

The Effect of Using Computer-Based Graphic Organizers on Writing: A Case Study

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Abstract

Using graphic organizers as a technique is considered one of the techniques that is considered effective in helping students organize their writing and motivate them to learn. The study investigated the effectiveness of graphic organizers as an intervention to improve discourse structures in sentence and syntax formation. The effect of graphic organizers was assessed by comparing spontaneously argumentative essays and sentence-combining skills from pre- to post-test in four weeks. The participants included students and teachers from a rural school in Lebanon. Each week the students were given a topic, and after being discussed, they took a pre-test, explaining the graphic organizer and filling it and then took a post-test. The pre and post-test scores were analyzed numerically and statistically to determine the effectiveness of such intervention in producing higher test results and improvements. The study found that graphic organizers had significantly enhanced students' writing abilities including CLDs and SLDs students and produced higher test results. These results suggest that a graphic organizer can be an effective tool to use in the writing process to produce sentences in an argumentative essay encompassing a more complex structure of syntax and discourse.

Keywords

Argumentative Writing, Computer-Based Graphic Organizers, Discourse, Syntax, Syntactic Complexity

1. Introduction

Writing is the hardest skill to master compared to other skills of language. Writing is rated as the most demanding skill to master. Many American teachers consider that their students have limited writing abilities and struggle to write compositions that convey their ideas and thoughts (Unzueta, 2009: p. 1). Graham (2006)

notes that students who do not learn to write well at school level is a disadvantage at college level because they are assessed based on their ability to convey their thoughts through writings. Hence, many students fail their courses and consequently fail to graduate at an expected time and maybe released from college. English language instructors and educators are urgently requested to look deeply into this problem and find solutions to avoid this weakness and improve writing proficiency. Western researchers suggested that teachers should provide step-by-step instruction for struggling writers (Kajder, 2005). Other researchers suggested that providing continuous positive feedback to students in a risk-free setting can be a good way to develop writing skills (Szlachta et al., 2023). Nevertheless, much research was conducted to investigate the use of graphic organizers and to supplement the teaching of various writing processes (Capretz et al., 2003; Faull, 2007; Novak, 1990; Servati, 2012; Parker et al., 2013). Graphic organizers are visuals that help a student to sequence his ideas in an organized manner and help him focus on developing his ideas rather than the format of complete sentence structure.

There are two types of graphics-based organizers: handwritten-based graphic organizers and computer-based graphic organizers. Various research studies have scrutinized the impact of CBGOs on different writing varieties, such as persuasive and narrative essays, and have involved distinctive students and struggling writers. Thus, the present study focuses on computer-based graphic organizers and their impact on the Argumentative writing of Elementary school students in Lebanon. Furthermore, the researcher aims to figure out the effect of such visuals on encouraging students with special needs specifically SLD and CLD students.

1.1. Problem of Study

Lebanon is a pluralistic country with people from different cultures, races, religions and languages. Three major languages common in Lebanon include Arabic, English, and French. The two largest groups of elementary students in Lebanon schools who could not understand argumentative writings include culturally and linguistically diverse (CLD) and specific learning disabilities (SLD) are the problem statements. Based on teacher experiences, there are some problems found in the field when giving writing materials to the students, especially the argumentative text. The first problem is that the students' writing does not show counter arguments and the ideas are not clearly defended or even united. The second problem is that there are many errors in sentence structure and syntax. Another problem is that students have subject verb agreement problems, conjunctions and transitional words as well as students are not interested in doing the task and writing hours are boring to them. In fact, there are many techniques to improve their writing skills such as freewriting, brainstorming, clustering and also graphic organizer. However as being noticed by the researcher and in his point of view, teachers are using the conventional technique in teaching the writing process. This technique made writing boring for most of the students because it is teacher centered

more than student centered. So, based on the problem stated above the researcher intended to conduct the research on “The Effect of Computer Graphic Organizer Technique on Students’ Achievement in Writing argumentative Text” to study the effectiveness of implementing graphic organizers as a technique to teach writing in a fruitful and less boring way.

1.2. Purpose of Study

Argumentative writing is challenging for elementary students in Lebanon. A previous study claims that 66% of students with specific learning disabilities (SLD) write below proficiency level. Therefore, the current study aims to highlight the impact of computer-based graphic organizers (CBGOs) on argumentative writing and their impact on the argument writing skills of elementary students in schools in Lebanon. Furthermore, the study examined the common problems that affect the argumentative writing of second language learners and the importance of using computer-based graphic organizers to improve writing. However, it differs from previous studies in three ways. First, using a computerized graphic organizer is dealt with at the pre-writing stage focused on instructional strategy. Second, the type of writing is mainly focused on argumentative writing. Third, the students have differentiated abilities.

1.3. Hypothesis of Study

Alternate and null hypotheses have been enlisted depending on the conceptual research framework.

H0: Computer-based graphic organizers (CBGOs) have an insignificant impact on the argumentative writing of elementary students in Lebanon.

H1: Computer-based graphic organizers (CBGOs) significantly impact argumentative writing in elementary students in Lebanon.

H0: Cultural and linguistic diversity (CLD) at the elementary level in Lebanon have an insignificant impact on argumentative writing at elementary schools in Lebanon.

H2: Cultural and linguistic diversity (CLD) significantly impacts argumentative writing at elementary schools in Lebanon.

1.4. Questions of the Study

This research is intended to answer two questions that are directly related to the above hypotheses.

