INFOGRAPHICS IMPLEMENTED BY EDUCATIVE INSTITUTIONS

A review of its tendency and applications

Infografías implementadas por instituciones educativas

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ABSTRACT

Objective: To describe the use of infographics in different areas of educational centers. Methodology: Mixed, descriptive, and non-experimental. Thirty-two research reports on the subject were retrieved. Also, examples of the different uses that educational institutions have made were identified. Results: The trend in research is to report on using infographics within the teaching-learning process. Although, the institutions have diversified their application in tutoring, institutional communication, and Schools for Parents. Conclusion: It is necessary to analyze the applications given in educational centers and encourage the use of interactive infographics.

RESUMEN

Objetivo: Describir el uso de las infografías en diferentes área de los centros educativos. Metodología: Mixta, descriptiva y no experimental. Se recuperaron 32 reportes de investigación sobre el tema. También, se identificaron ejemplos de los distintos usos que instituciones educativas han hecho. Resultados: La tendencia en investigación es reportar sobre el uso de la infografía dentro del proceso de enseñanza-aprendizaje. Aunque, las instituciones han diversificado su aplicación en la tutoría, la comunicación institucional y las Escuelas para Padres. Conclusión: Se requiere analizar las aplicaciones que se han dado en centros educativos e incentivar el uso de la infografía interactiva.

1. Introduction

Through the development of new digital content, educational processes have become more flexible and participatory, but above all, motivating for students. Likewise, this has given growth to other classroom activities, such as research and creativity (Diaz-López, 2021). One of these contents is infographics, presented in analog, digital, and interactive formats. This format boomed in the 90s of the last century, acquiring great popularity due to its high degree of visibility (López et al., 2018). Moreover, since it extraordinarily presents texts compared to what had been consumed from printed formats and even from Web 1.0, it promotes interactivity, the use of hypertext, and personalization through multimedia (Rost, 2006).

As a resource for learning, infographics have shown clear signs of their efficiency, starting with the health field. The precision and ease of these visual elements allowed us to socialize information among medical professionals and their patients and relatives. Furthermore, the information exposed to the hearings has been presented according to the level of the hearings. Thus, the workers in this area could appreciate the advances in machinery, equipment, and medicines, among other data. Meanwhile, other infographics were enabled to promote Permanent Education in health (Sanz-Lorente & Castejón-Bolea, 2018; Dorneles-Lopes et al., 2020), with a more preventive approach for those who consult them.

Infographics display images and text, which, when structured in a certain way, present information about science, synthesizing complex concepts (Unsworth, 2021) and promoting the construction of meanings of the receivers and those who produce them. This multimodal text appears in various digital media and communication media, transcending as a journalistic genre and likely to be analyzed by the present discourse (Cocarelli & Ribeiro, 2022). Moreover, as a teaching resource, it underpins the development of necessary skills for the digital age, such as those related to multimedia, digitality, communication, and computing (Aguirre et al., 2015), that is, a multi-literacy approach.

In this context, teachers have been implementing infographics in the classroom, exposing their effectiveness as support for the fulfillment of learning objectives and purposes (Almunive & Alshammari, 2018; Alyahya, 2019; Alsheri & Ebaid, 2016; Baglama, 2017; Bradshaw & Porter, 2017; Becerra-Rodríguez et al., 2021; Bernal & Cedillo, 2021; Bicon & Beneshti, 2022; Cavazos et al., 2021; Fadzil, 2018; Grieger & Leontyev, 2021; Intriago-Alcívar, 2017; Mata et al., 2020; Nhan & Yen, 2021; Rios *Higuera et al.*, 2022); at the same time, it promotes critical thinking, audiovisual intelligence and other cognitive processes (Cheng et al., 2021; Dunlap & Lowenthal, 2016; Damayanov & Tsankov, 2018; Haksiza et al., 2021; Ismaeel & Al Mulhim, 2021; Nava et al., 2022; Shabak-Alrwele, 2017). Although, other modalities that can be given in educational centers have hardly been documented, focusing on the teaching-learning process, and leaving aside its potential use in the different areas of education. Thus, this document presents the revision of the application in these valuable didactic resources from the known cases and the work carried out in the institutions.

