Enhancing students' writing competence and 21st-century skills simultaneously via infographics

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Abstract

The accelerating pace of technological trends has numerous reflections in education. Accordingly, various tools have been utilized to reap their benefits in English classes. Among others, infographics, which combine text with visually stimulating images, stand out thanks to their advantages, such as being concise and academically rewarding. Although their effects have been studied worldwide, a gap in the literature has been observed in measuring infographics' effects on developing students' writing and certain other 21st-century skills simultaneously in Iraq. Therefore, the main purpose of this study was to gauge the role of infographics in improving university students' writing competence and 21st-century skills. Having chosen 30 freshman students through convenience sampling from a private university in Erbil, Iraq, in the spring semester of the 2023–2024 academic year, they underwent a treatment spanning 10 weeks on writing essays. Data collection encompassed writing exams, questionnaires, and interviews in this mixed-method research design. The data were analyzed using either SPSS 29 or NVivo. The control group received writing instruction based on the common curriculum, whereas the experimental group's lessons were expanded with infographics. The findings revealed that infographic-enriched writing education yielded better results in terms of writing exams with a *p*-value of .002. Complementary findings also showed that certain 21st-century skills, such as critical thinking and taking initiative, were promoted. On the other hand, the achievement of the control group students was far from noticeable. The findings of this study may have various implications for interested parties who plan to integrate infographics into English classes harmoniously.

Keywords: academic writing; infographics; 21st-century skills; writing enhancement

Introduction

The importance of academic writing has been acknowledged unanimously in the 21st century, aligning with the increasing dominance of English globally. This encompasses 1.5 billion people who speak it either natively or as a second language. Academic writing has been considered a prerequisite to completing formal tasks, regardless of whether they are academic or non-academic (Albury-Garcés, 2024; Gallagher, 2023). In this respect, it has been taught seriously at educational institutions to reap the benefits during education and in professional and social life, respectively. For example, writing is an indispensable part of education from kindergarten to doctorate level in different forms, which may be dictation, written responses to prompts, paragraphs, or essays. In addition, standardized English tests, such as the Test of English as a Foreign Language (TOEFL), International English Language Testing System (IELTS), Key English Test, Preliminary English Test, and Cambridge English First test, cannot be envisioned without a writing section (Boggs & Manchon, 2023). Similarly, adopting the principles of academic writing is expected in certain publications, including articles, books, and proceedings. Moreover, professional life urges people to communicate in formal English via email. Thus, citizens who can command the rules of academic writing stand out from others, increasing their chance to climb the career ladder more quickly than their rivals. Apart from professional and academic life, writing is mandatory in some instances, including petitions, complaint letters, or application forms (Decorte et al., 2024; Hyland, 2023). Another noteworthy point is that academic writing skills have endless potential in people's lives, ranging from critical thinking to leadership (Bilgin, 2024). Last but not least, academic writing courses equip learners with other essential skills such as time management, collaboration, and digital literacy. Evidently, academic writing is not solely about writing competence, and has various reflections throughout people's lives.

Writing in a second language is a cognitively challenging task because it requires formally combining many elements within a single work. In other words, a multifaceted approach must be employed to write effectively, which includes domain knowledge, proficiency, rhetoric, and mastering the conventions (Maamuujav et al., 2020). Domain knowledge refers to absorbing specialized knowledge about a specific field so the concepts, terms, and principles can be used appropriately in writing tasks. Moreover, learners need to have a high level of competence in terms of writing so that they can apply their macro and microskills harmoniously to show proficiency. The third prerequisite of writing effectively is rhetoric, which can be put into practice in writing activities by using the language effectively and persuasively. Thus, the readers' attention can be captured easily by the appealing tone (Smith, 2020). Lastly, conventions refer to the norms that govern writing activities, allowing them to be accepted as well-established in a formal way. Conventions encompass grammar, syntax, spelling, formatting, style, and organization. Ultimately, all the aforementioned details should be synthesized clearly and coherently to convey the meaning thoroughly. In addition, racing against time is a must in academic writing settings because the learners' ability to complete tasks on time matters greatly. However, having some challenges does not necessarily mean that writing is impossible. Learners can employ some strategies to overcome difficulties and write flawlessly. For example, brainstorming, outlining, and researching can pave the way for writing more confidently (Yildiz, 2022). In addition, setting clear goals, and using drafts and reading models several times can dramatically relieve the stress of learners. After that, activating final revision, seeking peer or teacher feedback, and purchasing typing assistants can boost learners' motivation because such activities help them shape their learning accurately and increase the chance of long-term retention with repeated initiatives (Ahmad et al., 2023). Obviously, academic writing poses some challenges that can be handled easily by adopting certain strategies wisely.