What is the impact of CBGOs on Argumentative writing among elementary students in Lebanon?

Minor Questions

Q1. What factors affect the argumentative writing of elementary students in Lebanon?

Q2. What is the impact on the writing performance of elementary students in Lebanon without using CBGOs?

Q3. What is the impact of inclusive classroom settings on the argumentative writings of elementary-level students in Lebanon?

Q4. What is the most effective strategy for implementing the CBGOs in maintaining argumentative writing in elementary students of Lebanon?

1.5. Significance of Study

The study at hand offers both local and international teachers' insights to address new ways to teach writing. It sheds light on teachers' practices within schools besides their viewpoints regarding such practices. Thus, readers are exposed to one of the most critical issues confronting educational systems worldwide: the degree to which teachers use innovative ways to assist students and motivate them to write. The success of this study generates the need for future research that could provide researchers with more information about how to effectively develop strategies to teach writing effectively in classes and examine the progress through students' lenses, especially in higher classes.

2. Literature Review

2.1. Importance of Writing

Writing improves students' performance in many school subjects. Writing instructions expands students' skills in other subjects depending on shared knowledge and processes (Shanahan, 2006). Students comprehend and remember the material, whether read or presented in science, social studies and mathematics, if they wrote about it (Bangert-Drowns et al., 2004; Graham & Hebert, 2011). Besides, writing is now a vital feature of social life, as it is used to connect, share ideas, persuade, record experiences, and entertain others (Graham, 2019). As a result, society, policymakers, school administrators, and teachers should know the importance of including writing as a central and valued factor of the school curriculum (NCOW, 2003). Regrettably, there are few numbers of research done in Lebanon regarding how writing is taught. There is rare research on secondary school writing in ESL classrooms and elementary 16 classrooms; well, nobody can ignore the issue of creativity and demotivation when looking into how writing is taught in our schools. How a writing task is created and instructed affects the learners' motivation and creativity (Boscolo & Gelati, 2019). Thus, a teacher should be thinking of creating the best level of competence among learners (Boscolo & Gelati, 2019; Runco, 2005).

2.2. Elements of Effective Writing

Writing instruction varies from grade to grade. In the first and second grades, it starts with focusing on learning to spell, punctuate, print and generate simple sentences. Third grade is when a student starts to become a writer. In grade four, they will be able to write independently using adjectives and conjugate sentences using conjunction. In third grade, they start learning conjunction that they can use in later classes, which is considered an initial step toward becoming better writers.

Students are also taught in grade 4 to write more extended essays and stories with better structure (Calkins, 1994). Writing progresses and becomes more refined with a new structure in syntax and discourse. Fourth graders start using writing in each subject and have to master the proper discourse for each type, narrative writing, expository nonfiction writing, and persuasive writing. In school, explicit teaching emphasizes the writing process all students learn at school, prewriting organization, drafting, revising, editing and publishing. Through this process and as children age, they are expected to produce more complex sentences with independent and dependent clauses (Loban, 1976; Vogindroukas et al., 2020), and the discourse structure of their writing becomes more advanced (Calkins, 1994; Snow & Uccelli, 2009).

Writing is an essential skill which can limit academic, professional, and personal achievements (Graham, 2006). It embraces cognitive processes like stating intentions, uniting ideas, problem-solving and critical thinking (Jebreil et al., 2015). Researchers claim that although it is essential, it is not given sufficient time, and students do not frequently write (Brindle et al., 2016). Also, many children 17 do not obtain the writing instruction at school that they deserve or need (Graham, 2019). Hence, writing involves different competencies (Brown, 2000: p. 335). It is affected by interest in writing, anxiety, lack of self-efficacy and confusion (Driscoll & Powell, 2016). Similarly, the teacher's instruction can affect students' emotions and attitudes while writing. For Sperling & Fredman (2001), writing involves planning, translating, and reviewing. However, the process often occurred more than those stages. Bailey (2015) demonstrated the writing process into several parts: 1) choosing the topic, 2) reading texts and finding sources, 3) note-making, 4) planning and outlining, 5) uniting a variety of sources, 6) establishing paragraphs, and 7) rewriting and proof-reading.

2.3. Syntactic Complexity

Students are assessed primarily on their syntactic complexity. Sentence length is one feature that allows teachers to compare high achievers and low achievers (Loban, 1976). In his study, Loban (1976) stated that high-achieving students had longer complex sentences with adverbial, adjectival, infinitive, conjoined, and fixed, at each grade level from the 4th through 12th grades).

2.4. Sentence Combining

Combining sentences is an essential skill that improves writing scores (Abrahamson, 1977; Amiran & Mann, 1982; Andrews, 2005; Hillocks, 1986). Mellon (1969) stressed the importance of teaching students how to combine sentences and transformational grammar. Many studies showed the importance of teaching sentence combining to improve writing (Hillocks, 1986). Students with specific disabilities and underprivileged students showed more significant change than higher achievers after sentence combining practice (Hunt & O'Donnell, 1970; Perron, 1974).

2.5. Discourse

Discourse is as vital as syntactic complexity. Discourse, or the structure of the text, allows us to communicate meaning and intent by building links between sentences. The style and structure of the discourse are based on the type of writing (Britton et al., 1978). For example, a story has a narrative discourse pattern, while an argument follows an argumentized pattern. In writing, discourse is construed into paragraphs, with each paragraph focusing on a topic or theme.