1.1. Educational infographic

The infographic is mainly integrated with a visual part, which ranges from illustrations, graphics, photographs, icons, or diagrams presented aesthetically (Lankow et al., 2012; Ru & Ming, 2014; Damyanov & Tsankov, 2018). Visual elements can be dynamic or static, being a means of interactive consultation for the receiver, as is the case with digital infographics (Bueno-Chuchuca}, 2022). The content is established according to a discursive logic that facilitates its understanding (Colle, 2004; Guzmán-Cedillo et al., 2015), and the information and knowledge in the form of stories, hypotheses, or facts that readers quickly decode, promoting formal or informal learning (Almunive & Alshammari, 2018; Mata-Santel et al., 2017; Villaplana, 2019). Palmucci (2017) states that infographics have two characteristic features, the informative-explanatory one, which refers to the possibility of explaining complex theoretical constructions, and the appellative-aesthetic one, which makes reading it pleasant; both traits are relevant to the teaching process.

However, it is not just a visual resource in which data provided by the teacher in a class is summarized; or a means to facilitate student learning by observing this format and decoding information given the meaning of its elements (Minervini, 2005; Palmucci, 2017). Students' preference is usually a multimodal medium (Díaz-López, 2021). It also implies effectively communicating knowledge, especially that which is complex for students, who at that moment are facing the infographic based on their cognitive development and prior knowledge (Intriago-Alcívar et al., 2017; Oetting, 2015). Educative infographics are based on some theories Dunlap & Lowenthal (2016) have pointed out, such as the Theory of the superiority of the image or the Theory of dual coding. Likewise, the visual and synthetic value is recognized from learning theories such as Constructivism or Connectivism, or under the approach of multiple intelligences and communication modalities.

Furthermore, it is a learning strategy to increase different literacies such as traditional, digital (Smiciklas, 2012), or audiovisual. Infographics must be built by answering fundamental questions about a critical concept –for example, what, who, when, where, and how–and adhere to a good design and ethical sense (Fazdil, 2018). These graphics are aids that communicate complex content immediately from any area, from the social sciences (Souza, 2016) to subjects in exact sciences such as mathematics or physics. They are better understood from the

exposition of processes in infographic support, which does not require more than an explanation that reading provides and that it is interpreted more, as mentioned by Texeira (2010) by a visual thought. Alsheri & Ebaid (2016) suggest contrasting the abstract meaning of these topics through infographics, especially in the early stages, so that from initial education, this resource supports the conditions so that students are not reluctant to study these sciences.

Although, didactic infographics can be applied in different areas of education. For example, considering that they can be classified according to the user's needs, the structure they present, and the situation in which it is applied (Reinhardt, 2010). In addition to this, it can also be found in a static or interactive format. The interactive one can be an option that, in addition to providing much more information for the reader, allows them to know the evolution of an event or make comparisons, restarting their presentation as many times as they consider necessary. There are specifies characteristics of this type of infographic such as: 1) the information is organized with a particular criterion to show in a specific order the evolution or phases of a theme; 2) the data that is presented in the infographic is attractive to the reader, as it mixes with colors, images, and texts that change; and 3) it simplifies large amounts of information on topics of daily life into a single multimedia resource (Alsheri & Ebaid, 2016).

2. Objectives and Methodology

2.1. Main Objective

Describe the use of infographics in the different areas of an educational center

2.2. Specific Objectives

1. State the use of infographics as a tool in the teaching-learning process.
2. Define the application of the infographic as a communication tool and extra educational services.

2.3. Methods and procedures

A mixed, descriptive, and non-experimental methodology was applied to achieve the research objectives. As part of the analysis, a literary review was carried out to retrieve research articles that addressed the use of infographics in the different areas of education. The search was carried out during the first quarter of 2022 in the DOAJ, Scielo, Redalyc, Dialnet, Google Scholar, Ebsco, and Jstor databases. The documents were selected based on keywords –alone and combined– such as Infographics, Education, Didactic Resources, School Parents, and Educational Center. The search horizon initially included only five years. However, it was extended once it was identified through the findings, some previously published articles that were repeatedly cited for their approach to educational infographics.

