

Systematic Literature Review on Adaptation of Infographic and Acceptance Factors in Summarizing Medical and Health Literature 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 for swift analysis of visualization increases, there is a growing need to design visualization tools that can enhance students' learning comprehension. Educators and students at all levels now depend critically on new forms of courseware. Educators will nearly always make full use of all available resources during class time in order to pique students' curiosity and deepen their understanding. Infographics are becoming a popular way to share health information, but there aren't many randomised controlled studies that look at how well they work as an intervention especially focusing on medical related literature. Infographics also have become a tool regularly [1] used and tested as a means to inform people about health and risk information [2]. Infographics depicting danger at various points during the COVID-19 epidemic are abundant. Infographics detailing the basics of the COVID-19 virus, including symptoms and preventative measures and this Infographics appear useful for the rapid diffusion of clinical knowledge and Infographics are still being studied around the world as a way to spread information efficiently. The collaboration between the Singaporean Ministry of Health and the World Health Organisation resulted in a greater overall retention of the correct methods for utilizing a mask. It was found that 85.2% of the group felt that the information contained in the infographic was well conveyed [3].

A research also study the attitudes of pharmacists were assessed based on their behavioural beliefs that the

infographic would be effective in giving adequate knowledge and their anticipated advantage of using the infographic in consultations session [4]. Infographic is a visually appealing method for communicating messages that can be effective in health education and to express public health messages [5]. Infographics have become more popular in recent years, in part because they can grab people's attention, keep them interested, and make complex facts, ideas, or knowledge easier to understand.

The term "infographics" refers to utilize visuals to narrate complex information in a simple manner and representation of data that effectively and plainly conveys complicated information. It is composed of numerous components, including maps, charts, graphics, and photographs. In more recent years, the term infographic, or information graphic, has been linked to the concept of data visualization [6]. 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 [7]. 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 [8]. 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 transferring information and conducting valuation were difficult to find [9]. 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 [10]. 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 [11]. 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.

Numerous studies have looked into the use and effectiveness of infographics in the classroom, demonstrating the academic community's interest in this area of infographic application and use. There has been a lack of comprehensive assessments of the literature concerning the use, effectiveness, and utilisation of infographics in the academic setting, despite the abundance of study in these areas. Since reviews of earlier research are typically superficial, prone to reviewer bias, and seldom account for shifts in study quality, a systematic review is essential [12]. 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 in medical literature.

A systematic literature review is one method for reviewing existing literature in a systematic manner. Furthermore, the SLR is a strategy that organises, selects, and critically analyses previous studies in order to provide a solution to the issue that was posed [12]. The protocol or plan is set prior to the SLR review process. The SLR is a systematic and transparent approach that spreads the search effort across different databases; a comparable process can be imitated and reproduced by other researchers. It describes a rigorous search strategy that enables researchers to respond to a given inquiry [13]. The systematic review offers comprehensive information regarding the review method, including the specific keywords employed and the criteria used for article selection. This level of detail enables other researchers to replicate the study, verify the findings, and explore the extent to which the results can be generalised.

Although some studies attempted to conduct systematic reviews pertaining to graphics, they did not concentrate

specifically on infographics. Scholars have focused more on the effective application of infographics to a specific subject or issue for instance, limited their research to infographics in nursing education [14]. The absence of studies that have specifically implemented a systematic literature review on the infographic acceptance factors in facilitating teaching and learning among higher education students has resulted in a lack of understanding and an inability to comprehend the related existing literature in a systematic manner.

The study was based on the main research question of how useful infographics are in higher education. What kinds of changes have teachers made to diagrams for use in medical education? The goal of this study was to fill in a gap in our knowledge by carefully looking over previous research to get a better idea of how to recognise and describe the use and usefulness of infographics between medical literature and educators. The books were picked for a number of reasons and purposes. Based on empirical evidence, educators employ infographics as a means of teaching and learning to improve the transfer of knowledge. The integration of graphical knowledge and its application in higher education is becoming increasingly necessary. The quick development of educational technology has necessitated infographic adaptation and tactics that might enhance students' learning comprehension. This can help to close the information gap between traditional teaching methods and infographic adaptation, as well as raise educator knowledge of the importance of infographics in medical related development. Furthermore, the study assists interested parties in understanding current adaptation practises and developing an adaptation plan that will keep them current with today's quickly evolving technology.