Integrating visual aids into writing classes has gained increasing popularity thanks to their advantages over traditional methods. Prominent examples of visual aids include graphic organizers, storyboards, photographs, videos, film clips, real-world objects, and interactive whiteboards (Indrayanti et al., 2023). They have a distinct ability to inspire learners to become more proficient in writing. To illustrate, graphic organizers, some of which are mind maps, Venn diagrams, and flowcharts, can be beneficial for organizing thoughts according to a predefined template before writing. Similarly, storyboards motivate learners to plan their stories scene by scene so the smooth flow of the story can be ensured. Likewise, photos can be engaging tools to spark students' curiosity and stimulate their critical thinking skills if they are relevant to the writing topics (Macwan, 2015). Subsequently, videos can promote a topic, raise awareness, and describe an issue so that students can obtain the background information and lexical power about specific topics in advance. Thus, they can compose their ideas in writing based on the points illustrated in the videos. Movies have various extensions to highlight many chronic problems in life, so relevant topics can be covered together to receive the benefits of visual aids (Abdulrahman & Kara, 2023). Movies can contribute to learners' story-telling skills substantially. Real-world objects can be used to bridge the gap between real life and academic writing tasks, so students can have first-hand experience by touching and expressing their ideas based on real-life objects rather than relying on abstract notions (Kusuma & Nurkamto, 2021). Afterwards, interactive whiteboards allow teachers to use different shapes, fonts, and colors to make concepts more intriguing for learners. Thus, teachers can be granted the freedom to tailor education so that they can meet students' individual needs flexibly in English classes. Furthermore, interactive boards can be used to write essays, receive feedback, and take quizzes online (Celik & Kara, 2024). Digital integration can be enhanced in this way via visual means, so digital natives can be more engaged in writing classes with increasing enthusiasm. Clearly, conducting writing lessons engagingly without visual aids seems to be unavoidable.

Infographics (IGs) have been used broadly in various sectors to present information concisely and effectively in limited spaces through the power of visual aids and catchy text. Several types of popular IGs include lists, information, timelines, flowcharts, statistics, and hierarchies (Rezaei & Sayadian, 2015). For example, politicians use them to promote their campaigns and get ahead of their rivals in elections. Telecommunication companies take advantage of IGs to show their offers and increase their customers. Utility companies activate IGs to display energy use every week. In addition, some foundations such as UNICEF and the World Health Organization reap the benefits of IGs by informing people about vaccination; preventive acts against chronic diseases, hygiene, and climate change; or opportunities for children to receive a proper education (Abdulla, 2024; Kucuk, 2024). Apart from other usages, IGs have been used widely in education because they are catchy and handy for instantly capturing learners' attention and are conveniently used for many purposes. When they are used regularly, learners grasp details quickly and retrieve their memories when needed in the following days. Additionally, visual literacy helps students to categorize and comprehend themes so they can grasp details and store information without much difficulty. IGs can be used in three forms at educational institutions, where readily available infographics on the web and teacher- and student-created IGs can be chosen, tailored to the specific needs of students (Ponzio & Matthusen, 2018). Whereas IGs on the web can describe and illustrate information, student- and teacher-created IGs can be customized to meet specific needs. Piktochart, Easel.ly, Venngage, Visual.ly, Infogr.am, Canva, Vista Create, and Poster Maker are some apps for creating IGs for free or at a minimum cost if advanced features are needed. Clearly, IGs are excellent when information is abundant but the attention span is inadequate for absorbing all knowledge.

Significance of the Research

Developing writing skills is the key to success in language proficiency. However, it is a tough task regardless of whether one is a native speaker, or an English as a second language or English as a foreign language (EFL) learner. Thus, motivating learners to be keen writers takes precedence in this century so that writing competence can be ensured at educational institutions, thereby ensuring its positive influence at later stages of their lives (Jones et al., 2019; Kara, 2023). In this regard, using visual aids in education has been applied to appeal to various learning channels. IGs are one of the leading examples of visual aids in English classes used to capture students' attention and keep them engaged during writing sessions. It is acknowledged in many circles that students engaged with IGs become avid learners, so their writing performance can be gradually enhanced (Yaseen, 2023). In addition, being more creative and being a critical thinker go hand in hand when writing classes are enriched with IGs. Visual aid-enriched writing education is expected to pave the way to becoming for being constant readers and expressing their ideas more eloquently so that individuals can meet the criteria of being regarded as global citizens.

Literature Review

Utilizing IGs has gained irresistible momentum since the early 20th century because marketers and advertisers recognized the value of visualization in promoting products and making extensive datasets more digestible for the average customer. Alfred Leete and Otl Aicher exemplify the use of IGs, and they received many compliments from all circles worldwide. The former, a British graphic artist, developed a poster highlighting the pros of the London Underground over other modes of transportation in 1915. In contrast, the latter, a German graphic designer, designed an infographic to help users find destinations easily in the Munich Olympic Games held in 1972. Their unprecedented success has inspired others to take advantage of IGs in various fields, ranging from journalism to sports, as they offer clarity for readers. It is worth noting that the advent of the World Wide Web in 1991 hastened the development of IGs worldwide because personal computers are more flexible, convenient, and user-friendly to making, editing, or deleting IGs. Similarly, Adobe Flash Animation contributed to the popularity of IGs with its distinct features in the 2000s. It might be thought that the rise of IGs cannot be unstoppable; however, they will evolve more rapidly with the advancements in artificial intelligence and virtual reality. Reflections of IGs in education can be seen in various forms, such as pie charts, graphs, and histograms. Educators plan to maximize students' learning by providing beneficial means in emerging technologies. Scholars have expressed numerous advantages of IGs in education, such as enhancing memory retention (Bhat & Alyahya, 2023), stimulating critical thinking skills (Indrayanti et al., 2023), developing ambition for further learning (Kusuma & Nurkamto, 2021), offering contextual knowledge (Ozdamli et al., 2016; Yucedal & Kara, 2023), fostering digital literacy (Bilgin, 2024), supporting linguistic skills holistically (Damyanov & Tsankov, 2018), and promoting creativity (Jaleniauskiene & Kasperiuniene, 2023). Considering the untapped potential of IGs, educators in English language teaching have sought opportunities to integrate them into the curriculum and gradually foster students' learning. To name a few, Lopez Cupita and Puerto Franco (2019) found a positive correlation between implementing infographic-enriched instruction and students' reading performance at a university in Colombia. They stated that students created IGs to summarize short texts, culminating in a substantial rise in their reading scores. Likewise, Manickam and Aziz (2020) examined the role of IGs on primary school students' reading scores in Malaysia. They increased the students' memory and ability to grasp meticulous details in the text, thereby increasing their marks in the corresponding exams. Subsequently, in the US context,