The chosen documents were reviewed, and their contents were revealed through an observation sheet. This way, it was possible to identify various Hispanic American authors' contributions and applications on the subject. Likewise, this process allowed us to quantify the results obtained in this stage. Additionally, in this way, the use that the research articles mention has been given to the infographic was delimited.

Subsequently, some Internet sites were reviewed to recover infographics in which some of the uses given in the Educational Centers were observed. Finally, through an observation sheet, each piece of communication's particular elements was analyzed to delimit their essential characteristics by exposing good practices in the schools and their convergence with the exposed by some authors.

3. Results

After the literary review, 32 research reports published in Spanish and English over 18 years were chosen. As can be seen in figure 1, there is a tendency to address the infographic and its relationship with education, starting in 2015. However, since 2004, some works dealing with the subject have been detected. In contrast, in some years, no publications were registered with the proposed keywords.

Figure 1. Production concentrate on the bases of scientific articles per year
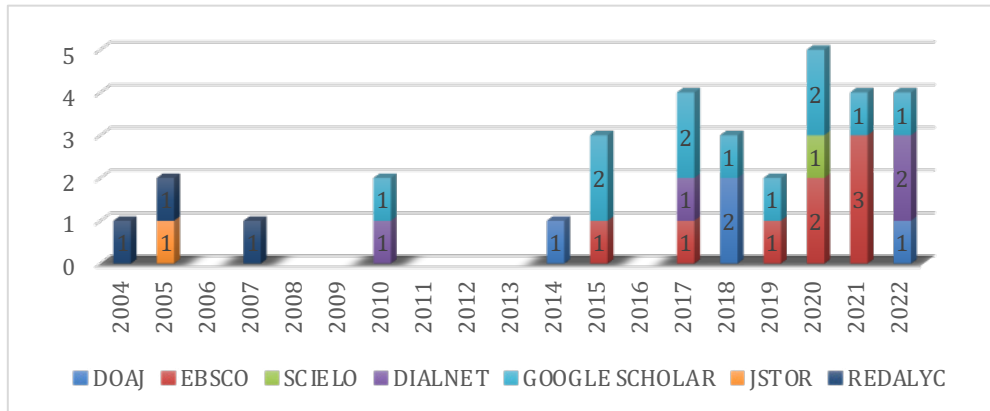
Source: Own elaboration.

In general, in the Jstor repository, the least number of articles was located, not so in the Google Scholar base. Additionally, it stands out that Spain is the country that has analyzed this issue the most. On the other hand, countries such as Bolivia and Chile contributed to a lesser extent. Finally, Australia was the only English-speaking country in which an article related to the object of study of this research. For more information, review figure 2.

Figure 2. Concentration of scientific articles in repositories by nationality of the authors
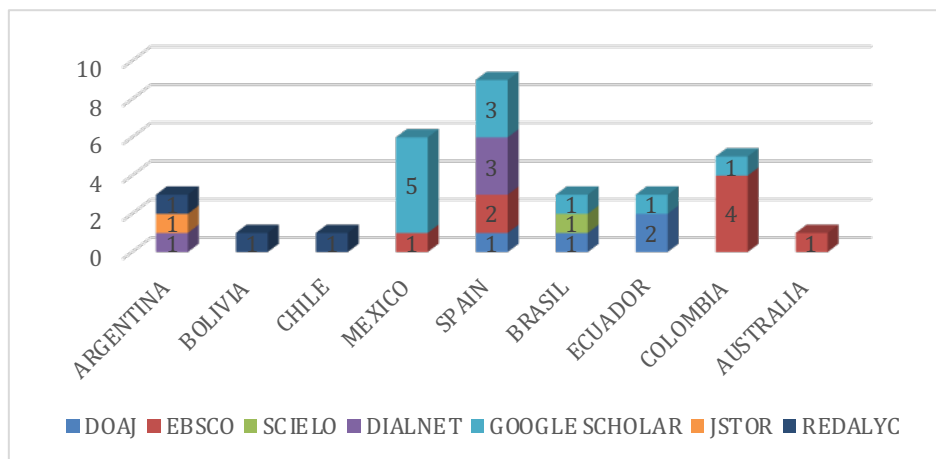
Source: Own elaboration.