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 is an acronym that stands for RepOrting Systematic Evidence Standards. Syntheses are specifically designed for systematic reviews and maps in environmental management [15]. Systematic reviews and mapping are carried out in a transparent and reproducible manner, with the goal of maximising impartiality and striving to minimise bias throughout the review. ROSES has been specifically designed 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 strives to encourage researchers to provide accurate information with the appropriate level of detail. The authors began their SLR based on this review process by developing acceptable research questions for the review. Systematic reviews are widely used to evaluate the efficacy of management actions or the impact of an anthropogenic or natural event. Recently, these methods have been used to address broader questions about complex systems, such as how and under what conditions an intervention or action may have the greatest impact. 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. The authors then proceeded to evaluate the quality of the selected papers, explaining the technique used to ensure the quality of the articles to be examined. Finally, the authors described how the data for the review were abstracted and how the abstracted data were analysed and validated.

Formulation of the research questions

The research questions for this study were developed using PICO. The acronym PICO stands for population, phenomena of interest, and context. PICO is a tool that helps authors identify appropriate research questions for the review. Because qualitative reviews strive to uncover the meaning of occurrences and their linkages, a different strategy is necessary in qualitative research synthesis. PICO is used to guide the development of a clear and meaningful question. Based on these concepts, the authors included three major aspects in the review: the student (population), infographic acceptance (interest), and higher education (context), which led the authors to formulate the main research question of infographic acceptance in facilitating teaching and learning in higher education.

Systematic searching strategies

The systematic searching methods procedure consists of three primary steps. The present study was undertaken with a three-fold approach, encompassing the stages of identification, screening, and eligibility.

Identification

The identification process was a series of actions designed to methodically look up any synonyms or terms that were connected to the study's primary keywords. The amount, calibre, and kinds of databases that have to be utilised in the SLR were issues that the writers were worried about. The study's variant keywords—infographic acceptability and visual literacy—were chosen based on this criterion, and medical education students were the target population. During the identification phase, the authors came up with the fundamental keywords. By adding more keywords, the database was able to find more possible linked articles for the review. The keywords were developed based on the research questions [16]. The primary keywords were enhanced by consulting two sources: an online thesaurus and the keywords from previous studies. To prevent retrieval bias, as emphasized, the researchers opted to utilize multiple databases [17]. The online thesaurus, keywords from previous research, keywords recommended by Scopus, and keywords recommended by specialists were all employed in the identification process. Rather than depending solely on database searching, the researchers needed to diversify their sources and searching strategies in order to find the most relevant and acceptable database. Its thought that researchers can conduct more thorough searches if they have complete search strings and query development abilities. Because of a number of benefits, the two primary databases—Scopus and Science Direct—are the best for systematic literature reviews.

The identification process was a series of actions designed to methodically look up any synonyms or terms that were connected to the study's primary keywords. The writers were worried about the quantitative. These databases have comprehensive and powerful searching options, as well as verified quality control [18]. As an extra database, Google Scholar, the third database, was chosen. When appropriate, Boolean operator (OR, AND) and phrase searching functions were used to practise combining terms, such as "infographics," "education," "medical," and "visual literacy." In order to enrich the keywords by finding their synonyms, related terms, and variants, these four keywords were insufficient and had to pass the identification procedure. But Google Scholar was not a good choice to be the main database for the SLR because of several problems and limitations [19]. Technical issues including a reduced tolerance for complex search strings and a lack of advanced search tools are typically linked to Google Scholar's quality control issues [20]. However, Google Scholar could be a useful supplementary resource when conducting a search similar to the one used in this study [15]. Towards increase the length of their list of works, researchers might think about using manual searches in addition to database searches. Researchers should give equal weight to the accuracy and comprehensiveness of their results while doing a search [21]. Excessively narrow keywords, on the other hand, will provide more relevant articles but may cause records to be lost. A total of 683 articles were found after searching across these three major databases: Scopus, Science Direct, and Google Scholars.

