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The Effectiveness of using Infographics on the Academic Achievement of Elementary Students

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Abstract

The primary objective of this research was to investigate whether or not the incorporation of an infographics program into elementary school curricula had any effect on the student's overall academic achievement. The investigation involved a total of forty participants, with an equal distribution of twenty people in each of the experimental and control groups. The findings of the research showed that the experimental group had significantly higher post-test scores regarding academic achievement as compared to the control group. There was not a statistically significant difference in academic achievement scores between the experimental group and the control group either immediately after the intervention or during the subsequent follow-up test. Both of these observations were made while comparing the experimental group and the control group.

Keywords: *infographics program, academic achievement, elementary students.*

Introduction

The contemporary period is distinguished by swift transformations and advancements in scientific and cognitive disciplines, resulting in significant societal shifts. In order to effectively address this transformation, individuals must acquire a substantial level of knowledge, skills, and values (Manickam & Aziz, 2020). Additionally, numerous institutions collaborate with one another to attain this objective, with particular emphasis placed on the educational institution. The educational institution in question assumes the role of cultivating students' cognitive capacities by fostering critical thinking and reflective skills (Al-Behadili & Al-Dayni, 2022). Given the advancements in technology and technical growth, it is evident that images have become omnipresent, encircling us from all directions. The utilization of visual representations has emerged as a prominent form of communication in contemporary society, serving as a fundamental element within the realm of modern culture (Habeeb, 2020). The utilization of imagery is not a contemporary concern, as there exists a body of evidence and documentation of human engagement with imagery, dating back to inscriptions found on cave walls millions of years ago. The correlation between imagery and language aids in the organization of extensive information into fundamental structures, thereby facilitating the processes of recall and retrieval (Pazilah & Hashim, 2018).

The infographic technique is regarded as a contemporary technological approach. The integration of images and text in a visually appealing manner, characterized by harmonizing colors and shapes, is a contemporary and inventive approach to presenting

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information (Salihu & Abubakar, 2020). This method effectively captures the attention of pupils. The utilization of infographics plays a crucial role in effectively communicating information to the minds of students. The matter of information organization has emerged as a significant concern in the contemporary day due to the disorder caused by extensive amounts of unprocessed data (Elaldi & Çifçi, 2021). This is the rationale behind the necessity for the utilization of created information, such as graphs, symbols, and pictures, by individuals. The topic of creating data representations in the form of mental visualizations and infographics warrants further examination. The methodology employed aims to facilitate visual communication, enhance perception and comprehension, identify various patterns within intricate material, condense and extract crucial content, consolidate it, align its components, and present them in a coherent and lucid manner (Ozdamli & Ozdal, 2018). The design of the curriculum should be structured in a manner that fosters students' drive to actively engage with and comprehend the subject matter, rather than solely focusing on knowledge acquisition. The infographic technique is known to facilitate constructivist thought, drawing from Dewey's theory (Aydemir, 2021). This theory emphasizes the internal construction of information in relation to an individual's unique experiences, enabling learning through multi-faceted structures presented in a clear sequence and vector format. By incorporating real-life connections, this technique enhances the educational process, capturing students' attention and fostering a heightened interest in the subject matter (Aldalalah, 2021).

Educators consistently emphasize the importance of basing education on the lived realities of learners, advocating for the integration of technical tools as a pervasive educational resource. This approach is not solely limited to the aforementioned aspect, but also encompasses the ongoing utilization of technology for educational purposes across various contexts and timeframes (Almelewth & Alqahtane, 2020). Furthermore, advancements in learning theories and behavioral psychology have significantly contributed to a transformative shift in educational practices. Research is now being conducted on novel technologies that can be utilized in education to enhance teaching methods, learning approaches, and evaluation techniques. These technologies aim to facilitate the attainment of desired learning outcomes by learners (Alyahya, 2019). The utilization of infographics as a method for presenting information is widely recognized as a versatile, impactful, and visually appealing approach that holds significant potential in educational settings. The utilization of contemporary technology enables the conversion of intricate facts and information into a series of visual representations, facilitating comprehension for individuals without the need for extensive textual analysis. This amalgamation of simplicity, expediency, and amusement caters to the demands of the information era, effectively disseminating knowledge to the recipient (Dipa et al., 2022).

