before the review process in the SLR, the protocol or plan is specified. The SLR is a systematic and transparent process in which the searching effort is spread across multiple databases, and a similar process can be replicated and reproduced by other researchers. It describes a rigorous search approach that allows researchers to respond to a specified query (Xiao & Watson, 2017). The systematic review provides details on the review process (e.g., keywords used, article selection) so that others can repeat the research, check the findings, or investigate the generalizability.

Although there are some studies that attempted to perform systematic reviews related to graphics but they were not specifically focusing on the infographics. Scholars have been more focused on the effective implementation of infographics in one particular subject or issue. A study by Chicca & Chunta (2020), for example, placed their focus only on the infographics in nursing education. The lack of studies that have specifically implemented a systematic literature review on the infographic acceptance factors in facilitating teaching and learning among students in higher education has led to a lack of understanding and failure to comprehend the related existing literature in a systematic way.

The review has been driven by the primary research topic about the effectiveness of infographics in higher education. What adaptation techniques for infographics have been implemented by educators in higher education? This research has aimed to address a knowledge gap by systematically reviewing prior studies to get a deeper understanding of recognizing and explaining the implementation and functionality of infographics between educators and higher education students. The literature was chosen for several reasons and platforms. Empirical data shows that educators utilize infographics as teaching and learning methods to enhance information transfer. There is a mounting need to integrate infographic knowledge and its implementation in higher education. Infographic adaptation and strategies are needed in response to the rapid growth of education technology, which can improve students' understanding in learning. This can narrow the gap in available information on conventional teaching methods and infographic adaptation, and encourage educator

alertness and awareness of the role of infographics in higher education development. Furthermore, the study enables the interested parties to understand the current adaptation practiced and enables them to strategize an adaptation plan that they need to be in line with the fast-changing technology used nowadays.

Methodology

The review protocol – ROSES

ROSES is specifically adapted for a variety of synthesis methods common to the field of environmental research, such that narrative and qualitative syntheses (i.e., synthesis of qualitative data) also benefit from the form. Methods for systematic evidence syntheses are becoming an industry standard for cataloging, collating, and synthesizing documented evidence. ROSES stands for RepOrting Systematic Evidence Standards. Syntheses are created specifically for systematic reviews and maps in the field of environmental management (Haddaway et al., 2018). Systematic reviews and maps are conducted through transparent and repeatable processes, maximizing objectivity and attempting to minimize bias throughout the review. ROSES has been adapted specifically for systematic reviews in the field of conservation and environmental management, and as an experienced systematic review, as authors of evidence synthesis methodological guidance, as quantitative and qualitative conservation and environmental research,, and as editors of journals publishing systematic reviews. ROSES aims to prompt researchers to ensure they offer the right information with the correct level of detail. Based on this review protocol, the authors started their SLR by formulating appropriate research questions for the review. Systematic reviews are frequently used to assess the effectiveness of management interventions or the effect of an anthropogenic action or natural impact. More recently, these methods have been used to answer broader questions that deal with complex systems, for example investigating how, and under which conditions, an intervention or an action may have the greatest effect. Based on this review protocol, the authors started their SLR by formulating appropriate research questions for the review. Then, the authors explained the systematic searching strategy which consisted of three main sub-processes, namely identification, screening, and eligibility. Then, the authors proceeded to appraise the quality of the selected articles whereby the authors explained the strategy applied to ensure the quality of the articles to be reviewed. Lastly, the authors explained how the data were abstracted for the review and how the abstracted data were analyzed and validated.

Formulation of the Research Questions

The formulation of the research questions for this study was based on PICO. PICO stands for the population, the phenomena of interest, and the context. PICO is a tool that assists authors to develop suitable research questions for the review. Qualitative reviews seek to understand the meaning of phenomena and their relationships; therefore, a different approach is required in the synthesis of qualitative research. PICO is used to guide the development of a clear and meaningful question. Based on these concepts, the authors have included three main aspects in the review, namely: the student (Population), infographic acceptance (Interest), and higher education (context) which then guided the authors to formulate the main research question of the infographic acceptance in facilitating teaching and learning in higher education.

Systematic Searching Strategies

There are three main processes in the systematic searching strategies process. This study was conducted based on three main phases, namely identification, screening, and eligibility.