Table 1: The Search String

Database	Search String
Scopus	TITLE-ABS-KEY ("infographic" OR "information" OR "info graphic") AND ("teaching" OR "educator" OR "lecturer" OR "educationist" OR "tutor") AND ("learning" OR "learner") AND ("visual") AND ("literacy") AND ("higher education") AND PUBYEAR > 2019 AND PUBYEAR < 2024 AND (LIMIT-TO (EXACTKEYWORD , "Education") OR LIMIT-TO (EXACTKEYWORD , "Information Literacy") OR LIMIT-TO (EXACTKEYWORD , "Higher Education") OR LIMIT-TO (EXACTKEYWORD , "Learning") OR LIMIT-TO (EXACTKEYWORD , "Information And Communication Technologies") OR LIMIT-TO (EXACTKEYWORD , "Visualization") OR LIMIT-TO (EXACTKEYWORD , "Students") OR LIMIT-TO (EXACTKEYWORD , "Teaching") OR LIMIT-TO (EXACTKEYWORD , "Article")) AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ARTS") OR LIMIT-TO (SUBJAREA , "MEDI") OR LIMIT-TO (SUBJAREA , "HEAL") OR LIMIT-TO (SUBJAREA , "NURS")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (OA , "all"))

Screening

The second procedure in the SLR is screening, which is based on inclusion and exclusion criteria. Screening is a systematic searching method that includes or excludes articles from the review and is put up automatically by employing a database sorting mechanism. The selection criteria are based on the study question presented by [22]. A systematic review is required since it is practically difficult for academics to review all of the existing published publications. Researchers should define the time span that they can review [16]. Based on the results of the search on the chosen database, it was discovered that the number of studies related to infographic implementation and adoption has been steadily increasing since 2014. The author restricted the search from 2014 to 2022 in order to obtain the most recent database spanning an 8-year period and to assure the quality of the publications, and only studies having empirical data and published in a journal were included. The inclusion process used key characteristics of the target population to answer the research questions, whereas the exclusion process looked at several characteristics of the population that could have hampered the study or increased the risk of unfavorable results, and these would have been excluded from the researcher's consideration [23]. This method eliminated 1990 items because they did not meet the inclusion requirements and did not focus on education-related infographics. The remaining 296 articles were used in the eligibility stage.

Table 2: The Inclusion and Exclusion

Criteria	Inclusion	Exclusion
Timeline	2020-2023	<2020
Document type	Article Journal (empirical data)	Chapter in book, book series, proceeding
Language	English	Non English

Eligibility

The final procedure was eligibility, in which the authors manually checked all of the selected papers in this study to confirm that all of the themes met the criteria. Researchers may include publications that do not fit the criteria established following the screening procedure [12]. This was accomplished in this study by reading the titles and abstracts of the papers. Eligibility is a critical manual step that allows the author to compensate for the database's shortcomings as much as feasible. In total, only 16 articles were chosen.

Quality appraisal

The process of determining the quality of an article's content is known as quality appraisal. Different researchers use different methodologies to quantify quality in systematic reviews because they examine different quality factors based on their research interests and demands for different systematic review settings [24]. The selected publications in this study were provided to two experts for quality assessment, and the experts categorised the remaining articles into three quality categories: high, moderate, and low [25]. Only papers of high and medium quality were considered for this examination. In order to determine the quality rating, the experts focused on the methodology of the publications. This algorithm assigned all 16 articles a high rating and 1 items a middling rating. As a result, all of the remaining papers were reviewed.