3.1. Infographics in the teaching-learning process

From the bibliographic search that was carried out, various studies of the application of infographics in the classroom were located. Some authors take up the use and creation of these resources from the students' perspective (Abio, 2014; Becerra-Rodríguez *et al.*, 2021; Bernal-Gamboa & Guzman-Cedillo, 2021; Bicen & Beneshi, 2022; Elaldı & Çifçi, 2021; García-González, 2022; Grieger & Leontyev, 2021; Guzma-Cedillo *et al.*, 2015; Ismaeel & Al Mulhim, 2021; Macías *et al.*, 2017; Minervini, 2015; Nhan & Yen, 2021; Nava-Rodríguez, 2022; Portillo, 2007; Ruiz-Ramírez, 2020; Valero & Morera, 2019; Unsworth, 2019; Weiner & Lorber, 2021), some from the perspective of teachers (Coscarelli & Ribeiro, 2022; Chaudhurry, 2019; Ríos-Higueras *et al.*, 2022; Sanz-Lorente & Castejón, 2018) and in others, both actors are considered (Diaz-López, 2021; Intriago-Alcívar *et al.*, 2017). However, specific characteristics that have prevailed in the different studies stand out and are the subject of analysis in this section.

There are several benefits that infographics generate indirectly in the student body. Thus, collaborative work to create visual products promotes communication and social skills. For example, Díaz-López (2021) highlights that the academic work required for groups of students to create an infographic favors empowerment, self-control, self-confidence, negotiation skills, and conflict management. At the same time, it encourages that among peers, there is support to increase their qualifications for managing digital tools oriented to constructing infographics. On the other hand, Chaudhury (2019) asserts that the task of making infographics is an ideal activity to encourage students' self-learning. This skill is a priority for modern work in the Knowledge Age.

Another aspect linked to infographics is motivation. It was found that the motivation of students to learn increased through infographics -what Nhan & Yen (2021) mention as learning based on infographics-. Furthermore,

the level of commitment and motivation of the student body is even higher if the infographic to be built is on a topic of interest (Polman & Gebre, 2015). So, motivation affects, of course, the quality of the product and the evaluation results. However, as Díaz-López (2021) clarifies, it requires teachers to recognize the value of infographics as an educational tool and be trained to include it in their didactic planning.

In general, the construction of the infographic implies that its creators must apply different cognitive processes. Nava-Rodríguez (2022) specifies that through synthesis, hierarchy, classification, and prioritization, students build new narratives that combine images and different languages –such as mathematics– to convey a theme. From an education 2.0 orientation, the infographic is an exercise that enables students to plan and organize to construct visual elements based on social learning. At the same time, it contributes to disseminating academic and scientific content by applying ethical principles such as mentioning information sources and presenting data clearly and objectively (Ruiz-Ramírez, 2020).

Regarding the impact that this tool has on the understanding of thematic content, some authors conclude that it facilitates the retention and appropriation of knowledge for all types of students, even those with lower school achievement (Alrwele, 2017; Baglama *et al.*, 2017; Bernal Gamboa & Guzmán Cedillo, 2021; Elaldı & Çifçi, 2021; Fazdil, 2018; Minervini, 2005; Valero-Sancho & Morera, 2019). Likewise, using infographics as a tool for reviewing, reinforcing, or expanding learning has been significant (Becerra *et al.*, 2021; Macías-Castro *et al.*, 2017; Sanz-Lorente & Castejón-Bolea, 2018). Even more convincing results have been shown when the infographic is interactive (Ismaeel & Al Mulhim, 2021). However, the choice and preparation of both types of infographics demand specific skills from the teacher (Coscarelli & Ribeiro, 2022; Intriago Alcívar *et al.*, 2017), so their level of multi-literacy must be developed for these purposes.