Identification

The identification process was a set of activities aiming to systematically search for any synonym and term that was related to the main keywords for this study. The authors were concerned with the quantity, quality, and types of databases that should be used in the SLR. Based on this guideline, there were variant keywords for this study, namely infographic acceptance and visual literacy, and higher education students were selected. The authors developed the basic keywords during the identification process, and with more keywords, the database was able to retrieve more potential related articles for the review. The research questions served as the basis for the creation of the keywords (Okoli, 2015). The identification process included the online thesaurus, keywords used by past studies, keywords suggested by Scopus, and keywords suggested by experts. The researchers needed to select the most appropriate and related database instead of relying on database searching by diversifying their sources and searching techniques. It is believed that researchers who are equipped with full search strings /query development skills can perform more rigorous searching. The two main databases, namely Scopus and Science Direct, are the leading databases in systematic literature reviews due to several advantages.

These databases have advanced searching functions that are comprehensive, and the database quality control has been proven (Martin-Martin et al., 2018). The third database, namely Google Scholar, was selected as an additional database. Whenever appropriate, a combination of keywords, such as “infographics”, “education”, “student”, and “visual literacy”, were practiced via functions of phrase searching and Boolean operator (OR, AND). These four keywords were inadequate and needed to pass the identification process to enrich the keywords by identifying their synonyms, related terms, and variations. However, due to a number of issues and shortcomings, Google Scholar was unsuitable for use as the primary database for the SLR (Gusenbauer & Haddaway, 2020). The problems normally associated with a lack of quality control in Google Scholar are focused on technical shortcomings such as a lower tolerance for complex search strings and a lack of advanced search features (Halevi et al., 2017). Google Scholar, on the other hand, could serve as a valuable supporting database during the search process as in this research (Haddaway et al., 2015). Researchers also should consider manual searching in addition to database searching to expand their list of literature. When doing a search, researchers should place equal emphasis on both the comprehensiveness of their results and the correctness of their findings (Wanden-Berghe & Sanz-Valero, 2012). On the other hand, overly specific keywords will produce more relevant articles but there is the risk of losing records. The searching processes in these three main databases, namely Scopus, Science direct, and Google Scholars resulted in a total of 251 articles.

Screening

Screening is the second process in the SLR and is based on the inclusion and exclusion criteria. Screening is a systematic searching strategy that includes or excludes articles from the review and it is automatically setup by using a sorting function that is available in the database. The criteria for selection are based on the research question as proposed by (Kitchenham et al.,

2009). As it is nearly impossible for researchers to review all the existing published publications, a systematic review is necessary. Researchers should determine the range of period that they are able to review (Okoli, 2015). Based on the searching process on the selected database, it was realized that the number of studies related to infographic implementation and acceptance have been having a massive incrementation since 2014. The author has limited the search from 2014-2022 to get the latest database over an 8 year range and to ensure the quality of the articles, and only articles with empirical data and published in a journal were included. The inclusion process employed the key characteristics of the target population to answer the research questions, whereas the exclusion process considered several characteristics of the population that could have obstructed the study or increased the risk of undesirable results, which would have been excluded from the researcher's consideration. (Patino & Ferreira, 2018). This process had excluded 221 articles as they did not fit the inclusion criteria and did not focus on the infographics that were related to education issues. The remaining 32 articles were used for the next stage, eligibility.

Eligibility

Eligibility was the third process where the authors manually examined all the selected articles in this study to ensure that all the topics were in line with the criteria. Moher (2009) stated that researchers may add papers that do not meet the criteria they establish following the screening procedure. In this study it was done by reading the articles' titles and abstracts. Eligibility is an important manual process that lets the author make up for the database's flaws as much as possible. There were only 17 articles selected in total.

Quality Appraisal

Quality appraisal is a process to determine the quality of the articles' content. In systematic reviews, different researchers use different tools to measure quality because they look at different quality criteria based on their research interests and needs for different systematic review settings (Seehra et al., 2016). The selected articles in this study were presented to two experts for quality assessment as suggested by Walker (2007), and the experts ranked the remaining articles into three quality categories - high, moderate, and low. In this review, only high- and medium-quality papers were considered. The experts concentrated on the methodology of the articles in order to determine the quality rank. This process rated 15 articles as high and 2 as moderate. As a result, all of the remaining articles were eligible for review.