Ponzio and Matthusen's (2018) study revealed that IGs could increase students' listening and speaking performance considerably thanks to their interactive and appealing natures on multilevel students. Another notable study was conducted by Alwadei and Mohsen (2023) in Saudi Arabia at the tertiary level, which unearthed that IGs offer tremendous opportunities to expand vocabulary knowledge so students can express their ideas more confidently with their expanded lexical powers. Tavanapour et al. (2022) found that IGs had far-reaching effects on Iranian students' vocabulary retention at a language institute. In the US context, Jones et al. (2019) examined the role of IGs in developing 21st-century skills, which revealed that IGs paved the way for improving digital literacy, critical thinking, and problem-solving skills. Moreover, Rezaei and Sayadian (2015) stated that IGs transformed students' attitudes towards grammar instruction in Iran after noticing a wide range of positive effects in grammar lessons at the tertiary level. Furthermore, Hameed and Jabeen (2022) investigated the impact of IGs on university students' writing skills in Saudi Arabia which showed students unlocked their potential to be more creative in writing classes. Thus, they enjoyed the pleasure of enhanced writing performance at the end of the treatment period. To substantiate other studies, Elaldı and Çiftçi (2021) conducted a meta-analysis to measure the effectiveness of IGs in terms of overall academic achievement, which demonstrated that their integration in EFL settings fostered students' learning in all macro- and microskills from primary education to university level on a global scale.

The effects of IGs were also investigated in Iraq, where the researcher conducted this present study, to contribute to the literature. For instance, Issa (2024) carried out a comprehensive study on university students, which unearthed that IGs received compliments from the learners because they became more engaged in cooperative activities, so their writing competence was significantly enhanced. In the same vein, Yaseen (2023) examined pre-service teachers' perceptions about the effectiveness of IGs, which showed that IGs were found to be useful in fostering vocabulary and using written and spoken English simultaneously. A similar study was conducted by Abdulla (2024) on pre-service teachers, which elucidated that IGs, particularly customized infographics on the Canva platform, could foster students' productive skills when implemented with a well-defined and monitored program.

Although IGs have numerous advantages in EFL settings, it is not uncommon for instructors and students to have some difficulties when creating visualized data or grasping the details. For example, Toth (2013) stated that student-made IGs posed some problems because it was challenging for students to fit in large chunks of data in a comprehensible and catchy way. His study hints that a lack of information and communication technology literacy and decision-making skills can hinder students' learning via IGs. In addition, Chicca and Chunta (2020) found that a student-oriented visual data design can elevate students' stress because having a fixed time to submit IGs can cause anxiety for many students. In addition, Gover (2017) pointed out that IGs can have adverse effects in EFL classes when the visualized data's resolution is poor or the information is overwhelming for readers. Considering the studies mentioned above, it is safe to conclude that IGs have endless potential when some constructive warnings are taken seriously to maximize the benefits for learners.

Theoretical Underpinnings

Using visual stimuli to engage learners has been put forward by many renowned scholars. To name a few, the Cognitive Theory of Multimedia Learning was developed by Richard Mayer, who asserted that texts should be accompanied by audio, videos, or images so the visual and verbal channels can be triggered at the same time to allow the recipients to process information faster and transfer it to their long-term memory. This assumption is based on the dual-channel

hypothesis, claiming that humans possess separate channels to receive information and manage it in a meaningful way to recall it instantly in their future endeavors (Alwadei & Mohsen, 2023). Therefore, the seamless fusion of textual and visual elements is acknowledged as a powerful catalyst to retaining knowledge for a long period of time. In addition, Neil Fleming's visual–auditory–reading–kinesthetic theory emphasizes that visual learners maximize their learning when traditional courses are combined with illustrations, graphs, diagrams, videos, and movies (Khongpit et al., 2018). His theory suggests that providing visual materials transforms students' learning because visual aids are appealing and can be retrieved easily later. Similarly, Howard Gardner's Multiple Intelligence Theory highlights the importance of visual inputs to increase positive learning outcomes in education (Nulhakim & Berlian, 2020; Topal, 2024). Evidently, the use of IGs has many trustworthy theoretical underpinnings for their implementation at educational institutions.