Infographics are commonly referred to as a kind of artistic expression that involves the conversion of intricate data, information, and concepts into visually appealing visuals and illustrations, hence facilitating comprehension and engagement (ALMashaleh, 2023). This approach is distinguished by its ability to communicate intricate and challenging material in a coherent, accessible, and lucid manner. The utilization of infographics facilitates the presentation of information in a manner that is easily comprehensible and digestible (Ismaeel & Al Mulhim, 2021). This visual representation enhances the persuasiveness and appeal of the information, thereby increasing its retention over an extended period. In contrast to abstract textual formats, infographics transform data, numbers, and letters into visually engaging images and illustrations (Hope & Cheta, 2018). The act of sharing and publishing content on social media platforms is not only pleasurable but also facilitates ease of dissemination. Furthermore, engaging in such activities fosters the development of various cognitive abilities, such as critical thinking and visual thinking skills (Yılmaz et al., 2019).

The utilization of infographics is associated with the acquisition of information through the utilization of explanations, pictorial depictions, geometric figures, symbols, and

various other visual modes of representation. It is widely regarded as one of the most efficacious methods for effectively conveying scientific information to students (Yuruk et al., 2019). The aforementioned notion is associated with the concept of visual learning, a phenomenon that is growing in significance within the context of the contemporary digital era. The utilization of infographics facilitates extensive engagement with many forms of visual information, enabling individuals to actively participate in the processes of analysis and critical reflection on the aspects of representation and significance (Wu & Kuwajima, 2022). Educational infographics play a crucial role in the educational process by presenting scientific facts in an audio-visual format. They offer learners opportunities for comparison and contemplation, as well as fostering deductive thinking (Albassuny et al., 2022). Moreover, infographics serve as a cognitive foundation for individuals who struggle to draw conclusions solely through direct reading. They effectively convey the contents of discourse, clarify ideas, and facilitate understanding by simplifying information (Safar & Qasem, 2022). The research problem pertains to the subpar academic performance of primary school students. This issue necessitates an investigation into the potential advantages of incorporating modern technologies, specifically educational infographics, to enhance their academic achievement. Additionally, the study aims to assess students' attitudes towards the utilization of such technologies.

Research Questions

The aim of this study is to analyze the inquiries discussed in the previous discourse.

1. Do the results of the experimental and control groups show statistically significant differences in academic achievement assessment after the implementation of infographics?

2. Do significant discrepancies in academic achievement exist between the experimental group before and after the implementation of infographics?

3. Is there a statistically significant difference detected between the scores obtained from post-test and follow-up tests when testing academic achievement?

Literature Review

One notable attribute of the contemporary period is the expeditious advancement in information and technology. Consequently, the incorporation of diverse technological tools and methodologies into the educational sphere has become imperative in order to bolster the process of education (Alsoub, 2021). One of the strategies utilized is the implementation of infographic technology, which encompasses a variety of visual formats. The modern learning strategy has incorporated it as one of its new developments (Alwadei, & Mohsen, 2023). While considered a contemporary technology within academic disciplines, the constituent elements employed in its creation are not novel, encompassing visual aids such as images, illustrations, numerical data, and symbolic representations. The infographic presents novel information or insights. The process involves the arrangement of visual elements to present information (Jaleniauskiene & Kasperiuniene, 2023).

The utilization and dissemination of infographics have experienced an unparalleled surge in appeal across several domains in contemporary times. Infographics, often seen as novel forms of visual representation including data and statistics in a comprehensible manner, had a historical lineage that extends back to ancient times (Lestari & Purnama, 2023). The practice of inscribing symbols and depictions of animals and the surrounding natural environment onto temple walls, with the intention of communicating information, can be classified as a type of infographics (Alqudah et al., 2019). During the past few decades, particularly in the 1970s, infographics were widely employed by periodicals and newspapers as a fundamental and efficient means of enhancing the dissemination of

information to the general public. In recent years, there has been a notable increase in the prevalence and dissemination of infographics, extending beyond their initial usage within academic spheres and traditional media outlets (Manickam & Aziz, 2020). The year 2011 witnessed a significant paradigm shift in the utilization of this particular form of visual representation. Infographics have garnered significant popularity and have witnessed substantial demand from both users and designers, particularly in the realm of social media (Al-Behadili & Al-Dayni, 2022).