A further application identified in the articles that made up the search is using infographics as a learning product to be evaluated, specifically, as part of a project in the classroom. Weiner & Lorber (2021) followed the construction of a digital infographic by students. Said infographic would be the presentation of results, after considering and solving, based on the scientific method, a research question. Due to the nature of the subject, the insertion of graphs was to demonstrate the main findings. These authors coincide with the methodology applied by Grieger & Leontyev (2021) since, in both cases, the infographics were developed through free access electronic sites, which would allow them to receive feedback from their teacher and make the appropriate modifications. Although, these last authors suggest the execution of the following phases to reach the concretion of this:

- Summarize and evaluate an existing infographic on the topic.
- Delve into the literature on the subject.
- Propose an infographic theme.
- Collect components for infographic.
- Analyze websites for infographic Creation.
- Create infographics and provide peer feedback on early drafts.
- Review infographics and provide final feedback.
- Publish infographics (Grieger & Leontyev, 2021, p. 1).

Regarding the evaluation of the infographic, García-González *et al.* (2022) propose applying a co-assessment process in addition to hetero-assessment and self-assessment. According to the experience they carried out in the classroom, it turned out that the students had higher academic performance and proved to be more committed to their assessment process than when the teacher assigned only a grade. Although, special care must be taken in the evaluation instruments used to assess a didactic infographic. Guzmán-Cedillo *et al.* (2017) validated a rubric through expert judgment; It shows three levels of performance –from novice to expert– and nine dimensions to be evaluated. The delimitation of instruments helps to carry out an adequate evaluation and for the students to clearly identify the criteria they must follow for constructing their evaluative products.

3.2. Infographic for communication in the Educational Center and extra educative services

With the media convergence that has taken place in virtual spaces, users have left only part of a passive audience. Contrary to this, the netizen demands multimedia content that allows him to interact with it and modify it (Bueno-Chuchuca, 2022). This dynamic has even expanded to reach other audiences with special needs who seek resources they can consult, given their condition. Thus, infographics comply with the possibility of adapting to multiple contexts based on a precise theme representation (Palmucci, 2017; Valero-Sancho & Morera-Vidal, 2019). Even more so, when certain utilities mentioned in figure X are distinguished, which are significant for the transmission of information not only in the academic or scientific sphere but for audiences in general.

Part of the literature review showed how institutions apply infographics as a format that presents information on the day-to-day of educational centers through the school newspaper. Ruiz-Ramírez (2020) points out that it is a digital tool that allows the school to be updated, as it helps to socialize information not only in an analog way but also in virtual spaces. In addition, it allows students to develop skills in producing, managing, and publishing content about the school. In addition to the above, Intriago-Alcívar *et al.* (2017) specify that the organizations'

data can be concentrated in a schematic and attractive format, which is compatible with collaborative spaces or websites, while the infographic is, as such, an image.

On the other hand, Mata-Santel *et al.* (2020) recognize that infographics can be used in workshops on topics more focused on society. Although, constructing this resource requires interdisciplinary work to specify an infographic that disseminates social projects. In this sense, Saraza-Agudelo & Silva-Cañaveral (2015) emphasize that this resource must be implemented to promote social and cultural well-being in such a way that they are linked to campaigns that encourage an improved quality of life. Haksiz *et al.* (2021) state this proof of this, which reveals how users with special needs can better understand traffic signs through this visual resource, with positive results. This characteristic also applies to educational institutions, where infographics promote themes, such as the growth mindset (Cheng *et al.*, 2021), health care, or violence prevention, towards the different actors involved in integrating educational communities. Figure 3 is a sample of how institutions take infographics that are not their own, but that help them promote good health practices during the pandemic, given the return to school.