Data Abstraction and Analysis

In this phase, the data extraction and analysis were performed by two experts to minimize errors in the data compilation process for the analysis (Charrois, 2015). Referring to the study's research topic, the experts examined each of the 17 publications in detail, focusing on the abstract, results, and discussion sections. Any data from the reviewed papers that could provide answers to the research questions may have been extracted directly. The experts could discuss any disagreement on the extracted data in deciding whether to maintain or exclude them (Kitchenham and Charters, 2007). The researcher next conducted a thematic analysis to identify the themes and sub-themes based on the efforts related to noticing patterns and themes, clustering, numbering, noting similarities, and identifying the relationships that existed within the abstracted data (Braun & Clarke, 2006). During the thematic analysis, the authors attempted to identify issues that emerged from the abstracted

data of all the selected articles and classified them into a specific group or theme. A total of four main themes were developed. These four themes were then re-examined to ensure the efficacy and relevance to the research. The authors began naming the themes, and the developed themes were presented to two panel experts for evaluation; both experts agreed that the themes were appropriate and relevant to the review results.

Results

Background of the selected articles

The review managed to obtain 17 selected articles. Based on the thematic analysis, 4 themes were developed, namely Presentable and efficient, understandable, visual literacy, and facilitating teaching and learning. Out of the 17 selected articles, 2 studies had been conducted in Canada, 2 in the United States of America, 2 in Malaysia, and 2 articles had been conducted in the Lithuania, and one study was conducted in each of these countries, the UK, Australia, Austria, Finland, Egypt, Saudi Arabia, Argentina, Turkey, and India. Out of 17 selected articles, two were published in 2014, one in 2016, two in 2017, one in 2018, six in 2019, one in the years 2020 and 2021, and three articles published in 2022.

The Themes

Presentable and efficiency

The students provided evidence that the infographics were well received as a means of acquiring knowledge, synthesising information, and presenting findings from the study (Hsiao et al., 2019). The ability to synthesise infographics is a great tool for communicating complicated ideas and procedures. Using the infographics was an engaging and time-saving experience. Moreover, developing the infographics was a pleasant and pleasurable experience for them, and it was more attention grabbing than a conventional study poster (Hsiao et al., 2019). They highlighted the following benefits of presenting scholarly information in the manner of infographics making the content engaging for viewers, making the information easy to understand, and making the information interactive, as well as making them enjoyable to generate (Hsiao et al., 2019). The use of infographics is one way to combat issues that arise from students' limited ability to focus on a single thing for an extended period of time (Jaleniauskiene & Kasperuniene, 2022). Studying in conjunction with the production of infographics has had a significant impact on students' academic achievements due to the fact that they assisted students in comprehending the subject's central ideas, teaching them how to condense information, and increasing their recall of topic-related information (Jaleniauskiene & Kasperuniene, 2022). It has been suggested that the usage of infographics in higher education necessitates the incorporation of digital literacy, which is not merely the ability to utilize digital technologies skillfully but also the ability to engage critically with digital content (Darcy, 2019). Digitally literate people know how to use and make digital media in a responsible and ethical way. They also know how to use technology and how to use ideas well (Darcy, 2019).

Understandable

Studies have shown the ability of infographics to support the students' perceptions of the provided information. This similarity is interpreted by the characteristic of the infographics as a visual communication form which has the ability to deliver the intended meaning of the information visually and assist the student to perceive the information by the carrier of information which is the semiotic signs that are link by a paired summarized text to transmit

visual information (Alqudah et al., 2019). Infographics help students build the critical faculties required to make sense of complex online communication and commercial systems (Martix & Hodson, 2014). As infographics require one to convey the meaning or essence more effectively than a textual description does. Students who use infographics keep their acquired information longer than students who only use graphic texts (Heimbürger & Isomottonen, 2019). This has been supported by Baglama et al (2017); Naparin & Saad (2017), and infographics help learners to realize remarkable amounts of information at once and keep the information in their minds for a long period of time. Further, it is always presented in ways that are designed to influence understanding. Infographic contents include several semiotic categories and graphical designs which depend on the aesthetic thoughts of the students themselves which actually defers from one person to another (Alqudah et al., 2019). Interestingly, using infographics as a visual learning tool leads to increased learning comprehension, and also extends support to connected collaborative learning environments where instruction design using Infographic assignments is fundamental (Alyahya, 2019). The study supplements for the designing of the infographics serve as a great tool for overcoming the challenges and realizing the shortcoming and benefits associated with them, such as developing visual literacy (Alyahya, 2019). This demonstrates that the infographics have helped to meet the objective of being understandable by themselves as well as that a good synthesis of the subject has been achieved (Savini et al., 2019).