Data abstraction and analysis

In this phase, two specialists performed the data extraction and analysis to minimize errors in the data compilation process for the analysis [26]. Referring to the study's research topic, the experts conducted a comprehensive analysis of each of the 16 publications, concentrating on the abstract, results, and discussion sections. Any data from the reviewed articles that could answer the research questions could have been extracted directly [22]. The experts could debate any disagreements regarding the extracted data before deciding whether to retain or exclude them. The researcher then conducted a thematic analysis to identify themes and sub-themes based on efforts related to recognising patterns and themes, aggregating, numbering, noting similarities, and identifying relationships that existed within the abstracted data [27]. During the thematic analysis, the authors attempted to identify issues that arose from the abstracted data of all the chosen articles and to classify them into

a particular group or theme. Four major themes were devised in total. The effectiveness and relevance of these four themes to the research were then reexamined. The authors then presented the developed themes to two panel experts for evaluation; both experts concurred that the themes were appropriate and pertinent to the review's findings.

RESULTS

Background of the selected articles.

The review managed to obtain 16 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 16 selected articles, 7 studies had been conducted in the United States of America and one study was conducted in each of these countries, the Malaysia, Australia, Thailand, Denmark, Netherland, Italy, Canada and 2 from United kingdom. Out of 17 selected articles, 1 were published in 2016, two in 2018, 1 in 2019, two in 2020, two in 2021, five in the years 2022, three in 2023 and 1 articles published in 2024.

The themes.

Enhance efficiency.

Various research data has proven that the infographics were well received as a means of acquiring knowledge, synthesising information, and presenting findings [9]. The ability to create infographics is an invaluable instrument for conveying intricate concepts and procedures especially in medical related issues. Infographics have the ability to elucidate intricate disease processes or outline the customary nursing treatment for a particular patient diagnosis [14]. Infographics was an engaging and time-saving experience and pleasurable experience. The use of infographics as a means to distribute information regarding COVID-19 vaccines has proven to be an effective method in reaching and captivating a wide range of people [28]. There are numerous examples of infographics visualizing risk throughout the COVID-19 pandemic. As example Johns Hopkins University produced an infographic containing fundamental details regarding COVID-19, including symptoms and preventive measures to safeguard against the virus [29]. Pharmacists and healthcare professionals are increasingly recognizing the potential of infographics as a tool for patient education and communication. Pharmacists intended to make use of the infographic in consultations with patients who were beginning pre-exposure prophylaxis (PrEP) and also to educate themselves [4]. In fact, health care workers both within and outside the coalition have provided feedback that they have used the infographics in conversations with patients and found them to be effective [28]. The intentions of pharmacists to utilize the infographic for self-education were correlated with their subjective norms, attitudes, and perceived behavioral control. Infographics are suitable to be implement for Multiple Sclerosis patients to increase efficiency in describing the symptom and treatment and also in health education in medical work [5]. Utilizing infographics is an effective strategy to address the challenges stemming from students' limited capacity to concentrate on a specific task for a prolonged duration. The integration of infographics into studying has greatly influenced students' academic performance by aiding their understanding of key concepts, teaching them how to condense information, and enhancing their retention of topic-related information [30].

Comprehensible

Research has demonstrated that infographics may improve students' understanding of the information they are dealing with. This similarity is interpreted by the characteristic of infographics as a visual communication form, that has the capacity to visually convey the intended meaning of the information and aid the student in perceiving the information through the carrier of information, which is the semiotic signs that are linked by a paired summarized text to transmit visual information [31]. It has been proved that infographic improve the statistic of correct answers regarding theoretical content [5]. This also supported that infographic assistance nursing students learn about the kidneys' functions, ways to stop or slow the development of kidney disease, and the problems that can happen because of it [14]. Distribution of infographics and brochures using the online application resulted in enhanced health literacy levels within the COVID-19 pandemic and Infographics were recognized for their visually appealing and simply comprehensible nature, rendering them well-suited for internet