Figure 3. Infographic used by school by communicating a specific topic
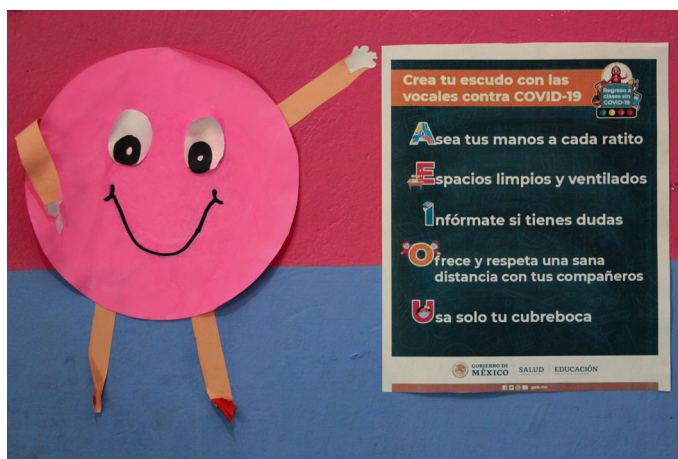
Source: Chicatti-Espindola photo archive (2021).

In the review of the educational centers' official electronic sites, those infographics intended for work in Schools for parents were also located. This visual modality constitutes an attractive way to expose topics of interest or problems that the institution is interested in addressing by those responsible for the students, in a simple language and format, by the user profile within the community. Likewise, this information can be sent to parents by traditional or digital means for consultation. In addition, it denotes the commitment that institutions have to their students. For example, figure 4 shows an infographic about tips for coping with children's poor grades. This representation shows key points parents can consider reacting appropriately and support their children to improve their average.

Figure 4. Infographic used in School for Parents

Source: Centro Educativo La Paz (2021).

On the other hand, some infographics have been designed to meet the academic needs of the student community from tutoring. Figure 5 shows an example of an infographic that seeks to guide the students on the processes they must carry out in extraordinary evaluations. This resource was published during the pandemic through social networks. In this, the specific steps for the fulfillment of the process are explained. Also, the resource provided the form of contact with the tutor. The combination of text and images makes the process that the student must carry out more understandable, remaining as a consultation document that provides the tutor with the orientation he or she needs to accomplish. In addition, it is a resource that has the advantage that it can be reused if the process does not change. For educational levels where the student is a minor, it can also be sent to the parents or guardians of the minor. It is essential to mention that the located infographics include a title and are organized logically. In addition, information is presented simply on the topic of interest to be understood by the educational community that consults it. It is possible that for its elaboration, an office automation program or application has been used for its construction.

Figure 5. Infographic used by tutoring
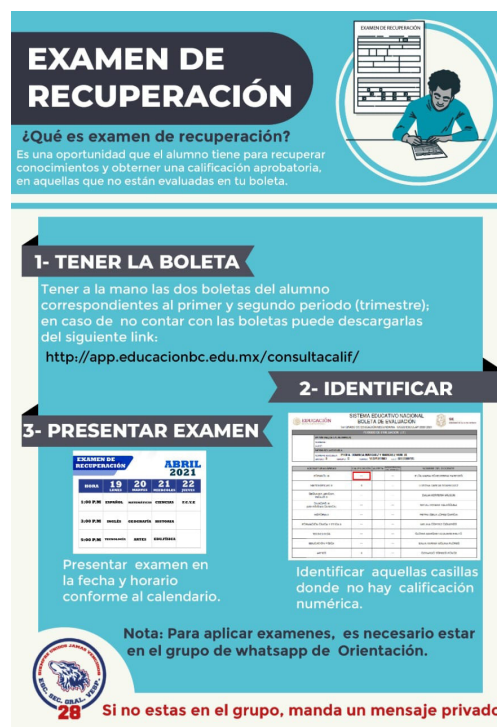
Source: Escuela Secundaria General Vespertina No. 28 (2021).

4. Discussion

Infographics applied to education are a trend in the classroom. The analyzed articles denote the effectiveness in the students is recognized a greater understanding of the different topics they may contain. The preceding is from mediating the increase in the grades obtained by the students after using this educational resource (Macías-Castro *et al.*, 2017; Sanz-Lorente & Castejón-Bolea, 2018; Villaplana, 2019). has compared the retention of information that the student has for days, in contrast to oral presentations or the use of other visual resources such as slides (Bernal-Gamboa & Guzmán-Cedillo, 2021). However, there are still not many studies that allow us to share the minimum requirements to assess infographics as a learning product, as has been done by Guzmán-Cedillo *et al*. (2017). This orientation would greatly help teachers in their day to day.