2.6. Argumentative Writing

Argumentative writing is a form of writing, which creates a position in a story or topic, and defines and supports this point with credible evidence. Argumentative writing forms an integral part of English language learning programs as it is considered a necessary form of written expression. Ozfidan & Mitchell (2020) suggested that argumentative writing is a composite psychological process related to authors' intent, audience opportunities, contextual status, and predictable speech patterns.

Ferretti & Graham (2019) claim that no matter the appearance of an oral argument, the written argument is unheard of in some ideas. It is fast-paced and usually of reduced quality. The study's outcomes publicized that high-quality argumentative writing is expected throughout the curriculum and is required in a continuous work environment that requires advanced communication skills. Indeed, a written response to a complete manuscript of information is the basis for several writing assignments in content areas such as basic science and social studies. Writing in basic science and social studies requires students to explain or intentionally and present an argument to create content information deliberately. The most common writing tasks in basic science and social studies include descriptive responses, reports, summaries and essay formats.

2.7. Factors Improving Argumentative Writing

Graphic Organizers are visual aids and kinetic displays of information. According to Ellis (2004), Graphic Organizers are many names, such as concept maps, mind maps, etc. It also has many forms, like a page of lightly organized notes, a simple outline, a Venn diagram, a linked organizational chart, or a bubble graph. Moreover, graphic organizers allow the writer to organize material logically and to understand the link between ideas. A graphic organizer is also considered an influential tool for assessing students (Chien, 2012). In addition, graphic organizer allows students to present their ideas clearly and lead to a better essay (Chai, 2006). According to Chai (2006) stated that graphic organizers can help writer present their ideas coherently, effectively and persuasively. Students construct an orderly and well-thought-out arrangement with the help of graphic organizers. Along the same lines, Professor Joseph D. Novak introduced concept maps as part of his research program. He recognized the role that concept maps may play in the organization of ideas and facts, and he presented concept maps. In a similar vein,

the importance of visual aids is supported by an integral theory called the multiple intelligence theory. This theory is specifically classified as belonging to the visual-spatial intelligence group. This kind of intelligence encompasses feelings of sympathy for color, line, shape, space, form, and art activities. It includes different teaching methods and techniques to allow expressive learning by using unlike branches of intelligence such as mind mapping, which contains visual elements such as correlations, images, words, and figures. These figures help students use their brains more successfully. Thus, mind maps are one of the methods that encourage students to concentrate and seek knowledge and think creatively (Zubaidah et al., 2017).

2.8. Computer-Based Graphic Organizers (CBGOs)

Effective writing strategies for students with specific learning disabilities mainly focus on teaching the writing process to students and implementing efficiently to develop their writing skills. There are four main lines of the attack suggested for elementary students with specific learning disabilities: scaffolding, self-regulating strategy development, mnemonics, and graphic organizers. The scaffolding strategy permits the students to divide the writing process into smaller parts. While self-regulating strategy development (SRSD) mainly focuses on improving the self-regulation of the writing skills of students to self-monitoring progress. The mnemonic method focuses on the use of words in which every letter demonstrates a particular task or phrase that supports the students in retention the writing procedure or precise writing type formula. While the fourth type of recommended strategy is graphic organizers (GOs) is the main focus of the current study.

Boykin, Evmenova, Regan, & Mastropieri (2019) defined the CBGOs as “*digital forms of diagrams that support the learners and students to establish their writing concepts visually*”. In other words, the CBGOs is the disparity of a computer-based graphic organizer utilized to spatially characterize information to make and organize various designs for writing. There are two types of graphics-based organizers: handwritten-based graphic organizers and computer-based graphic organizers. Various research studies have scrutinized the impact of CBGOs on different writing varieties, such as persuasive and narrative essays, and have involved distinctive students and struggling writers. Due to CBGOs as a prewriting tool, there is a great increase in the number of words created and enhanced quality of writing.

Kim, Linan-Thompson, & Misquitta (2012) found that graphic organizers (GOs) help students with specific learning disabilities establish the information they have read and improve their reading memory. Therefore, graphic organizers (GOs) help develop students’ understanding which is a student’s ability to process past and present knowledge to make sense of the text. Conversely, the study revealed that previous studies of graphic organizers and argumentative writing did not monitor the line of continuous or systematic research, leading to misinterpretations and challenges in identifying sources of variability in outcomes. While

graphic organizers (GOs) have become increasingly used to understand reading in many subjects, there is a requisite for more graphic organizers to expand limited research on implementing the graphic organizers to develop student writing skills.

The research studies based on computer-based graphic organizers (CBGOs) have established positive results on students' writing. However, [Lin & Ray \(2004\)](#) suggested that CBGOs are motivated to develop the broad range of ideas produced. Furthermore, [Lorber \(2004\)](#) found developments in writing skills when the CBGOs were used. [Gonzalez-Ledo, Barbetta, & Unzueta \(2015\)](#) claimed that the elementary students with specific learning disabilities produced extensive works and assertiveness towards writing was also enhanced. Moreover, [Sturm and Rankin-Erickson \(2002\)](#) claimed that CBGOs could enhance students' writing skills.

2.9. Culturally and Linguistically Diversity (CLD)

[Willis \(2000\)](#) defined the CLD students as "Culturally and linguistically diverse (CLD) students' backgrounds differ from the prevalent White middle or upper-class students' by one or more of the following: race, class, culture, ethnicity, and language". CLD students face various challenges who are struggling with argumentative writings. Students from CLD families own a wealth of cultural knowledge and practices that can be used to improve their literacy development ([González, Moll, & Amanti, 2005](#)). Research has highlighted that CLD students bring assets to the classroom which can be exploited on and used to help them learn English ([Chamot & O'Malley, 1994](#); [Flint & Jagers, 2021](#)). However, many times classroom teachers do not know how to identify and use these assets in their instruction ([Dantas, 2007](#)).