Visual Literacy

Infographics are created with the help of digital tools and such practices are suitable to upsurge digital literacy, and it has been proven that those tools have merged both ready-made infographics and students' hands-on experience in creating their own infographics (Jaleniauskiene & Kasperuniene, 2022). The tasks of creating infographics has helped learners to become more creative and increased students' satisfaction with tasks (Jaleniauskiene & Kasperuniene, 2022). Learning from both ready-made infographics and the process of making infographics may enhance visual thinking and encourage students to develop multimodal literacy skills, new visual digital competencies, and all types of skills related to visual literacy (Ozdamli et al., 2016). The respondents have stated that they were able to understand information communicated through the use of visual images or symbols with the implementation of good designs, and infographics are highly suitable to be used for facilitating their learning process (Noh et al., 2015). Infographics help students acquire visual literacy, which helps teachers teach pupils to interpret and evaluate visual information (Namarin & Binti Saad, 2017). This study has proven that visual literacy ability is an important component in determining the ability of the learners to accept the use of infographics as a tool for effective learning of information (Noh et al., 2015).

Facilitating Teaching and Learning

The development of teaching and learning materials has become crucial for learners in every level of education. Infographics help teachers and students to understand difficult and complex materials. Infographics are a flexible medium where educators use their expertise to enhance student learning and with an engagement of students in the creation of infographics could be used to replace traditional teaching/learning methods with more active and innovative ones (Chicca & Chunta, 2020). Infographics might be used in varied ways and for a number of educational purposes, especially for facilitating teaching and learning activities.

As a teaching tool, infographics enhance engagement, memory retention, recall, comprehension, and the development of communication skills (Traboco et al., 2022). Infographics can help educators transform complicated material into more easily digested, engaging, and visually appealing information. Although infographics are a useful teaching-learning strategy, these visual stories are not often used by educators (Chicca & Chunta, 2020). Diversity as a teaching-learning strategy allows infographics to be used with all levels of undergraduate and graduate students in classroom, clinical, and online settings (Chicca & Chunta, 2020). Hsiao et al (2019) suggest that infographics, as an innovative strategy, were used to facilitate this process for undergraduate senior dietetic students. Whenever course materials are supplemented with infographics, they facilitate their acquisition.

Infographics are a promising educational tool across various subjects in higher education (Ozdamli et al., 2016). Infographics both facilitate the acquisition of the subject-related material and help learners to develop a number of real-life and career readiness capabilities and skills (Alqudah et al., 2019). The effect of infographics toward learning and the individual infographics can really support the teaching and learning process of Robust learning with selection of the infographics from many resources and general topics of infographics (Naparín & Saad, 2017). The contribution to the analysis of the literature review on the infographic design in education can become a guideline to solve the problems in education by using infographics (Naparín & Saad, 2017). Alqudah et al (2019) concluded that presenting lecture material in the form of infographics increased students' perceptions and positively affected their interactions. Baglama et al (2017) examined the effect of using infographics on students' achievements and attitudes towards geography lessons, and showed that infographics are an effective way in improving student achievement in geography lessons and triggering positive attitudes towards the lecture.

The effectiveness of the infographics for different grades can also be evaluated regarding the educational lesson's effectiveness and learner's performance. The effective use of infographics has been found to be beneficial in other areas or levels of education including higher education (Baglama et al., 2017). The suitability of infographic creation for knowledge acquisition and enhancement of self-regulation of cognition have been proven (Jaleniauskiene & Kasperuniene, 2022). It was found that reviewing article summaries in an infographic format was associated with lower cognitive load scores than reviewing articles in a text-only abstract format. Participants preferred infographic summaries to traditional text-only research abstract summaries, which was consistent with previous research. These findings imply that infographics could play a role in summarizing medical literature because healthcare professionals prefer infographics to text-only abstracts because they are less mentally taxing to review (Martix & Hodson, 2014). Evidence has shown step-by-step guidelines and resources for using these visual stories to engage learners and simplify complex content and concepts (Chicca & Chunta, 2020). Therefore, there is an emerging need for training courses for the teachers and students on how to create effective infographics in their fields and educators should be encouraged to use infographics while transacting the content (Parveen & Husain, 2021). This will greatly increase the value of an infographic activity.