Research Aim and Research Questions

A considerable body of research has been examined globally; however, a gap in the literature has been noticed about the influence of IGs on university students' writing competence in persuasive essays regarding writing exams and students' perceptions. To address this gap, the current study explored the impacts of IGs on students' writing performance and the development of 21st-century skills via the research questions given below.

> RQ1: What is the influence of IGs on developing EFL learners' writing competence?
> RQ2: How effective are IGs in improving certain 21st-century skills?
> RQ3: What are students' overall perceptions about IG-enriched instruction?

Method

Research Design

This study adopted a convergent mixed-method research design, collecting quantitative and qualitative data separately and merging them in the final phase to arrive at more reliable interpretations. Based on Younas et al.'s (2023) assertions, a convergent mixed-method design offers several advantages in social science studies because the researchers have the flexibility to use the stronger points of quantitative and qualitative research designs so that the final product is adequately reliable. Additionally, they posited that merging data to make comparisons strengthens the robustness of the data, thereby eliminating doubts to a large extent.

Setting and Participants

The study's setting was a private university in Erbil, Iraq, with 5000 students across 30 departments in the 2023–2024 academic year. It has been increasingly chosen by students thanks to its provision of English-medium instruction, the adoption of the latest technology in classes, and the welcoming atmosphere that includes nationals from around 10 countries. The participants of this study were chosen from Foundation English course students through a convenience sampling method. The participants' departments included pharmacy, aviation engineering, and business. Thirty participants were chosen from 250 students, and their ages ranged from 18 to 27. The participants included 11 female students and 19 male students. The rationale for choosing Foundation English students was that they were ambitious to sharpen their English skills during the year by taking this course of 10 hours. Moreover, they were motivated to

develop their language skills as early as possible to adapt to lessons in their departments where all courses were also presented in English. Students were placed in the Foundation English category upon taking the Proficiency Exam, which combined Oxford and Cambridge materials to assess the students' levels professionally and arrange their classes correspondingly. The foundation English course is a three-credit non-elective course taken throughout the year by students whose levels are not satisfactory enough to understand the concepts of their departments. In other words, the Foundation English course lays the foundation for students to figure out all the details in English so that they can be as successful as possible in their departments from freshman to junior years. The students' courses used a renowned series called *Own It!* by Cambridge University Press. This series has been known to have appealing topics for university students, offering top-notch supplementary materials and enriching classes with flawless I-tools, including interactive games, videos, and audio tracks. It is worth mentioning that the academic staff of Tishk International University Language Preparatory School has been trained through various workshops to raise standards and foster students' learning each week. Additionally, the students' performance was tracked by mock exams, unit tests, and official exams via Zip Grade, so the statistical analysis was monitored periodically by both administrators and responsible academics for the betterment of education.

Instrument and Procedures

The researcher used several instruments so that the study could align with a convergent mixed-method research design. A prior test, Oxford Placement, was conducted to ensure the homogenous distribution of students. Thus, it was planned to categorize students according to their proficiency. Oxford Placement is a comprehensive test to measure students' skills from different angles. It has an established reputation in the ELT community. Once students had taken the exam, it was found that their marks were distributed evenly, which was a sign of homogeneity. After the initial process, the second set of instruments, namely writing exams and surveys, was introduced. The topics for the writing exam were chosen from the essay pool created by committee members, including ELT experts. Of particular note is that all topics were chosen to activate persuasive essay writing rather than expository, descriptive, or comparative writing. After jointly choosing the topics, the committee members created the grading rubric, which was a combination of the grading criteria from the IELTS and TOEFL independent writing section. In the subsequent stage, writing exams were piloted on other students whose levels were not different from the actual participants. The pilot study revealed that the Cronbach Alpha Index (.94) was adequate to ensure internal consistency. In addition, the face and content validity of writing topics were triple-checked by the committee to enhance the intelligibility of the items. The writing topics which were covered in the study were as follows:

- Ways to eliminate traffic accidents.
- Reasons to use the Internet.
- Strategies to eliminate air pollution.
- Tips to be a successful student.
- The best book you have ever read.
- The best movie you have ever watched.
- Reasons to listen to music.
- What leads to a healthy diet?
- What matters most to you in your life?
- What is the best country to visit?

Apart from writing exams, surveys (questionnaires and surveys) were used to collect students' genuine opinions about IGs. The questionnaires and interviews were held in two sessions to determine whether the students' opinions differed greatly after the treatment. Items in the questionnaire used a 5-point Likert scale because this format is easy to assess statistically and is easily understandable by the participants. On the other hand, the interview questions were composed in a semi-structured form to welcome the students' perspectives from various angles.