2.10. CLD with Specific Learning Disabilities (SLD)

CLD students with specific learning disabilities (SLD) are the students who have restrictions in the physiological processes required to use or understand the languages, either written or spoken and have a background that varies from other prevalent students based on race, culture, class, language and ethnicity. [Englert, Zhao, Dunsmore, Collings, & Collings \(2007\)](#) claimed that various SLD students face concerns directing the five stages of the writing process, including planning, organizing and reviewing. Various students with specific learning disabilities (SLD) cannot create ideas during the planning stage and express and expand them in written and organized form during the organization stage. For students with CLD and specific learning disabilities (SLD), attaining in academics is not simply accomplished.

2.11. Inclusive Classroom Settings

Currently, all the learning schools provide wide-ranging approaches to education. The classrooms contain various learners based on sexual orientation, gender,

ethnicity, language and cultural backgrounds. Concerning writing performance, every inclusive setting may include advanced or proficient learners and hard-working writers. There are different school settings, such as self-contained and inclusive classroom settings. Inclusive classroom settings are where all the students are trained to recognize and grow social differences. Furthermore, in inclusive settings, the teachers obtain the maintenance required to take account of all students in a systematic education classroom.

3. Method

The present study employed the mixed method; using both qualitative and quantitative to gain more insights related to the current topic in; which the data was collected using qualitative methods initially, while some of the data was analyzed using quantitative methods; the process in which the data is collected and analyzed through numerical data (Rutberg & Bouikidis, 2018).

3.1. Participants and Setting

Data were collected from elementary students conducting pre and post-test writing tests and teachers through interviews in private and public schools in Lebanon. The present study observed $n = 7$ students and obtain their pre-post writing samples to identify whether technological-based methods impact their argumentative writing skills. The sample of the study was calculated by using the Raosoft calculator.

The participant teachers were audio-recorded for 40 - 50 minutes of the two-session. Their interaction with the elementary school and their efforts to encourage the students to use technology was observed. Further, it observed the participant teacher's logs and lesson plans to identify the strategies intended to impact the writing expression of the students. The participants were selected by partnering with an elementary school providing educational services in Lebanon. For the partnering purpose, the help from the school's principal were taken, and all the data related to the present study was collected by observing the students and interviewing the two teachers providing the educational services to children. The selection of the schools and the teachers was based upon the inclusion and exclusion criteria. This study involved three phases. The Baseline phase, the Experimental phase and the post-experimental phase. It was conducted during the second half of the first semester of the 43 academic year 2021-2022. It started on January 2022 and continued for four consecutive weeks. The research used the before-after design or pre-post design. The researcher used the writing rubric based on The Georgia Department of Education Scale was selected and modified by the researcher to examine different writing skills concerned with argumentative writing. It was utilized to assess the students' writing samples before and after they took the training on how to use the graphic organizer. It examined students' abilities in five areas: content, organization, stating both arguments with supporting details, sentence fluency and convention.

3.2. The Baseline Phase (Week One)

This began on the 20th January after all the required arrangements were taken. The students took a conventional writing lesson where the topic was written in front of them and they had to outline and write about it. The teacher explained argumentative essay and that different point of view has to be mentioned. She showed a sample.

In the second session of the baseline phase she gave the writing prompt discussed before and they had to expand their ideas and submit at the end of the period. It involved writing about agreeing or disagreeing with internet is good for students. Some essential grammar points were highlighted to make them aware. They also watched a short video about advantage and disadvantage of internet in student life. Then after these steps were made and the researcher felt that the topic is clear to them he asked them to start writing a three-body paragraph in which they state their opinion and support it. They were also reminded with the writing process which includes plan, draft, edit and revise.

The applicants had finished the writing task within the elected time and their papers were collected and handed over for evaluation. Evaluation was carried out by two qualified teachers who were experienced and well-trained. They evaluated their work based on the modified rubric. Each paper was scored twice and the scores were averaged to be compared with results before and after using the intervention.

3.3. The Intervention Phases

This phase came after the baseline and it is the treatment phase. It started in the second week and lasted for three weeks. Each week the students have two writing hours.

3.4. Introduction of Graphic Organizers

This began in the second week of January. They were introduced to the concept of graphic organizers and were given printed blank samples before using the computer-based graphic organizers. The participants were informed about the importance of these organizers and the structure importance in expanding and explaining a certain concept as well as brainstorming in a sequential order. The different types of graphic organizers have been introduced according to the type of writing.

3.5. Introduction of Computer-Based Organizers

This began in the third week of January. The researcher projected on the board the computer-based organizers in the second session and actual training began. The training elaborates how to brainstorm main ideas and use supporting details to develop. The different parts of the graphic organizers were highlighted and projected on the white board one at a time so that they would be filled as group work on a prompt different from what they will be evaluated. The researcher then

listened to the participants' questions and explorations and provided some simplified answers for them. At the end of the session, the participants were given chance to use some links that has electronic sites which has graphic organizers to practice.