Infographics refer to visual representations of information, data, or knowledge that are designed to convey complex concepts or data in a clear and concise manner. Visual representations are crucial and indispensable tools for effectively presenting intricate data and information in a concise, comprehensible manner (Habeeb, 2020). By utilizing graphics, these representations have the potential to increase the perceptual abilities of the visual system, enabling individuals to more easily identify and comprehend trends and patterns. The art of presentation encompasses the harmonious integration of simplicity, efficiency, and engagement, facilitating the effective dissemination of information to recipients in a captivating and appealing manner (Pazilah & Hashim, 2018). A significant proportion of individuals engage in cognitive processes primarily involving visual representations. The utilization of vivid and interconnected imagery, accompanied by carefully chosen language, possesses a greater capacity to convey meaning compared to textual explanations and descriptions. Infographics are effective in enhancing interest and fostering motivation by virtue of their visually engaging and vibrant images, which effectively guide the viewer's gaze, capture their attention, and elicit a desired response (Salihu & Abubakar, 2020). The motivation to engage in the act of reading it. The benefits of a well-executed infographic can be succinctly described as the simplification of intricate information, facilitating comprehension, and leveraging visual elements to effectively communicate the data. Additionally, it reduces the duration. Rather to engaging in extensive textual analysis, visual scanning offers a more efficient means of information processing (Elaldi & Çifçi, 2021). The process of converting mundane numerical and textual data into visually captivating images and illustrations enhances efficiency and expedites the transmission of information. The act of studying and grasping various subjects on the Internet has been found to alleviate stress when compared to conventional drawings and images (Ozdamli & Ozdal, 2018). Additionally, this practice facilitates the dissemination and publication of infographics on social media platforms, while also improving cognitive abilities such as information processing, association, and organization. Furthermore, it has been observed that this method aids in the long-term retention of acquired knowledge (Aydemir, 2021).

The significance of infographics is underscored in enhancing the efficacy of education and enhancing its results by establishing a stronger alignment between students' needs and the instructional curriculum, as well as by integrating data and information with visual representations and symbols (Aldalalah, 2021). Infographic technology is distinguished by its integration of the advantages of visual learning with traditional and integrated learning methodologies. Infographics offer numerous advantages, encompassing the subsequent:

1. Increasing the effectiveness of learning: By enhancing learning outcomes through the establishment of stronger connections between knowledge, images, and symbols, as well as expanding the avenues for obtaining information, individuals can maximize their potential and attain optimal results (Almelewth & Alqahtane, 2020).

2. Diversity of means of knowledge: The utilization of infographic technology enables learners to employ many modes of information acquisition, selecting the most suitable approach based on their individual abilities and skills from a wide range of electronic and conventional resources. This facilitates the acquisition of extensive knowledge and enhances the overall quality of the educational process (Alyahya, 2019).

3. Achieving active learning for students: This approach prioritizes the active engagement of the learner and their interaction in acquiring knowledge, through a combination of solo and collaborative activities and projects, as opposed to the traditional model where students passively receive information (Dipa et al., 2022).

4. Educational flexibility: Infographic technology enables the attainment of adequate adaptability to cater to the unique requirements and cognitive preferences of pupils, taking into account their varying proficiency levels, age groups, and temporal constraints. An infographic that aligns with the specific educational stage is employed for each step of schooling (ALMashaleh, 2023).

5. Mastering practical skills: Infographic technology offers a valuable means of presenting scientific ideas and skills that are challenging to convey by traditional or solely electronic teaching methods, particularly in the realm of scientific skills (Ismaeel & Al Mulhim, 2021).

6. Achieves satisfaction with education: This technology enables students to engage with Internet applications in order to access information, enhance academic performance, and reinforce theoretical knowledge through practical application within educational institutions. Consequently, this approach facilitates an enhanced learning experience and fosters more pleasure with the learning process (Hope & Cheta, 2018).