dissemination [32]. Infographics help audience focus greater attention when reading medical literature. The selection of images for an infographic should be done cautiously, considering their potential impact on emotions and comprehension. It is important to avoid overly abstract images, as they may hinder the audience's ability to connect with the content [33]. Furthermore, infographics are a beneficial teaching-learning strategy because they cater to the multimodal preferences of students and these visual narratives may facilitate students' retention of information [14]. Infographics facilitate the effective dissemination and comprehend of information by employing images to convey public health messages. Its extensive implementation by the WHO serves as an illustration of its utility. The use of infographic on recurring-remitting Multiple Sclerosis (RRMS) and reproduction, and assesses its efficacy in disseminating information to women of reproductive age who are afflicted by this disease and are receiving treatment at our hospital [5]. Infographics are becoming increasingly popular for transmitting information and conventional lectures may be transformed into easily comprehensible courses that incorporate a greater number of infographics and its proven that infographics enhance their acquired information longer than students who only use graphic texts [9]. The efficacy of infographics in reducing the adverse impact of jargon. Although not universally preferable than text, infographics are extremely beneficial in simplifying difficult material, especially in situations when the use of technical language is inevitable. Therefore, it is advisable for communicators to carefully utilise visual aids in order to improve comprehension and overcome the difficulties presented by technical terminology [34]. 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. This demonstrates that the infographics have successfully met the objective of being self-explanatory and have effectively synthesized the subject matter.

Effective Visual Communication

One potential way to improve patient care outcomes and interprofessional collaboration is to use infographics as a means of communication between prescribers and community pharmacists. This novel method encourages in-person conversations based on factual evidence, paving the way for fruitful talks that go beyond the limitations of conventional modes of communication [35]. A combination of pre-made infographics and students' practical experience in making their own infographics has been demonstrated to be possible through the use of digital tools for infographic creation; this practice is conducive to increasing digital literacy [30]. In others platform, the potential of social media for rapid knowledge dissemination using infographics was recognized early in the COVID-19 pandemic by health professionals [28].

The infographic posters serve as a holistic approach of communication to promoting awareness of cleanliness and hygiene, encompassing personal hygiene, environmental cleanliness, and infection prevention measures. This can aiming countless demographic groups and sectors, and various from public to government health agencies. digital infographics can improve individuals' trust in science, reduce misinformation believability, and encourage preventive behaviors such as handwashing, social distancing, or vaccination is underway at the time of this submission. Importantly, the efficacy of infographics in mitigating the negative effects of jargon. While not universally superior to text, infographics proved invaluable in simplifying complex information, particularly in contexts where jargon is unavoidable. This suggests that communicators should judiciously employ visual aids to enhance comprehension and counteract the challenges posed by technical language [34]. Double Pyramid infographics functions as both a conceptual model and a practical tool for individuals, communities, and organisations to effectively manage the intricate relationship between diet, health, and environmental sustainability [36]. By adopting its ideas, we can collectively progress towards a future where the promotion of health and the protection of the environment are interconnected, resulting in a more wholesome way of living. Infographics are a well-established method of presenting information in a more accessible and comprehensible manner.

They utilize straightforward language, visual components, images, and graphic symbols like pictograms to communicate through visual and this system widely recognized as effective tools for health communication and education [37]. Infographics have theoretical implications for understanding the interplay between communication, cognition, and behavior, emphasizing the pivotal role of processing fluency in shaping responses to health messages and the practical implications underscore the importance of crafting clear, accessible communications, especially in critical public health contexts like the COVID-19 pandemic, where

effective messaging can be a matter of life and death [34]. Efficient communication and symptom management are vital in hospital and institutional settings to guarantee the welfare and ease of patients. The symptoms that individuals encounter can vary greatly and have a substantial impact on their quality of life and the effectiveness of their treatment. Hence, it is crucial to incorporate rigorous testing procedures in conjunction with efficient communication and management processes to maximise patient care. Through rigorous testing and thoughtful implementation strategies, healthcare organizations can enhance the well-being and symptom experiences of patients, ultimately improving overall treatment outcomes and quality of life. By prioritizing interdisciplinary collaboration, training, and patient engagement, healthcare systems can successfully integrate evidence-based practices into routine clinical practice, leading to more compassionate and effective care delivery. Medical infographics can facilitate symptom communication by creating symptom awareness and providing patients with the vocabulary to describe their symptoms and concerns [37]. Effective symptom communication and management through infographic are essential components of patient-centered care in hospital and institutional settings. By providing prescribers with insightful data on quality measures for patients with chronic diseases, infographics serve as catalysts for collaborative dialogue, leading to the recognition of pharmacists as integral members of the healthcare team and the outcomes of such discussions extend beyond mere information exchange, resulting in the development of collaborative working relationships and expanded patient care opportunities [35].