In the third week and after they became familiar with the organizers, the researcher reviewed and asked the participant and showed them how to add or delete any box on it to creatively build it as needed and then printed it so that they have both. He then told them that they will be writing about a topic after watching a video and discussing it as. The investigator told his students that they were going to use the argumentative graphic organizers to state their opinion with a topic under title "School days should start at 9" he also highlighted the grammatical points and to the importance of filling the organizers before writing the three body paragraphs. When the researcher was sure that all participants had filled their organizers correctly, he then asked them to write their three-paragraph composition following the model of the previous session. He instructed them carefully on how to use them to write linked ideas and in a sequential manner using the right conjunctions. The researcher also highlighted the importance of using vocabulary and figures of speech. He set the allocated time and after the 40 minutes ended he collected the printed copies and checked the turned in assignment on teams.

3.6. The Post Intervention Phase

In the week four the students were supposed to write an essay about internet through using the computer-based organizer that they were trained to use in the training week. The prompt was written on the board and read aloud to the students.

The time was 45 minutes to complete this task. They were reminded by the steps to use it and the importance to use what is written inside it and expanded. When the participants completed the task, they passed it over for evaluation. Evaluation was done by the same raters who evaluated the baseline writing. The scores of the students were averaged and recorded to be compared to their scores before the intervention which is the computer-based organizers. The results were compared later to reject or verify the hypothesis and answer the research questions. The second data source related to the present study was interviews with the participant teachers.

4. Results

This result offered essential findings on teaching writing and the importance of using computerized graphic organizers. It has shown that graphic organizers are good ways to improve students writing and highlight problems students faced in writing. Teachers' perceptions showed their importance and students' results. They were confident about using it to improve creativity and motivate students through implementing technology. However, they did not claim that students write as opposed to how they are supposed to. Accordingly, teachers have to make

a shift in their teaching strategies. The data collected from pre-test and post-test and interviews of the two teachers are analyzed, and research findings have been presented in the form of a description. Moreover, the discussion consisted of the result of the present research. First, the pre-test and post-test scores are analyzed to find the mean score and standard deviation. The total score of the pre-test and post-test are presented to determine whether students write better argumentative essays after using the Computer-Based Graphic Organizer in the post-test.

4.1. The Result of Pre-Test and Post-Test Scores

The present study conducted an argumentative essay writing test for grades 4th and sixth to analyze the writing features such as discourse, syntactic complexity and sentence combining in students' argumentative essays. A pre-test was conducted on the students initially without using CBGOs, and pre-test scores were attained. Then, a final test was conducted using CBGOs, and post-tests scores were achieved. The following table shows the results of pre-tests and post-tests of students.

4.2. The Performance of 4th and 6th Graders on English Tasks during the Phase of Pre-Testing

The data was analyzed with SPSS 26, and the results are shown in the accompanying table. Students who were taught with graphic organizers had significantly higher mean scores on assessments of writing quality than those who had received traditional instruction for both Grades 4th and 6th.

Table 1. The performance of 4th and 6th graders on English tasks during the phase of pre-testing (n = 7).

English skill tested	4th graders (n = 3)		6th graders (n = 4)		p-value
	Mean	Standard deviation	Mean	Standard deviation	
Discourse	0.167	0.288	1	0.408	0.031*
Complexity	0.33	0.577	0.625	0.478	0.496
Sentence combination	0.833	0.288	0.375	0.25	0.074
Total score	1.33	0.577	2	0.816	0.286

Independent samples t-test; *p*-value < 0.05 is considered significant.

According to **Table 1**, the mean score on the pre-test for students in the fourth grade was 1.33, and the standard deviation was 0.577. On the other hand, the mean score on the pre-test for students in the sixth grade was 2, and the standard deviation was 0.816. This indicated that the writing features such as discourse, syntactic complexity, and sentence combination in the student's essays were moderate because the scores in discourse, syntactic complexity, and sentence combination were fair. Specifically, the scores in discourse, syntactic complexity, and sentence

combination were as follows: displays the results of a descriptive statistical study that was carried out on aspects of writing. This exemplifies the significant variance in mean scores that exist between the many aspects of writing. Students who are instructed using the more traditional means of instruction can develop their writing abilities, but students who are taught with the use of graphic organizers are able to improve their writing skills more successfully than students who are instructed with the more traditional ways. The p -value of discourse is 0.03 which is less than confidence interval indicating the significant impact of discourse on English skill tested.

T-test on the performance of 4th and 6th graders on English tasks during the phase of post-testing.

On the other hand, as shown in **Table 2** we performed an independent sample t-test to compare the performance of Grade 4 and Grade 6, results show significance only at the level of Discourse where the 6 grader has higher performance than their peers (p -value 0.215) all of the students who took the post-test achieved satisfactory or better results, as indicated by the scores they received on the post-test. This shows a bigger difference in the results between pre and post-test. After using a computer-based graphic organizer, the final results concluded that students secured more scores in the post-writing test, meaning that discourse, syntactic complexity and sentence combination in argumentative writing were improved. Especially the mean values and standard deviation values in **Table 2** demonstrate a rising level in the scores in the CBGO usage phase. The following figure illustrates the overall difference in the scores of the students in Grade 4 and Grade 6 respectively.

Table 2. The performance of 4th and 6th graders on English tasks during the phase of pre-testing (n = 7).

English skill tested	4th graders (n = 3)		6th graders (n = 4)		p -value
	Mean	Standard deviation	Mean	Standard deviation	
Discourse	2	0	1.625	0.478	0.215
Complexity	2	0	2	0	-
Sentence combination	0.833	0.288	0.75	0.288	0.721
Total score	4.833	0.288	4.375	0.478	0.206

Independent samples t-test; p -value < 0.05 is considered significant.