Discussion

The thematic analysis produced four themes. This section provided additional discussions on the established themes. Presentable and efficient was one of the effective means of using infographics in the teaching and learning process. Infographics have been well received as a means of acquiring knowledge, synthesizing information, and presenting findings from a study (Hsiao et al., 2019). This viewpoint has been further supported by Jaleniauskiene & Kasperuniene (2022) students' achievements improved significantly when they combined their studies with the creation of infographics because the process improved their understanding of the subject's essential principles, taught them to condense material, and improved their recollection of topic-related knowledge. Infographics have been considered as interesting, time-saving, and more attention-grabbing than a traditional study poster (Hsiao et al., 2019). They noted that presenting scientific knowledge in an infographic form makes it entertaining for viewers, easy to grasp, interactive, and fun to create. Furthermore, it has been claimed that the use of infographics in higher education involves the incorporation of digital literacy, which is not only the skillful use of digital tools but also the critical engagement with digital content (Darcy, 2019). Digitally literate individuals are able to use and create digital media in an ethical and responsible manner. They are also adept at utilizing technology and ideas (Darcy, 2019).

Infographics can give a useful and aesthetically pleasing presentation of information that reflects the content's worth and the user's comprehension of all infographic aspects. As a result, infographics have a greater contribution to making information accessible to students in a form that is both straightforward and easy to understand. An infographic format has the capacity to convey the intended meaning of information visually and aids the learner in seeing the information through the information carrier, which is the semiotic indicators that are linked by a matched summary text to transmit visual information (Alqudah et al., 2019). Infographics assist pupils' development of the analytical skills necessary to comprehend complicated internet communication and business systems (Martix & Hodson, 2014). Students who use infographics retain information longer than those who solely use graphical text (Heimbürger & Isomottonen, 2019). Both views have also been supported by (Baglama et al., 2017). Namarin & Saad (2017) stated that Infographics enable learners to comprehend a large quantity of information at once and retain it for an extended period of time; it is always presented in a manner intended to promote comprehension. Alyahya (2019) found that infographics boost learning understanding and facilitate connected collaborative learning environments where Infographic assignments are fundamental. This shows that the infographics are understandable and provide a decent synthesis of the subject (Savini et al., 2019).

Visual literacy is crucial for educators because they need to be able to use visual aids to help students learn. Information literacy is the skill of being able to find, evaluate, and use information quickly and effectively. Visual literacy and infographics are intertwined and play a crucial part in the production of effective visual information. Digital literacy and infographics are about ideas as much as technology. The use of infographics will foster visual literacy, which will assist educators in teaching pupils to interpret and evaluate visual information. They also highlighted that they learned new technical and cognitive skills that will be useful in their study and these skills are a usage of infographic tools, graphic designs, visual literacy, and conceptualization (Heimbürger & Isomottonen, 2019). Such practices are suitable to

increase digital literacy because infographics are created with the assistance of digital tools. It has been proven that those practices that merged both ready-made infographics and students' hands-on experience in creating their own infographics are the most effective ones for accomplishing this goal (Jaleniauskiene & Kasperuniene, 2022; Ozdamli et al., 2016). Visual literacy is an important factor in determining whether or not students will accept infographics as a tool for effective information acquisition (Noh et al., 2015).

The effectiveness of infographics in facilitating the teaching and learning process has been demonstrated in multiple publications. Infographics are a flexible medium where instructors can use their knowledge to boost student learning, and involving students in their development could replace traditional teaching/learning techniques with more active and innovative ones (Chicca & Chunta, 2020). This point of view has been supported even further by Traboco et al (2022) who found that infographics can be used to facilitate teaching and learning in many ways, and infographics can improve learning, memory, recall, comprehension, and communication skills. Infographics assist teachers in turning complex content into engaging, aesthetically appealing knowledge. Infographics are a useful teaching tool, which can be employed with undergraduate and graduate students in classroom, clinical, and online settings (Chicca & Chunta, 2020). Infographics assist students in understanding content and improve real-world and career-readiness skills (Alqudah et al., 2019). The Robust learning method has selected the infographics from various sites and general issues (Naparín & Saad, 2017). Alqudah et al (2019) found that infographics boosted students' perceptions and interaction. Baglama et al (2017) examined the influence of infographics on student achievement and attitude towards geography lessons and found that infographics improve student achievement and stimulate a positive attitude towards the lecture. Infographics have been found useful in higher education. Infographics are useful for knowledge acquisition and cognitive self-regulation (Jaleniauskiene & Kasperuniene, 2022). It is crucial for educators to be prepared to use infographic approaches in the teaching and learning process, given the evidence and support provided by numerous works regarding the effectiveness of infographics in facilitating the teaching and learning process.