Typically, these websites offer a complimentary service tier alongside a premium subscription option, which grants users enhanced functionality beyond what is available in the free plan. The comics lack a standardized design and do not adhere to set dimensions. The creation of an infographic is not constrained by any limitations (Yılmaz et al., 2019). The process of clarifying information necessitates the collaborative efforts of the content owner and the designer, who must employ their creative abilities. In the realm of infographics, certain designers may choose to specialize in a particular design style, while others may opt to offer services specifically tailored to infographic design. of visual communication that may effectively convey complex information in a concise and visually appealing manner (Yuruk et al., 2019). Infographics have gained popularity in various fields due to its ability to present data, statistics, and other information in a visually engaging format. Whether used as a primary or secondary means of communication, designers and content owners have the opportunity to exercise their creativity when utilizing infographics. The content that holds the greatest influence in the realm of the internet (Wu & Kuwajima, 2022).

There exist two distinct categories of infographic designs, namely static and dynamic. The initial kind of infographic is the static variant, denoting a visual representation that elucidates a subject matter in a consistent manner, devoid of necessitating any engagement or participation from the reader. Regarding the second category, it encompasses animated content, specifically videos and animations (Albassuny et al., 2022). The aforementioned work is frequently seen in customer requests and is regarded by designers as a challenging yet enjoyable endeavor. It affords individuals the chance to exercise their creativity by transforming facts and information into an engaging video presentation that is both intelligent and aesthetically pleasing (Safar & Qasem, 2022).

The infographic is a highly significant contemporary educational medium utilized for the purpose of presenting information in a visual style (Alsoub, 2021). Additionally, the design of this medium aims to convey information to the reader by utilizing a diverse range of visual elements, including text, photographs, drawings, charts, lines, and other forms. The utilization of infographics has become increasingly prevalent in both commercial advertising endeavors and educational settings (Alwadei, & Mohsen, 2023).

The value of infographics and their advantages are rooted in their significant influence on the three primary components of the educational process: the instructor, the learner, and the subject matter. Infographics have the capacity to stimulate students, enhance their

motivation, reinforce information, and facilitate its retention (Jaleniauskiene & Kasperiuniene, 2023). The infographic provides a valuable opportunity for diversifying activities, which aids in bridging the gap between individual differences and facilitates the transformation of complex material into visual representations such as drawings, symbols, pictures, and memory cues, hence facilitating students' comprehension and retention of knowledge. Infographics have been found to facilitate active student engagement in the acquisition of experience, knowledge, critical thinking skills, and observational accuracy (Lestari & Purnama, 2023). The utilization of infographics by the teacher facilitates the process of simplifying the lesson, hence enhancing its accessibility and relevance to the student's cognitive processes and personal interests (Alqudah et al., 2019).

Infographics play a significant role in facilitating information retention among students by enhancing their concentration during instruction, fostering an enjoyable and engaging learning experience, and expediting the comprehension and assimilation of educational objectives through the concentrated and visually presented information (Manickam & Aziz, 2020). Furthermore, the utilization of visual aids in education not only enhances the communication of abstract ideas and facilitates a deeper comprehension among students, but also serves to simplify intricate information, rendering it more lucid and accessible. Moreover, the widespread dissemination of visual content among students is expedited through the seamless sharing capabilities offered by social media networks (Al-Behadili & Al-Dayni, 2022). Additionally, the integration of visual aids in educational settings fosters the development of crucial skills such as image recognition, interpretation, comparison, construction, and evaluation. The effectiveness of this approach lies in its ability to cultivate a robust cognitive understanding or rectify erroneous perceptions among students (Habeeb, 2020). This is achieved through the meticulous incorporation of clarity, simplicity, scientific accuracy, and linguistic precision in the infographic's design. Furthermore, the infographic undergoes rigorous experimentation and refinement processes prior to its ultimate production in its definitive format (Pazilah & Hashim, 2018).

According to Salihu and Abubakar (2020), numerous programs have been identified as crucial at the core of infographics. Some of these programs include the following:

- Adobe Illustrator: The application is widely regarded as the leading choice among designers for infographic creation, renowned for its exceptional adaptability and capacity to generate visually appealing outcomes (Elaldi & Çifçi, 2021).

- Adobe Photoshop: The software application Photoshop has the capability to create infographics, however with less versatility compared to Illustrator. This is due to Photoshop's main focus on image manipulation rather than graphic design. Nonetheless, Photoshop may still be employed to effectively present facts in visual form (Ozdamli & Ozdal, 2018).