Through rigorous testing and thoughtful implementation strategies, healthcare organizations can enhance the well-being and symptom experiences of patients, ultimately improving overall treatment outcomes and quality of life. By prioritizing interdisciplinary collaboration, training, and patient engagement, healthcare communication systems can successfully integrate evidence-based practices into routine clinical practice, leading to more compassionate and effective care delivery. Even most of literature's are supporting positively the use of infographic in summarizing medical literature, found that risk numbers negatively influenced intentions to become more physically active [2]. This contradicts conventional wisdom in informed decision-making literature, which emphasizes the provision of risk numbers even in cases of poor numeracy. Nevertheless, when it comes to cardiovascular disease (CVD) risk calculators, which frequently underestimate dangers, simply presenting risk figures may not be enough to encourage changes in behaviour [2]. This highlighted the importance of carefully designing risk communication materials, considering the needs and cognitive abilities of the target audience, and balancing the use of textual and visual elements to effectively convey qualitative risk information should be in consideration when designing infographic.

Facilitating Teaching and Learning

The creation of teaching materials has become essential for students at all levels of education. Infographics facilitate the comprehension of challenging and intricate content for both educators and learners. Essentially, it is crucial to utilise innovative communication methods, like infographics, to promote collaborative healthcare and bring about positive improvements in patient outcomes and with continued exploration and implementation, infographics stand poised to become invaluable assets in the arsenal of strategies aimed at improving healthcare delivery and patient outcomes [35]. Infographics has increase audience visual literacy and improved students' satisfaction with tasks [30]. Infographics are a versatile medium that educators may utilize to increase student learning. By including students in the creation of infographics, traditional teaching and learning methods can be replaced with more dynamic and inventive approach [14]. Infographics might be used in varied ways and for a number of educational purposes, especially for facilitating communication activities. They can improve the patient's capacity to focus on, comprehend, retain, and comply with information. Meanwhile, Students expressed high levels of satisfaction with infographic-based presentations of course subjects. The majority believed that infographics provide advantages over other visual aids, with a significant percentage reporting that infographics enhanced their understanding of the course material [38].

While it is widely acknowledged that visuals enhance information retention, research on the utilization of infographics for communication in medical literature remains limited [11]. Healthcare professionals may be more inclined to review infographics than abstracts to enhance their understanding of new literature, as they prefer infographics to text-only abstracts and find them less mentally taxing to review. Consequently, infographics could be a valuable tool for summarizing medical literature. Infographics serve as a communication tool that improves engagement, memory retention, recall, comprehension, and the development of

communication skills [33]. Infographics enable instructors to convert complex content into easily comprehensible, captivating, and aesthetically pleasing information. Although there was some uncertainty regarding the specific advantages of infographics, most students displayed a positive attitude toward their use and showed a willingness to incorporate infographics into their study routines [38]. Despite the usefulness of infographics as a teaching-learning approach, educators do not frequently utilize these visual narratives [14].

Making infographics as part of pharmacist education is a way to learn effectively. This study found that creating an infographic was an entertaining approach to learn new content and spurred creativity in unexpected ways [39]. It emphasizes the importance of conciseness and clarity in health communication. The utilization of infographics as a teaching-learning approach enables their application across all academic levels, including undergraduate and graduate students, in various educational environments such as classrooms, clinical settings, and online platforms [14]. Infographic development proven to be an excellent possibility for students to creatively evaluate and communicate data while providing educational materials for a target audience, and it will serve as a foundation for students to apply their infographic design talents to future patient care applications [39]. Students perceive significant benefits in using infographics within official courses or curricula, believing that infographics offer superior visual representation [38]. This makes the course material more memorable and understandable without compromising essential information. Infographics, as a novel approach, were employed to aid in this process for senior undergraduate dietetic students, supplementing course materials with infographics enhances the learning of knowledge [40]. Additional educational resources on visual communication/information graphic development could enhance performance requirements and give a more nuanced grading rubric to better examine the numerous facets of infographic design [39]. Providing a consumer-created infographic with relevant information about physical activity during a GDM pregnancy, in addition to standard education, led to significant short-term improvements in women's knowledge and self-efficacy to engage in physical activity [1]. The consumer co-created infographic provided women with gestational diabetes mellitus (GDM) with the precise and pertinent information regarding physical activity during pregnancy. This information was specifically requested by women with GDM and was presented in a way that was both easy to comprehend and visually appealing [1].