4.3. Figures and Tables

A comparison of the results from the pre-test and post-test for the fourth grade for each student is presented in **Figure 1**. The pre-test scores of the students are represented by the blue bar, and the post-test scores are represented by the red bar in the graph. The student's overall performance on the post-test was significantly higher than their performance on the pre-test. This suggests that using graphic

organizers that are based on computers had a significant impact on the students' argumentative writing.

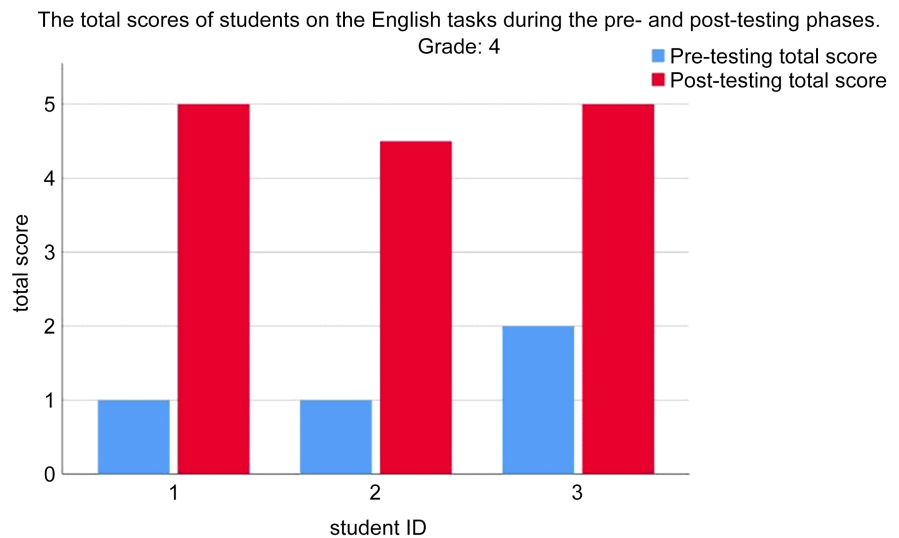


Figure 1. Total score of students on the English tasks during the pre and post phase Grade 4.

Figure 2 presents a comparison of the findings obtained from the pre-test and post-test administered to students in the sixth grade for each individual. On the graph, the blue bar indicates the students' results on the pre-test, while the red bar indicates the students' scores on the post-test. The overall performance of the students on the post-test was noticeably improved compared to the performance they had on the pre-test. It appears from this that utilizing visual organizer that are based on computers had a substantial impact on the students' ability to write convincing arguments.

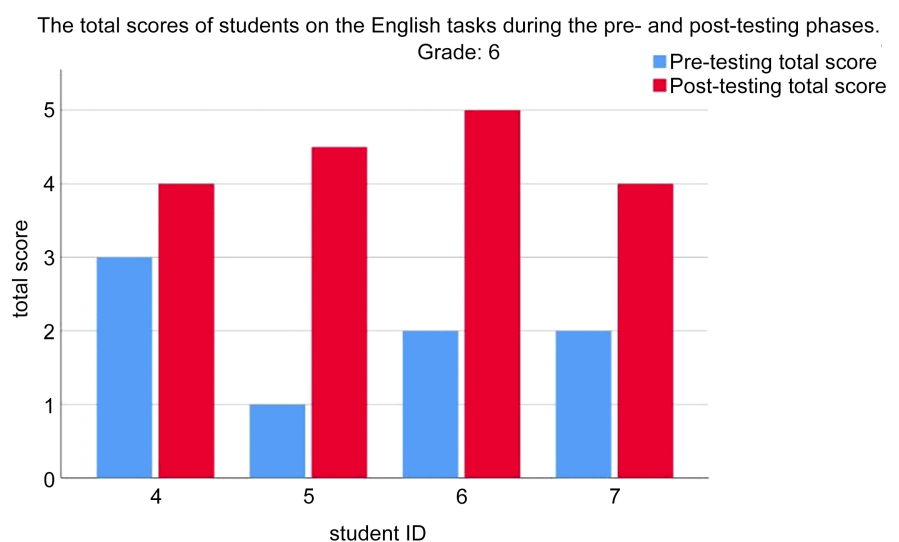


Figure 2. Total score of students on the English tasks during the pre and post phase Grade 6.

Comparison of the pre-testing and post-testing performance of Grade 4

The results of a t-test were performed on several aspects of writing performance, and those results are presented in **Table 3**. It illustrates the disparity in mean scores between the various writing characteristics of Grade 4. Students post-testing mean score increased to (2 > 0.167) indicating the improvement in discourse skill than pre-testing. The *p*-value of discourse also indicate (Sig = 0.00 < 0.05) which is less than standard confidence interval indicating significant improvement in discourse skill post-testing than pre-testing. The mean value of complexity also increased to (2 > 0.33) representing the increase of average complexity in post-testing than pre-testing. The *p*-value of complexity accounted for (Sig = 0.03) indicating the significant improvement in complexity of writing in post-testing. Conversely, the mean value of sentence combination has not shown differences and *p*-value is (Sig = 1 > 0.05) indicating the insignificant improvement in student's sentence combination.

Table 3. Comparison of the pre-testing and post-testing performance of grade 4 students (n = 3).