- Inkscape: inkscape can be seen as a cost-free alternative to Adobe Illustrator (Ozdamli & Ozdal, 2018).

- Tableau: The program is available at no cost and is compatible exclusively with the Windows operating system. Its primary function is to generate visually appealing and distinctive designs (Aydemir, 2021).

- Adobe Fireworks: An underutilized yet highly effective application for creating visually appealing infographics (Aldalalah, 2021).

Academic achievement holds significant importance within the realm of education, serving as a fundamental component of student evaluation and forming the very foundation upon which it is built. In contemporary usage, achievement refers to the attainment of appropriate scientific methodologies that enable individuals to acquire scholastic competencies in a systematic and scientific fashion (Almelewth & Alqahtane,

2020). Hence, it pertains to two fundamental facets of the results. The process of learning encompasses the cognitive and skilled dimensions, and the exploration of these dimensions inherently involves an examination of the emotional side (Alyahya, 2019). Undoubtedly, the process of cognitive achievement is not solely mechanistic in nature, but rather it may be seen as a cognitive art form, characterized by its origins, norms, and methodologies. A more detailed examination reveals that cognitive achievement is contingent upon various factors (Dipa et al., 2022). The cognitive processes encompassed in this context include awareness, perception, comprehension, analysis, synthesis, comparison, application, generalization, differentiation, and the ability to establish connections between subjects as well as between these subjects and many elements of life. Academic achievement refers to the ultimate outcome that reflects a student's level of growth and proficiency in acquiring the knowledge and skills expected of them (ALMashaleh, 2023).

Educators and psychologists claim that the act of evaluating success serves the purpose of mitigating potential biases among teachers, hence ensuring equitable grading practices and avoiding favoritism towards certain students (Hope & Cheta, 2018). The identification and analysis of the strengths and weaknesses of school curricula through their practical application facilitates further modifications. It is beneficial to identify the shortcomings inherent in various pedagogical approaches and to engage in comparative analysis of teachers' practices (Ismaeel & Al Mulhim, 2021). It provides assistance. In order to assess the proficiencies and deficiencies of individual students in their academic pursuits, several educational institutions employ a diagnostic approach. This method serves to provide guidance and support to students, particularly female ones, by identifying their areas of expertise and aptitude for specialization (Yılmaz et al., 2019). The objective of this study is to ascertain the level of achievement of students in academic subjects and to categorize them according to their chosen academic specializations. Various groups are formed based on individuals' grades in different areas, with the aim of identifying relatively homogeneous groupings in terms of academic achievement.

Hence, the outcomes derived from assessing academic performance serve as crucial determinants in shaping the prospects of the students who are subjected to such evaluations. Hence, it was imperative for these measures to accurately assess their intended constructs with a significant level of validity, ensuring that their outcomes effectively reflect the proficiency level of the assessed student.

Previous studies

Safar and Mohammed (2020) examined the impact of incorporating infographics into social studies instruction on the academic performance of second-grade pupils. To accomplish the primary objective of this investigation, a research study of an experimental nature was devised and implemented, involving a total of 65 individuals who were evenly allocated into two distinct groups: an experimental group and a control group. The initial cohort received instruction supplemented with infographics, while the subsequent cohort received instruction in a traditional manner without the use of infographics. In addition, an assessment tool was employed as a means of gathering data in this study to evaluate students' academic performance or level of understanding. The researcher employed the Mann-Whitney test to examine the data, aiming to assess the disparities between the two groups and determine the presence of a statistically significant distinction. The findings of the research demonstrated a favorable influence of using infographics in the context of social studies education for eighth-grade pupils. The results also demonstrated notable disparities, as the statistical data indicated a higher average score in the achievement exam for the experimental group, which utilized infographics as a study instrument, compared to the standard group.