Furthermore, the benefits of the infographic construction and coding work promote the use of higher mental operations for the assimilation of knowledge, as highlighted by some authors (Damynov & Tsankov, 2018; Díaz-López, 2021; Dorneles-Lópes; 2020; García-González, 2022; Grieger & Leontyev, 2021; Weiner & Lorber, 2021). Additionally, these tasks help develop social, communication, management, and planning skills linked to collaborative work on analog and digital planes (Nava-Rodríguez, 2022; Ruiz-Ramírez, 2020).

The retrieved studies analyzed in this review show a tendency to document these advantages that the infographic presents for education, which should continue to be documented. Although, teachers must receive the necessary training to build their educational resources, as Alsheri & Ebaid (2016) already mentioned. Likewise,

they require knowing how to apply the infographic in educational planning for pre-training, training, and post-training activities. At the same time, how should these uses be evaluated in the classroom.

On the other hand, the use of this visual resource as a support for educational organizations is glimpsed. The examples cited as communicative formats –such as tutoring and school for parents– are articulated from the general to the particular to make their content more accessible (Colle, 2004; Guzmán-Cedillo *et al*., 2015). Additionally, the readers, who are the different educational actors, can understand the message and even learn about what is exposed in these infographics, as cited by Almunive & Alshammari (2018) & Mata-Santel *et al*. (2020). It should be noted that, as in the case of using infographics in the classroom, many institutions are using this resource, empirically designing these contents. It seems that educational organizations have discovered how efficient their visibility and socialization can be (López *et al*., 2018), even more so, in the latter, with the start of the pandemic and the urgent need to provide information to the educational community through electronic media.

5. Conclusions

Through the literature review, it was possible to establish the research trend regarding infographics. The cited articles show the need to increase studies on this educational resource. Above all, at a time when this visual support is gaining strength. With this, there will be enough evidence to ensure that teachers properly develop its use in the classroom. Furthermore, students will benefit even more through resources that are not alien to them and capture their interests. This way, the specific objective 1 raised at the beginning of this investigation is covered.

In contrast, the review mentioned above allows us to point out that it seems that we are still in the first stage of inserting the infographic in other spaces and activities of educational centers. The applications shown are incipient, but it is worth recognizing the effort many institutions make today. Additionally, for future research, these uses must begin to be documented and analyzed, with the intention that those who use them, maximize the potential of these resources within their educational communities. Although some institutions have communication departments, knowledge of the design and proper use of infographics should be common knowledge. Furthermore, there is not a clear application of the interactive infographic; so, this is another opportunity area for studying by researchers in education. Thus, specific objective 2 is covered.

Based on this research's findings, some essential steps are proposed to construct infographics that support educational centers in different areas.

- Establish the objective of the infographic, considering the use it will be given and the space in which it will be shared. It is suggested to rely on experts on the subject to specify the content.
- As minimum elements, it is advisable to include a title, the central subject, 2 or 3 secondary ideas, easy-to-read typography, images, authors, designers –if applicable– references, and reference sources.
- In addition, as part of the institution's image, it is essential to include the name of the organization and its logo.
- Avoid spelling and typographical errors and implement objective and inclusive language.
- The infographic must also consider the basis of the institutional philosophy and values and, at the same time, be respectful of its educational community.

Additionally, if the institutions make infographics continuously, they must decide if there is a common thread between the themes or if they will be isolated products. For example, if it is part of an educational program, it will be pertinent to define the frequency with which the infographics will be socialized. In addition, in some cases, given the type of infographic, contact information can be included to provide information or go deeper into the subject.

By way of closing, this research allowed us to see how versatile the application of infographics can be in institutions that provide educational services, as stated in the general objective. However, the infographic is a resource that still has many applications. Therefore, we must be attentive to its proper use and avoid misinformation and citizens' infoxication.

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