The data collection process spanned 10 weeks to enrich the academic writing course with IGs in the spring semester of the 2023–2024 academic year. The period of the spring semester was chosen because the students had received preliminary information about essay writing in the fall semester so they could write essays confidently in the second semester. Both groups joined a common workshop to clarify each step of the study in advance. After the workshop, they were placed in their respective classes as control or experimental group members. The Foundation English course was covered by the *Own It! 2* series. However, a separate writing topic was covered in each unit to gradually sharpen the students' writing skills. In this regard, the control group wrote their essays in the traditional format, including brainstorming, making an outline, drafting, reading the model, composing their work, and getting feedback from the instructor. This cycle continued until the end of the data collection process. In other words, the topic was covered according to the principles of the course set in advance. On the other hand, the experimental group received novel instructions with the integration of IGs. In addition to doing all the control group's activities, they were introduced to IGs to discuss certain themes and see different points of view or statistical values. In addition, students exchanged their ideas in light of the points highlighted in the IGs. To illustrate this, some IGs about traffic accidents were displayed on the screen whereas students were composing their ideas in their minds about reducing traffic accidents. These IGs included causes, tips, and campaigns to raise awareness about traffic accidents. Thus, students were given the chance to increase their knowledge about traffic accidents from many points before creating their works. This cycle was repeated according to the predefined schedule. Obviously, the writing lessons given to the experimental group were considerably different from that of their peers in the control group, allowing us to measure the effects of IGs for enhancing students' writing. Once the 10 weeks were over, it was time to run post-tests to determine the effectiveness of IGs in writing competence.

Data Analysis

Quantitative data were analyzed using SPSS 29, which adopted the principles of descriptive statistics. Mooi et al. (2018) pointed out that descriptive statistical tools have been used widely because they effectively summarize numerical data in a meaningful way and interpret it more sensibly. More specifically, the writing exam results were analyzed via an independent samples *t*-test, whereas questionnaires were interpreted via the mean, median, and standard deviation. In addition to the quantitative data, qualitative data were collected via interviews to be analyzed by their distinguishing features in NVivo. In other words, content analysis was chosen to categorize the data from the interviews into themes and interpret them appropriately. Deterding and Water (2021) have stated that classifying the content into themes can help researchers manage data and offer more insightful points. The content analysis involved inserting transcripts, systematic coding, composing themes, thorough revision, and finalizing the results. Four analysts recorded the inter-rater consistency as 0.79, demonstrating an acceptable level of reliability.

Findings

This section is divided into three subsections, encompassing the writing exams, questionnaires, and interviews, to thoroughly explore each instrument and systematically address the research questions.

Writing Exams

Writing exams were statistically analyzed by an independent sample *t*-test, the details of which are given in Table 1.

Table 1 shows the descriptive statistics of both groups in both timeframes, namely the pre-test and post-test periods. When the pre-test scores were examined thoroughly, no significance was measured. In other words, the *p*-value (.053) was greater than the .05 significance level. However, the figures changed sharply in the aftermath of the study, when the *p*-value (.002) was recorded as having significance at the .05 level. These statistical analyses confirmed that experimental group students whose lessons were enriched with IGs improved their results after joining the study. On the contrary, the control group students whose lessons covered the pre-defined curriculum could not improve their writing performance substantially. The difference between the two groups is visualized in Figure 1.

According to Figure 1 the pre-test writing scores were nearly the same; however, there was a substantial increase in the experimental group's scores, whereas the difference was far from significant in the control group. More specifically, the control group improved their scores by less than one point; on the other hand, the rise for the experimental group was approximately 18.33 points.

Questionnaires

The questionnaires enquired about certain implications of IGs in terms of sharpening academic writing skills and mastering 21st-century skills, so that the first and the second research

Table 1 *Results of the independent samples t-test*

Variables	Measurement	N	Mean	Standard deviation	*t*	df	*p*-value
Pre-test	Control	15	48.33	18.290			
Pre-test	Experimental	15	48.67	16.088	0.053	28	.958
Post-test	Control	15	51.67	16.439			
Post-test	Experimental	15	70	13.229	3.365	28	.002
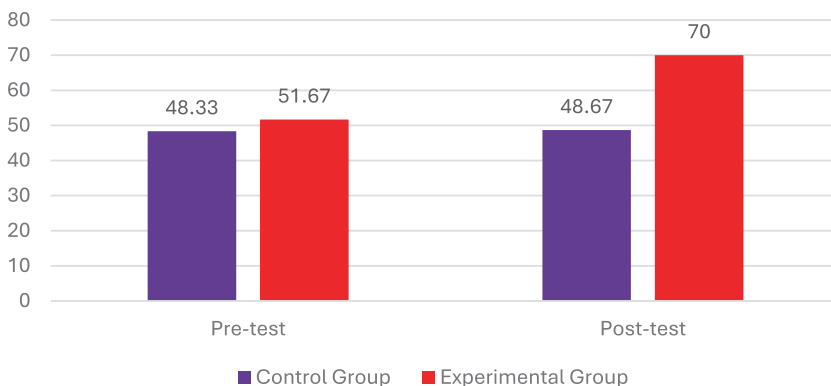
Figure 1 Comparison of writing scores.

questions could be examined in detail. In this respect, the students' perceptions are presented in Tables 2 and 3 as descriptive statistics. The participants' genuine opinions about the correlation between writing performance and IGs are illustrated in Table 2.