The efficacy of creating infographics for acquiring knowledge and improving self-regulation of cognition has been demonstrated [30]. The results suggest that infographics may be useful in condensing medical research, as healthcare professionals show a preference for infographics over text-only abstracts due to their lower cognitive load during review [9]. Hence, there is a growing demand for training programs aimed at equipping instructors and students with the skills to develop impactful infographics in their respective disciplines. Infographics and pamphlets have the potential to be useful instructional tools, but additional research is necessary to improve and ensure their wider applicability. Infographics and booklets have the potential to be successful educational aids, but additional study is necessary to improve these interventions and ensure their wider suitability [32]. Additionally, educators should be motivated to use infographics into their instructional methods while delivering content. This will significantly enhance the value of an infographic activity.

DISCUSSION

The thematic analysis produced four themes. This section provided additional discussions on the established themes. Enhance efficiency was one of the effective means of using infographics in the teaching and learning process. The research highlights the significant benefits of using infographics across various domains, particularly in medical education and healthcare communication. Infographics have been proven to be an effective tool for acquiring knowledge, synthesizing information, and presenting findings efficiently [9]. They help elucidate complex medical concepts and processes, such as disease mechanisms and standard nursing treatments [14]. The use of infographics has been shown to save time while engaging audiences effectively, as demonstrated during the COVID-19 pandemic. For instance, infographics to disseminate critical information about COVID-19 [29]. Pharmacists and healthcare professionals are increasingly adopting infographics for patient education and communication, particularly for initiatives like pre-exposure prophylaxis (PrEP) consultations [4]. Feedback indicates that infographics are effective in conversations with patients, enhancing understanding and self-education among healthcare worker [28]. Furthermore, infographics help address students' limited attention spans and improve academic performance by aiding in the comprehension and

retention of central ideas [30].

Infographics enhance students' understanding by visually conveying information through semiotic signs paired with summarized text [31]. Studies show that infographics significantly improve correct responses to theoretical content, supporting their effectiveness in nursing education [5] [14]. They cater to multimodal learning preferences, facilitating better retention and focus on medical literature. Their widespread use by organizations like WHO underscores their utility in public health communication. Students exposed to infographics retain information longer than those using traditional text-based methods [9]. Additionally, infographics support connected collaborative learning environments, demonstrating their self-explanatory nature and effective synthesis of subject matter.

Infographics foster better communication between prescribers and pharmacists, leading to improved patient care outcomes [35]. Creating infographics using digital tools enhances students' digital literacy and practical experience [30]. They mitigate the negative effects of jargon, making complex information more accessible and comprehensible [34]. Infographics are recognized as effective tools for health communication, aiding in symptom communication and patient-centered care [37]. Effective symptom communication and management through infographics can enhance patient well-being and treatment outcomes, emphasizing the importance of interdisciplinary collaboration and patient engagement.

Infographics improve visual literacy and increase student satisfaction with tasks [30]. They offer a dynamic alternative to traditional teaching methods, fostering creativity and engagement among students [14]. Infographics can be used across various educational levels and settings, from classrooms to online platforms, enhancing the learning of complex content [39]. They improve engagement, memory retention, and comprehension, making them a valuable tool for summarizing medical literature [11] [33]. Infographic creation allows students to evaluate and communicate data creatively, preparing them for future patient care applications [39]. Supplementing course materials with infographics enhances knowledge acquisition and performance, suggesting a need for additional educational resources on infographic design [40]. Infographics tailored to specific health needs, such as physical activity during pregnancy for women with gestational diabetes mellitus, can significantly improve knowledge and self-efficacy [1]. Overall, the research underscores the multifaceted advantages of infographics in enhancing efficiency, comprehensibility, visual communication, and teaching and learning. These findings advocate for the broader adoption and integration of infographics in educational and healthcare settings to improve knowledge dissemination and patient care outcomes.