English skill tested	Pre-testing		Post-testing		<i>p</i> -value
	Mean	Standard deviation	Mean	Standard deviation	
Discourse	0.167	0.288	2	0	0.008*
Complexity	0.33	0.577	2	0	0.038*
Sentence combination	0.833	0.288	0.833	0.288	1
Total score	1.33	0.577	4.833	0.288	0.007*

Paired samples t-test; *p*-value < 0.05 is considered significant.

Table 4. Comparison of the pre-testing and post-testing performance of grade 6 students (n = 4).

English skill tested	Pre-testing		Post-testing		<i>p</i> -value
	Mean	Standard deviation	Mean	Standard deviation	
Discourse	1	0.408	1.625	0.478	0.194
Complexity	0.625	0.478	2	0	0.010*
Sentence combination	0.375	0.25	0.75	0.288	0.058
Total score	2	0.816	4.375	0.478	0.023*

Paired samples t-test; *p*-value < 0.05 is considered significant.

Table 4 above demonstrates the findings of t-test on several aspects of writing performance. It illustrates the disparity in mean scores between the various writing characteristics of Grade 6. The mean value of complexity also increased to (2 > 0.62) representing the increase of average complexity in post-testing than pre-testing. The *p*-value of complexity accounted for (Sig = 0.01) indicating the sig-

nificant improvement in complexity of writing in post-testing. On the contrary, the mean value of sentence combination increased in post testing ($0.7 > 0.3$) and p -value is ($\text{Sig} = 00.6 > 0.05$) indicating the insignificant improvement in student's sentence combination. Additionally, the mean value of discourse increased in post testing ($1 > 0.4$) and p -value is ($\text{Sig} = 00.6 > 0.05$) indicating the insignificant improvement in student's discourse.

To summarize, the students whose writing is evaluated based on the criteria of Discourse, Complexity, and Sentence combination is significantly improved by the use of graphic organizers in the classroom. This is in comparison to students whose writing is evaluated based on standard teaching methods.

4.4. Teachers Interviews

The present study interviewed two teachers based on the proposed questions asked from respondents. The following questions were asked from the teachers after observing the classes.

Were students aware of the computer-based graphic organizers before the session? Do they face any issues using it?

Teacher A: No, they were unaware of the CBGO because no one had taught them.

Teacher B: Some students were aware of the CBGO and its usage.

Teacher A stated that the students were not aware of about CBGO before they were given a session. However, their scores increased after they came to know about its usage. On the other hand, teacher B stated that some of the students were aware of the CBGO and its usage.

To what extent can the students maintain their writing performance without using CBGO?

Both teachers A and B claimed that each student in the pre-test writing faced problems in gathering ideas on their own; there was a lack of coherence in the scenes, and paragraphs were short and little without CBGO. During the pre-test, the word choice and the quality of writing were not adequate. Moreover, they stated that without CBGO, students took much time to complete their essays because they were not using the writing techniques such as brainstorming, planning, and maintaining their points.

How does using computer graphic organizer impact students' ability to use words, structure and organization in writing?

The two teachers, A and B, reported positively about using CBGO and acknowledged student progress. The teachers appreciated students' progress after using CBGO and supported the sessions they gave the students about CBGO as they were "very helpful", they said. Moreover, they stated that the usage of technology supported the students in writing essays easily in a sequential manner. After using CBGO in their writing, teachers reported that the scores were raised in the argumentative essay. Moreover, the usage of words was higher, with more sentences and long paragraphs. Further, the teachers observed that students brainstormed

their ideas and planned the essay according to the given instructions in the CBGO. In this way, students gathered more ideas and wrote longer paragraphs.

Furthermore, teacher A commented that grade 4th students still need to know more about the skills and techniques used in the CBGO. Students are aware of the usage of computers, but the need to use such applications needs to improve.

How do culturally and Linguistically Diversity affect students' writing abilities? Does CBGO improve this effect?

Both classes in the sample were culturally diverse, belonging to different religions and races. Teachers A and B claimed that students could not gather ideas in the classroom based on cultural differences. As they belong to non-English communities, each student confronted problems in the choice of words. In addition, teachers stated that idea generation was challenging for CLD students because generating ideas requires a proficient language that all students lack. Moreover, teachers noticed that students with CLD struggled with planning before they started writing the essay. Generally, a writer spends more time brainstorming the ideas before the essay; however, teachers reported that CLD students took less time brainstorming.

Commenting on the second part of the question, both teachers suggested that when CLD students used CBGO in their post-writings, it helped them generate ideas and use different words as they were provided with the outline through a graphic organizer. Moreover, students were reported to take more time on the planning part of the essay, which helped them gather more ideas and write more paragraphs.

What type of challenges do CLD with Specific Learning Disabilities students faced in essay writing, and how has CBGO improved this?

The sample took one student from each class with a specific learning disability. One with LD (Learning disability) from grade 4th and the other with ADHD (attention deficit hyperactivity disorder) from grade 6th.

For this question, teachers commented that students with specific learning disabilities learn and understand this late or slowly compared to other students in the class; therefore, they require special attention from the teachers. These students struggled with their writing essays, and it was hard for them to understand the teaching. Teachers also stated that these students struggled with making complex sentences and texts. Teacher A stated that the LD student in grade 4th faced problems in learning; he was unable to understand the topic and organization of the essay. While teacher B stated that the ADHD student could not maintain his attention to the task, he faced issues with attention. Moreover, they reported having issues expanding the ideas in the argumentative essay. In addition, the concepts were not planned and ordered, and the message did not convey the information as stated by teachers.