As displayed in Table 2, Section 1 included five items about enhancing writing through IGs. When Item 1 was explored, it was observed that participants drew a correlation between grasping essential words and applying them to their essays in the treatment. More specifically, the mean score was recorded as 4.40, which was significant enough to notice positive effects. In addition, 86.7% of the participants chose to either strongly agree (60%) or agree (26.7%), which substantiated the mean scores. Additionally, Item 2 showed that making interpretations about the visualized data in cooperation fostered students' learning considerably because brainstorming paved the way for peer learning. Considering the mean score of 4.53 and the high satisfaction rates (totally agree = 73.3%, agree = 13.3%), it can be asserted that the participants valued peer learning through IGs. For Item 3, it was revealed that the participants appreciated focusing on different dimensions of a common topic to write more creatively because considering different dimensions motivated them to elaborate more and write more persuasively. The mean score of 4.47 and higher percentages for the strongly agree (60%) and agree (26.7%) options are highlighted to validate such gains. Subsequently, the participants agreed that using the phrases in IGs helped them to reduce spelling mistakes because they read them several times before composing their essays (Item 4). In line with this, the mean score was 4.20, which was quite significant. Accordingly, the percentages indicating satisfaction were considerably high (strongly agree = 53.3%, agree = 20%). The last item was more comprehensive in this part of the questionnaire, showing a direct link between

Table 2 *Participants' opinions about the development of writing via infographics (IGs)*

Section 1: Writing competence	Mean	Median	Mode	SD	Totally agree	Agree	Neutral	Disagree	Totally disagree
					Percentage				
1. IGs are helpful to have essential words for writing tasks	4.40	5.00	5	0.910	60	26.7	6.7	6.7	0
2. IGs are useful for brainstorming cooperatively	4.53	5.00	5	0.915	73.3	13.3	6.7	6.7	0
3. IGs are beneficial for noticing different dimensions and writing more creatively	4.47	5.00	5	0.743	60	26.7	13.3	0	0
4. IGs support me to sharpen my spelling	4.20	5.00	5	1.014	53.3	20	20	6.7	0
5. IGs assist me in forming essay structure	4.80	5.00	5	0.561	86.7	6.7	6.7	0	0

Table 3 *Participants' opinions about sharpening 21st-century skills via infographics (IGs)*

Section 2: Mastering 21st-century skills	Mean	Median	Mode	SD	Totally agree	Agree	Neutral	Disagree	Totally disagree
IGs are great for developing digital literacy.	4.60	5.00	5	0.910	80	6.7	6.7	6.7	0
IGs urge me to foster critical thinking skills	4.67	5.00	5	0.617	73.3	20	6.7	0	0
IGs drive me to spark curiosity	4.27	5.00	5	0.884	53.3	20	26.7	0	0
IGs motivate me to have social and cultural awareness	3.80	5.00	5	1.424	53.3	6.7	6.7	33.3	0
IGs encourage me to take the initiative	4.73	5.00	5	0.458	73.3	26.7	0	0	0

writing in a more organized manner and being exposed to infographic-enriched education. The mean score, 4.80, was the highest, which revealed that participants observed the positive influence of IGs in organizing their essays according to the principles of academic writing. Likewise, the percentages of positive responses (86.7% = strongly agree; 6.7% = agree) were in line with the descriptive statistics. It is evident that the participants found various correlations between writing more academically and receiving education through IGs.

In addition to writing competence, the participants revealed their ideas about the link between the development of 21st-century skills and using IGs in writing classes (Table 3).

Table 3 also reveals significant points that can be emphasized. To illustrate, Item 1 shows that digital literacy can be enhanced substantially when combined with IGs in an academic writing setting. More specifically, the mean score (4.60) and percentages of positive answers (strongly agree = 80%, agree = 6.7%) demonstrate the participants' positive views about the type of instruction employed in the study. Likewise, the participants believed that the power of IGs could improve critical thinking skills, according to the mean score (4.67) and the high percentages of positive answers (strongly agree = 73%, agree = 20%) for Item 2. Moreover, the participants were driven to satisfy their curiosity upon receiving IG-enriched writing education according to the mean score (4.27) and percentages of positive answers (strongly agree = 53.3%, agree = 20%) for Item 3. In addition to other 21st-century skills, the influence of IGs on the development of social and cultural awareness was examined in Item 4. In contrast to the other items, the finding was not as satisfactory as expected when the mean score (3.80) and percentages of positive answers (strongly agree = 53.3%, agree = 6.7%) were interpreted. The last item in this part of the questionnaire tried to forge a link between IG-based writing instruction and students' inclination to take the initiative. The findings encompassing mean scores and percentages of positive answers (strongly agree = 73.3%, 26.7% = agree) revealed that the participants were motivated to take responsibility for the betterment of society. Considering all items, it is safe to conclude that the participants acknowledged the significance of IGs in sharpening the aforementioned 21st-century skills without leaving any room for hesitation.

Interviews

The transcripts of the interview were categorized according to the principles of thematic analysis and interpreted accordingly. Table 4 clearly illustrates the advantages and drawbacks of IGs.