CONCLUSION

Infographics are gaining popularity in diverse industries and organizations as an influential medium for visual communication. Infographics facilitate the interpretation of complex material by presenting information visually using symbols and brief summaries. Infographics, as a type of data visualization, improve the process of learning by increasing the accessibility and engagement of text.

The positive response to infographics by learners indicates that infographics can effectively tackle some difficulties encountered during instructional sessions. Infographics are highly effective in reaching and engaging diverse online audiences, giving them an instant and efficient means of communication. Understanding infographics enables people to cultivate the essential critical thinking abilities required to traverse the complex media, economic, and societal networks of today.

A comprehensive literature study provides evidence to support the utilization of infographics in higher education, specifically for the purpose of summarizing and presenting medical and health-related content. Infographics are valuable in educational environments since they not only help with understanding but also enhance the memory of difficult material.

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 revealed diverse applications and technological tools for creating infographics. Infographics are perfect for visual learners, making them a very effective instructional instrument because of their particular features. This article presents empirical evidence demonstrating that infographics serve as an adaptable instrument for experts in the medical field and educators to effectively present information.

Infographics are increasingly popular across various industries and organizations as a powerful tool for visual communication. By conveying information graphically, infographics help to interpret complex text through semiotic indicators supported by concise summary text. As a form of data visualization, infographics enhance learning by making information more accessible and engaging.

The positive reception of infographics among learners suggests that they can address some challenges faced during educational sessions. Infographics effectively reach and resonate with diverse audiences online, making them a quick and efficient communication method. For students, studying infographics fosters the development of critical thinking skills necessary to navigate today's intricate media, economic, and societal networks.

A systematic literature review supports the use of infographics in higher education, particularly for summarizing medical and health literature. This approach not only aids in comprehension but also improves the retention of complex information, demonstrating the value of infographics in educational contexts.

RECOMMENDATIONS

Integrating infographics into educational courses, particularly in higher education, can greatly enhance learning results by condensing complex topics, encouraging improved understanding, and enhancing knowledge retention. It is essential to offer training sessions to both students and educators on the effective design of infographics. These sessions should be smoothly integrated into existing courses on digital literacy, visual communication, and educational technology. This approach guarantees that individuals acquire the essential abilities to produce influential infographics, thus optimizing their educational capacity and fostering a more profound comprehension of the topic matter.

It is crucial to use infographics into medical and nursing education programs in order to clarify complex medical concepts and procedures, thereby enhancing the learning process by integrating them into lectures, textbooks, and digital learning platforms. Moreover, incorporating infographics into patient education materials can significantly enhance patient comprehension and involvement by streamlining information regarding illnesses, therapies, and preventative measures. This ultimately enhances healthcare accessibility and empowers patients to actively participate in managing their own health.

Utilizing infographics in public health campaigns is important for efficiently and effectively spreading vital information to the public, especially during health emergencies such as the COVID-19 pandemic. Infographics can be invaluable tools for educating individuals and influencing health-related behaviors. Furthermore, it is crucial to promote cooperation between educational institutions and reputable health organizations, such as the WHO, in order to create and distribute excellent infographics that are customized to meet specific public health requirements. This will help to maximize their effectiveness and ensure that essential health information is easily accessible to a wide audience.

Continuously conducting empirical research is essential for evaluating the efficacy of infographics in various educational and healthcare environments, with an emphasis on measuring learning outcomes, retention rates, and user engagement. Furthermore, it is important to create feedback systems that involve students, educators, and healthcare professionals. These systems will help gather valuable information about the use of infographics and allow for ongoing improvements in their design and application. This will ensure that infographics remain effective and relevant in addressing the changing needs of these fields.

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