Alsoub (2021) Investigated the impact of utilizing infographics as a pedagogical tool in history instruction on the enhancement of visual thinking abilities in eighth-grade pupils. The research employed a semi-experimental design, with a study sample including two experimental groups that were subjected to the infographic-based learning method. The control group was examined using the conventional methodology. The total number of students in the study was 63, with 31 students assigned to the experimental group and 32 students assigned to the control group. In order to accomplish the aims of the investigation, a visual thinking skills assessment was devised. The study's findings indicate the presence of statistically significant disparities in mean scores between the two experimental groups, one of which utilized infographics, and the control group that followed conventional methods during the visual thinking test. These disparities favor the experimental group.

Aydemir (2021) concentrated on the utilization of infographics and examined the impact of incorporating infographics into social studies instruction on students' scholastic performance. The research strategy employed in this study was a quantitative experimental approach, specifically the Pretest-Posttest Control Group Random strategy. The participants in this study were fifth-grade students who were enrolled in a middle school located in the city center of Artvin throughout the academic year of 2018-2019. The researcher utilized an Achievement Test that they had devised to collect the data. In order to facilitate the investigation, two distinct groups were established, namely an experimental group and a control group. The experimental group received instruction in the "Global Connections" learning domain using infographics created by the researcher, whereas the control group received instruction according to the curriculum guidelines. A comparison was conducted between the academic success of the experimental group and the control group. The research yielded findings indicating a statistically significant disparity in academic success levels between the experimental group and the control group, favoring the former. In essence, the utilization of infographics in instructional methods has a beneficial impact on academic performance.

Al-Behadili and Al-Dayni (2022) determined the efficacy of utilizing infographics in the acquisition of chemical ideas. The research community was comprised of students from the fifth scientific grade at governmental preparatory and secondary schools for males affiliated with the Maysan Education Directorate. The total number of schools in this category was 41, consisting of both middle and secondary schools. The sixth applied scientific class consisted of 60 students, divided into two divisions, with 30 students in each class. Through a process of simple random assignment, Division B was designated as the experimental group, which will be subjected to the study utilizing the infographic. Conversely, Division A was assigned as the control group, which will engage in the customary mode of study and will receive incentives. The study involved two groups: an experimental group and a control group. The participants were assessed on their IQ, past achievement, and previous information test scores. A chemical concepts acquisition test was administered, which consisted of 36 items. The findings of the study indicate that the experimental group, which utilized infographics as a study tool, demonstrated superior performance in the acquisition of chemical concepts compared to the control group. This difference was statistically significant and exhibited a substantial effect size.

Methodology

The study utilized an experimental approach, which involved the manipulation of one or more variables (referred to as the independent variable), followed by the observation of the resulting effects on the dependent variable. To evaluate their impact on the target group, the researcher employed an infographic-based instructional method. The study involved the division of participants into two unique groups: the experimental group,

which received instruction using the infographic approach, and the control group, which received instruction using the traditional approach.

Population and Sample

The study population consists of 1524 students residing in the North Mazar directorate. A conscious choice was taken to include a representative group of students from two elementary schools located in the North Mazar directorate. The study's participants were selected using a random sampling method. The study utilized a sample of two classrooms, wherein one classroom was designated as the experimental group comprising 20 students, while the other classroom was allocated as the control group, also consisting of 20 students.

Research Instrument

The utilization of an infographics program as a research instrument was employed to facilitate the attainment of the study's objectives, with the aim of enhancing academic accomplishment. The research investigation centered on a certain domain of study, specifically investigating the augmentation of scholastic attainment among pupils enrolled in primary educational institutions. The present investigation was planned to be carried out throughout the upcoming academic year of 2023/2024. The researcher developed a complete set of 25 initial behavioral objectives through a thorough analysis of the overarching goals and subject matter of the themes being investigated in the experiment. The framework consists of several components, specifically remembering, understanding, applying, analyzing, synthesizing, and evaluating. In order to determine the accuracy and thoroughness of the content, it underwent a rigorous evaluation done by a panel consisting of professionals and experts in the respective sector. The individual objectives have been revised in accordance with the comments received, while maintaining a total of 25 objectives. The study groups have developed an infographics program that integrates a training program package for the experimental group, while utilizing a conventional technique for the control group. The panel of experts in the field of pedagogy was provided with a multitude of instances of exemplars. The objective of this action was to evaluate their appropriateness for the subject matter and the predetermined behavioral objectives. Based on the feedback provided by the experts, certain paragraphs underwent additional revisions, resulting in their ultimate form. A total of 30 instructional programs were implemented in both groups, with an equal allocation between the two strategies. Specifically, 15 plans executed an infographics campaign, while the remaining 15 plans used a traditional method.