Positive Aspects of IGs

The first essential theme that emerged from the qualitative analysis in Table 4 is that IGs display the information in an understandable format. The majority of students asserted that limiting the content and using simplified expressions gave them ample opportunity to understand without having much difficulty:

I am a big fan of expanding my knowledge through IGs because they are easy to understand. In addition, all IGs are related. Thus, getting required information from IGs and converting them to essays motivated me to improve my writing skills in this study. (Student 3)

The second fundamental theme of the interview is being exposed to eye-catching content through IGs. More than half of the students stated that combining text with images and interesting statistics grabbed their attention, so their attention span was boosted:

Reading the text continuously is dull for me. However, I become more willing to learn when texts are illustrated with relevant images. In this study, we read the content and focused on the related images, so we restored the knowledge easily because images helped us retrieve information and turn it into an essay format. In the end, my essays were more persuasive than ever before. (Student 4)

Table 4 *The themes, categories, and codes gathered through one-on-one interviews*

Positive themes	Codes	Negative themes	Codes
Understandable	1.1 Topic-oriented 1.2 Concise	1. Perplexing	1.1 Irrelevant images 1.2 Long sentences 1.3 Unknown words 1.4 Inaccurate graphs 1.5 Unable to transfer
Eye-catching	2.1 Illustrated features 2.2 Appealing statistics		
Versatile	3.1 Various dimensions 3.2 Comprehensive		
Raising sensitivity	4.1 Increased awareness		
Accessible	5.1 One click away		
Academically rewarding	6.1 Activating different learning styles 6.2 Easily digestible 6.3. Easy to recall		

The third theme of the interview is versatility. As many people know from firsthand experience, creating an infographic within seconds is possible thanks to technological developments. Accordingly, tech companies are racing to offer a handier app so users can form their IGs while saving considerable amounts of time. Additionally, students can brainstorm about IGs to consider many angles. In this regard, most of the students pointed out that being able to see a topic from many dimensions intrigued them:

When I read model essays, I cannot see a comprehensive point of view because writers try to persuade readers in limited paragraphs. However, IGs display the causes of serious problems, offer solutions, and leave a hyperlink for reading further and becoming more knowledgeable. For instance, we learned the major causes of traffic accidents, read sensible precautions to reduce them, and browsed different websites to learn more about this issue through IGs. As a result, this study was great for diving into a chronic problem and coming up with possible resolutions which stimulated my creativity in writing activities. (Student 7)

The fourth theme of the interview is related to sensitivity. Nearly three-quarters of the students thought that IGs made their consciousness more sensitive to many issues, ranging from environmental issues to health issues and violence. Thus, they become more conscientious about taking appropriate action to manage chronic problems before it is too late. Such activities to raise awareness affected their enthusiasm to write more effectively:

I became more aware of certain problems in our lives with varying degrees. For example, we were informed about air pollution and poor diets, so I changed my mind to reduce air pollution and eat healthily. After that, I transferred this information to my essays, which were more informative and convincing than before. (Student 10)

The fifth theme of the interviews was accessibility, which can be possible with advanced networks in the 21st century. IGs are flexible and can be reached anytime and anywhere, with a stable internet connection. Thus, learners can access them to read several times. In this respect, approximately all students stated that the accessibility of IGs drove them to take advantage of them several times:

I lead a busy lifestyle because I have a lot of courses to manage. However, I have realized that IGs can effectively satisfy my curiosity about many topics. Thus, I clicked on the websites to examine the IGs we studied in our writing class. As a result, it was a beneficial period to obtain knowledge from many sources and apply it to my essays practically. (Student 11)

The last positive theme that emerged in the interviews is that of IGs being rewarding from the academic side. More than 90% of students postulated that triggering various learning styles and carefully chosen expressions raised their ambition to figure out details instantly and retrieve them easily at later stages once needed. Thus, such gains can be easily turned into coherent paragraphs in an essay:

I am a visual, kinesthetic, and auditory learner, which can be implemented via IGs. We were prompted to comment based on the images and texts. Additionally, our teacher turned IGs into audio-format, so we could listen to sentences and analyze them. After that, we were divided into groups to brainstorm and compose our ideas cooperatively which was the example of kinesthetic learning. Being active continuously affected my learning positively. As a result, restoring my mind easily to meticulous details in the IGs was not surprising. (Student 13)

Negative Aspects of IGs

Having positive feedback does not necessarily mean that IGs do not pose any challenges for learners. Some students expressed their ideas about the drawbacks of IGs, such as misleading images, long sentences, false information, and overwhelming content:

There is no denying that IGs are promising. However, some points should be re-evaluated to increase their positive impacts on students. For example, some photos or charts may be irrelevant, as we have noticed several times. In addition, some infographics are not concise enough to understand major concepts briefly. Besides, some details are inaccurate when we double-check the accuracy from different sources. Finally, some IGs are not balanced in terms of the percentage of text and image, so we were overwhelmed while trying to understand essential points. Those hindrances prevent us from turning them into sentences in the essay. (Student 14)