Conclusion

Infographics are becoming more popular and are being used by a wide range of industries and organizations. Infographics are a visual communication form that can convey the intended meaning of information graphically and help students interpret it using semiotic indicators linked by a summary text. Infographics are one of these options since they incorporate data visualization, which enhances learning. A positive acceptance among learners of the features available in infographics can also help to resolve some of the problems faced by learners in the learning session. Infographics are a visual form of communication that may reach and resonate with a wide range of people online quickly and effectively. Students can develop the critical thinking skills necessary to make sense of today's complex media, and economic and societal networks by studying infographics. This systematic literature review revealed that using infographics to facilitate teaching and learning in higher education is supported.

It has been suggested that the usage of infographics in higher education necessitates the inclusion of visual and digital literacy, which is not merely the ability to utilize digital technologies proficiently but also the ability to engage critically with digital content. Visual literacy tasks, such as infographics, are crucial to the instructional design procedure and

should be incorporated into future learning models. The presentation of information is always intended to impact comprehension. Digital literacy is the knowledge and ability to utilize and create digital media in an ethical and responsible manner. This study has initiated the idea that visual literacy is a key factor in predicting whether students will accept infographics as a learning tool.

The systematic literature review has also realized that students have come up with different ways to use infographics and a number of technological tools. Educators could make learning experiences that are more varied, meaningful, and interesting. Active learning, such as that displayed by giving students the opportunity to make their own infographics, has been linked to a rise in students' performance in the classroom. Infographics as a learning tool meets the needs of visual learners due to the infographic properties. This article gives evidence that infographics are a flexible way for educators to use their knowledge to help students learn. In addition, the infographic challenge is an excellent example of a high-impact learning experience that meets the expectations of millennial students today.

It has been suggested that the usage of infographics in higher education necessitates the inclusion of visual and digital literacy, which is not merely the ability to utilise digital technologies proficiently but also the ability to engage critically with digital content. Visual literacy tasks, such as infographics, are crucial to the Instructional design procedure and should be incorporated into future learning models. The presentation of information is always intended to impact comprehension. This study initiate that visual literacy is a key factor in predicting whether students will accept infographics as a learning tool.

The systematic literature review also realize students came up with different ways to use infographics and a number of technological tools. Educators could make learning experiences that are more varied, meaningful, and interesting. Active learning, such as that displayed by giving students the opportunity to make their own infographics, has been linked to a rise in students' performance in the classroom. Infographics as a learning tool, it meets the needs of visual learners due to infographics' properties. This article gives evidence that infographics are a flexible way for educators to use their knowledge to help students learn. In addition, the infographic challenge is an excellent example of a high-impact learning experience that meets the expectations of millennial students today.

As a conclusion, this article has contributes to the new knowledge on the importance of infographic as a supporting teaching and learning tools that specifically in higher education field. The identified themes (presentable and efficient, understandable, visual literacy, and facilitating teaching and learning) in this study was discussed and elaborated empirically based on the latest findings. As a contribution to the scholars in education studies, this findings can be used as an extended or additional variables to any related theory or conceptual frameworks.

Recommendations

This study has made several recommendations for future scholars to consider. First, more studies are needed to review infographic acceptance in facilitating teaching and learning, especially focusing on students in social science courses. Its recommended for future scholars to conduct a Comparative study on infographic implementation focusing on groups with high

exposure to visual literacy such as art design students and compare it to another group of students that are not familiar with visual literacy. Most of the research works are focused more on implementation of infographics in medical and engineering related subjects. This is to measure and compare infographic acceptance among students within high and low visual literacy exposure levels. The systematic literature review has also recommended that the educators and students use and adopt any materials or applications that can facilitate the use of infographics in the classroom such as semi-automated online design tools, Piktochart or Infogr.am, may be more practical, and may serve to level the playing field among students, in order to shift the assignment's focus from design to information processing and critical analysis. In addition, it is recommended that new educational policies be put into effect by including infographics into online classes. This makes it easier for the instructor to improve the students' learning potential as well as their ability to remember material over a longer period of time.

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