Instrument Validity and Reliability

In order to determine the instrument's level of reliability, we used two distinct approaches.

1. The evaluation of the instrument's validity entails the administration of the instrument to a panel of 10 arbitrators, after which an acceptance rate requirement of at least 80% must be established as a minimum standard.

2. An assessment was carried out by a team of ten students in order to determine the extent to which it had discriminant validity. The discriminant validity of the coefficient was found by analyzing the significance of the observed (F) value, which came out to be 4.10.

The assessment of the instrument's internal consistency was performed using the Cronbach's alpha formula. The instrument exhibited a satisfactory level of dependability, as indicated by a value of (0.863).

Data Analysis

Following the completion of the data collection phase, the mean test scores and standard deviations for both the pre-test and post-test were computed. The Eta square statistic was employed to compute the effect size, providing a measure of the extent to which the infographics program contributes to the improvement of academic achievement. In order to enhance the understanding of distinctions between two comparable samples, the statistical methodologies of Wilcoxon's test and Z-value were employed.

Results and Discussion

Table 1 demonstrates that previous to the initiation of the infographics program, the levels of academic achievement in both the experimental and control groups were similar.

Table 1: Pre-Measurement

Variable	Group	N	M/R	S/R	U	Z	P
Academic achievement	Experimental	20	18.30	366.00	27.00	9.10	0.230
	Control	20	19.80	396.00			

Based on the data provided in Table 1, there is no statistically significant disparity seen between the two groups with regard to the mean scores pertaining to the students' pre-test of academic achievement.

In order to address the first question, which posited "Do the results of the experimental and control groups show statistically significant differences in academic achievement assessment after the implementation of infographics?". The aforementioned table illustrates the attained outcomes.

Table 2: Post-Measurement

Variable	Group	N	M/R	S/R	U	Z	P
Academic achievement	Experimental	20	23.30	466.00	378.00	0.560	0.000
	Control	20	24.10	482.00			

The results of the post-testing carried out on the experimental group are presented in Table 2. With respect to the assessments of academic performance, the results reveal significant changes in the average scores of both the control and experimental groups, indicating statistical significance. This implies that students in the experimental group exhibited a noteworthy degree of academic achievement.

The observed outcome can be attributed to the impact of infographics on augmenting the educational setting within the classroom. The utilization of visual aids in the form of still and moving images enabled educators to present subject matter in a simplified and sequential manner. This approach facilitated a closer connection between students and real-world concepts, as the visual aids effectively emphasized the various aspects and intricate details of educational content in an engaging manner. Consequently, students were motivated to explore the intricacies of the educational process further and actively seek out additional information pertaining to the subject matter. Infographics have also played a role in enhancing the variety of instructional approaches in alignment with the principles of constructivist theory. The visual representations employed in the discourse progressively addressed these subjects, first with the primary phenomenon, subsequently delving into the sub-phenomena, emphasizing the interconnections among them, and ultimately culminating in proposed resolutions. The utilization of infographics has also prompted educators to vary classroom activities in order to accommodate different levels of achievement. The nature of the themes allowed teachers to have greater flexibility in elaborating on the scientific content. This finding is consistent with prior studies

conducted by Safar and Mohammed (2020), Alsoub (2021), Aydemir (2021), and Al-Behadili and Al-Dayni (2022), which revealed that students in the experimental group who utilized the infographics program to enhance their academic achievement compared to students in the control group. This result offers empirical support for the efficacy of implementing an infographics program aimed at enhancing the academic achievement set of students.

In order to respond to the second question, "Do significant discrepancies in academic achievement exist between the experimental group before and after the implementation of infographics?" The findings are shown in the table below.

Table 3: Pre and Post-Measurement

Variable	Pr/Po	N	M/R	S/R	Z	P
Academic achievement	negative rank	4	2.00	8.00	58.60	0.000
	positive rank	16	8.00	128.00		
	ties	0				
	total	20				

The findings shown in Table 3 indicate a statistically significant disparity in the average scores of the experimental groups across post-measurement scores of academic achievements. This finding indicates that students in the experimental group demonstrated enhanced academic achievement subsequent to the introduction of the infographics program.