Discussion

The influence of IGs on promoting university students' writing performance was investigated thoroughly through the lens of a mixed-method research design via writing exams, questionnaires, and interviews. The quantitative findings from the exams documented that IGs are promising tools to enhance students' writing performance considerably. This finding corroborates the study by Elaldı and Çifçi (2021), who have pointed out that graphic-enriched writing instruction has untapped potential to improve students' writing competence. On the other hand, covering the writing course in a text-based format did not yield satisfactory results in the control group. This finding suggests that inserting audiovisual tools into writing sessions can boost students' motivation substantially. Likewise, the quantitative findings from the questionnaire revealed that students believe in the power of IGs in developing their 21st-century skills, such as digital literacy, critical thinking, curiosity, social awareness, and taking initiative. These gains were also found in a previous study by Jaleniauskiene and Kasperiuniene (2023), who asserted that IGs could transform students' 21st-century skills to the next level thanks to their versatile nature. Similarly, Bilgin (2024) has posited that visual stimuli can be captivating, thus promoting learning and developing various 21st-century skills simultaneously. These findings suggest that IGs not only sharpen linguistic skills but also subconsciously develop other essential skills. Alongside the quantitative data, the qualitative data offer insightful points in the interviews that were highlighted through content analysis. To name a few, students attested that IGs are easy to understand thanks to their ability to display topic-oriented content concisely. In other words, converting complicated topics into a brief understandable format has intrigued the learners. According to Noh et al. (2017), IGs are preferred widely at educational institutions because they are brief, crystal clear, and complete. In addition to that, eye-catching illustrations are found to be appealing by the students in the interviews, which is in line with the study of Parveen and Husein (2021), who have stated that the visually stimulating nature of IGs increases students' attention because they are inclined to examine images in the form of graphs, charts, or lists. Moreover, versatility ensures the focus of the students because examining the topic from many perspectives drives them to undertake further research until they are satisfied. In this respect, Abbazio and Yang (2022) emphasized that IGs encourage learners to develop a growth mindset because they offer comprehensive knowledge from many angles. Thus, they are urged to conduct thorough research until they can store the information in their minds appropriately. Moreover, the interview findings have shown that students become more sensitive to humanity's problems, such as health, traffic, pollution, and basic human rights, after being exposed to IG-enriched writing instruction, which aligns with the study of Prandi

et al. (2021). Furthermore, students appreciate accessibility, as IGs are readily available tools on the internet. This finding dovetails with the assertions of Monroe (2022), who pointed out that IGs are easy to access anytime, so they are used by educators in increasing volumes. The final positive outcome of IGs is that they are seen as being academically rewarding because they appeal to different learning styles, thereby increasing the chance to learn new information and retrieve it when needed. This finding is consistent with Atabek's study (2020), which revealed that IGs are engaging for learners, so they can be used in many ways to foster students' linguistic competencies. On the other hand, the students in the interview indicated some negative sides of IGs. To illustrate, irrelevant images, challenging sentences, false information, and overwhelming data are cited as drawbacks of IGs. This finding is in line with Kucuk's (2023) study, which demonstrated that audiovisual tools need to be revised; otherwise, unexpected outcomes can be inevitable as a result of technical faults. When all data were triangulated, it was seen that IGs were powerful tools to expand students' capacity in academic writing settings and sharpen many 21st-century skills simultaneously.

A further discussion of the findings can be attributed to the adoption of a communicative language teaching approach when harmonizing IGs into the writing curriculum. More specifically, showing visually stimulating IGs from a wide range of perspectives, discussing the main themes, composing outlines cooperatively, and receiving feedback from peers or teachers are prime examples of communicative language teaching (CLT). Additionally, covering lessons through CLT prompted the students to learn more out of curiosity because they were driven to contribute to the discussions with their sensible assertions. Afterward, increased awareness in many fields urged the learners to take the initiative for the betterment of society in general. This positive cycle continued throughout the study, enabling students to brainstorm, discuss, write, receive feedback, and take the initiative, ensuring their success in writing and other life skills. Toro et al. (2019) have stated that CLT is a visionary approach to fostering students' learning orally and turning it into meaningful writing tasks. This point of view suggests that CLT and academic writing go hand in hand to complement each other flawlessly.

Conclusions, Implications, and Recommendations

This research aimed to measure the influence of IGs on developing students' writing and 21st-century skills at the tertiary level. The findings have revealed that IGs are useful for sharpening writing skills considerably. In other words, IG-enriched instruction prompted students to write more persuasive essays. Subsequently, complementary findings have revealed that IGs are key to sharpening numerous writing skills, including creativity, critical thinking, curiosity, and initiative. On the other hand, following a common curriculum without any integration of IGs did not yield positive outcomes; rather, those students could not improve their academic writing performance. This shows that some appealing features of IGs, such as being visually stimulating, concise, and accessible, have been found to be rewarding in terms of academic success.

Based on the findings of the study, some pedagogical implications are given. To begin with, educational institutions should not underestimate the significance of technology-enriched teaching in this century via smartboards, stable network coverage, and useful applications. In the second place, authorized bodies should consider organizing more workshops to promote the usage of IGs in English classes in order not to leave teachers perplexed by the thousands of IGs. Such workshops can function as learning hubs to create lesson plans, show demo lessons, and welcome amendments to refine the system. After that, policymakers should allocate a budget for schools to subscribe to some design apps so that student-made infographics can be used effectively to keep students active, thereby bridging the gap between theory and practice.

With respect to the limitations of the study, a wide range of practical suggestions are put forward for further research. Firstly, this study was confined to 30 university students whose writing performance was measured to investigate the influence of IGs. Further studies can be conducted by expanding the number of students and the scope with other skills, such as reading, speaking, and listening. This study focused on writing persuasive essays; future studies can focus on other types of essays, such as narrative, expository, or descriptive writing. Furthermore, the duration of this study was 10 weeks, which could be prolonged to see a clearer image of the effects of IGs on students' learning in the long run. Finally, this study examined the effects of only IGs which were available on the internet. Future studies can investigate the effect of readily available IGs or student-made IGs on students' learning rates.

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