The observed outcome can be ascribed to the influence exerted by the infographic on the student population. For the participants, this signified a significant paradigm shift in the instructional approach, resulting in an augmentation of their engagement. This was evident in their active involvement in various classroom activities and their enthusiastic pursuit of comprehension of the scientific content. They demonstrated this by closely examining the presented visuals and actively seeking additional images. Furthermore, they displayed a keen interest in identifying the specific details depicted in each image, as well as discerning the geographical distribution of the phenomena represented and the underlying factors contributing to the diverse formations of scientific material. The aforementioned outcome can also be ascribed to the function of infographics in elucidating several scientific information. The majority of the scientific information were presented in textual and occasionally visual formats. However, these texts and images exhibit deficiencies in terms of clarity, comprehensiveness, and accuracy. Furthermore, the utilization of the infographic facilitated educators in offering a diverse range of instructional exercises within the classroom setting. These activities encompassed tasks such as conducting research on the information network and generating visual representations of scientific content. Additionally, the incorporation of formative assessment allowed students to gauge their own level of accomplishment and receive prompt feedback. The observed outcome can be ascribed to the implementation of graphical patterns, which stimulated students to engage in independent information-seeking beyond the confines of the classroom. By means of students delivering copious amounts of information surpassing what is provided in the textbook, as well as their enthusiasm to explore scientific material beyond the confines of the textbook. This finding is consistent with prior studies conducted by Safar and Mohammed (2020), Alsoub (2021), Aydemir (2021), and Al-Behadili and Al-Dayni (2022).

The last question, "Is there a statistically significant difference detected between the scores obtained from post-test and follow-up tests when testing academic achievement?".

In order to formulate an appropriate response, it is necessary to address the question. The results are displayed in the table that has been provided.

Table 4: Post and Follow-up

Variable	Po/ Foll	N	M/R	S/R	Z	P
Academic achievement	negative rank	12	7.50	90.00	11.60	0.260
	positive rank	0	0.00	0.00		
	ties	8				
	total	20				

Upon doing an examination of the data presented in Table 4, it becomes evident that there exist no statistically significant disparities in the mean scores of the experimental cohort when comparing the post-test and follow-up assessments. The results of this study suggest that the effectiveness of the program remained stable during the period after the intervention, without any noticeable indications of decline after its conclusion.

The observed outcome can be ascribed to the inherent characteristics of static and dynamic visuals that were created utilizing infographics for the purpose of conveying scientific content. The graphics were characterized by their capacity to emphasize the beautiful elements of the scientific subject matter, so instilling a sense of enthusiasm among the students to further their knowledge in this area. The impact of colors and tone on pupils' emotions and sentiments was evident in their profound enthusiasm for certain exhibited photos. The supplementary activities that accompanied the unit served to augment scientific consciousness. The curriculum encompassed a variety of imaginative exercises designed to foster students' recognition of the scientific aspects inherent in these subjects. This finding is consistent with prior studies conducted by Safar and Mohammed (2020), Alsoub (2021), Aydemir (2021), and Al-Behadili and Al-Dayni (2022).

Conclusion

This study presents empirical evidence that substantiates the hypothesis that the introduction of an infographics program aimed to enhance academic achievement among students in the elementary stage. Therefore, it is beneficial for educators to incorporate infographic activities that specifically target the enhancement of academic achievement. Hence, among other factors, one of utmost significance is the efficacy of infographic programs in fostering students' motivation and yielding favorable outcomes. The strategy employed by the individual in question fostered a heightened level of engagement between students and real-world concepts. This was achieved through the effective utilization of visual aids, which effectively highlighted the multifaceted elements and intricate intricacies of instructional content. As a result, students were inclined to delve deeper into the complexities of the educational process and proactively pursue supplementary knowledge related to the given subject area. The utilization of infographics has also contributed to the diversification of educational methods in accordance with the tenets of constructivist theory. Moreover, the individuals exhibited a strong inclination towards distinguishing the precise elements portrayed in every image, along with determining the spatial dispersion of the occurrences depicted and the fundamental variables influencing the varied configurations of scientific matter.

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