Nevertheless, both teachers' responses were positive when asked about using CBGO. They stated that CBGO improved students' writing and learning abilities with LD and ADHD. The post-writings of both students showed a progressive

approach. The overall performance in essay writing improved after using a computer-based graphic organizer.

4.5. How Do You Handle an Inclusive Setting?

Teacher A reported that she used the language of instruction for the students to understand the essay composition instructions and behaviour management techniques. She also suggested that it was difficult for her to handle students' different behaviors and varied abilities; as a result, the lesson flow was disrupted. During the pre-test, it was difficult for her to handle and make the students understand the structure and organization of the essays. In addition, she stated that SLD and CLD students found it difficult to understand the task easily. However, in post-test writing, she does not face problems handling the students and making them understand the task because it becomes easy for students to handle it themselves.

Teacher B reported she faced problems with SLD students as they could not cope with their tasks. She stated that students faced issues structuring their essays as they did not understand what to write and how to write it. Nevertheless, teacher B also reacted positively to using CBGO in essay writing, and her workload decreased due to students' progress in writing compositions.

4.6. What Strategies Should Be Applied to Improve Argumentative Writing Skills?

Based on the teacher's comments and strategies for improving argumentative essay, teachers provide writing prompt to the students first and then develop a graphic organizer and guide the class about developing the graphic organizer. After learning the usage of a graphic organizer, students should be given practical work to create a graphic organizer themselves so that it becomes easy for them to use it in writing prompts.

In addition, teachers commented that LD students require special directions constantly and in a sequence. Therefore, the computer-based graphic organizer should embed audio along with the instructions so students can click on the specific icon and get extra information or explanation to complete the writing prompt.

The teachers suggested that for LD students struggling with idea generation and coherence, CBGO must have drop-down buttons in which transitions and vocabulary related to the topic should be provided so that students can easily choose words to connect sentences and do quality writing.

4.7. Discussion and Findings

The present study provided insight into CBGO that assisted elementary school students in writing an argumentative essay. Such writing is needed for the students for all the classes with arguments based on the evidence (Link, Mehrzad, & Rahimi, 2022). The argumentations that are text-based give a deeper insight into the development and comprehension of reasoning skills.

With the help of these essays, students express their thoughts and describe and explain ideas related to the content. Some research stated that CBGOs help the student's written argumentation without disabilities (Regan et al., 2019); however, this study explored the usage of CBGOs, which progressed the written qualities of students with certain needs and abilities.

The present study recognized the usefulness and impact of the computer-based graphic organizer on 4th and 6th-grade students in elementary school. In general, the study findings stated that the usage of computer-based graphic organizers positively impacted the student's argumentative essays, improving the discourse, syntactic complexity and sentence combination in elementary school students writing in Lebanon. The mean score and standard variation were less in the pre-test scores for all the students who participated in the research. However, after using a computer-based graphic organizer, the mean score increased in the post-test writing, indicating that CBGOs effectively improved writing features among elementary school students. The findings are in line with the prior literature that suggests that Graphic Organizers enhanced the comprehension of students' writings as they improved their vocabulary by brainstorming the synonyms, and improved text structure and word selection (Mojaverian, Siahpoosh, & Davaribina, 2022).

Further, the study findings answered the second question. The findings suggested that culture and linguistics diversity, specific learning disabilities, and inclusive settings affect the argumentative writing of elementary students in Lebanon which is consistent with the evidence by (Boykin, Evmenova, Regan, & Mastropieri, 2019). Moreover, the findings answered the third question and proposed that an inclusive classroom setting impacted the argumentative writings of elementary-level students in Lebanon which is in line with the findings of (Heft, 2021). The differences, such as specific learning disabilities in the students faced problems in gathering ideas and writing more sentences. Furthermore, the teachers have to maintain an environment equal for all the students, which effected the instructions that teachers provide to students while writing essays. Finally, the findings suggested strategies for implementing the CBGOs in maintaining the argumentative writing of elementary students in Lebanon. According to the teachers, the strategies for maintaining the writing are practical guidance in generating graphic organizers and using audio and drop-down buttons for LD students in the CBGO.

According to the teacher's point of view, when the grade 4th and sixth students used CGBO in writing their argumentative essays, they wrote long paragraphs and quality text by combing the sentences correctly, despite CLD and SLD. The results are steady with the earlier research in which the students with disabilities used CBGO in their writing, which improved their quality (Boykin et al., 2019). Moreover, it agrees with the previous findings that instruction like planning and brainstorming improved essay writing compositions (Brady, Evmenova, Regan, Ainsworth, & Gafurov, 2021). Students planned their outlines in the post-test, where

they used the words in the given box to brainstorm ideas. Further, the given words in the box helped them add their word choices. Using the CBGO structure, the students could maintain a flow in their sentences and gather ideas rather than merge them into long sentences as long sentences lose clarity.

The words and sentences in the paragraphs improved from the baseline and the scores of quality writing also increased using both dependent and independent clauses in the sentences. A future direction for these students would be to explicitly teach them how to write increasingly complex sentences by combining and elaborating on simple, discrete sentences (Agus & Nurhayati, 2022).

CBGO usage progressed the student's scores by improving their essay writing quality. In the post-test writings, students' sentences were higher on average than in pre-test writings. Regan et al. (2018) stated that the complications students face with writing could be associated with the challenges they face while organizing the text through planning and brainstorming. The sentences in the post-test were better than in the pre-test when used CBGO. This study is consistent with various previous research on other forms of writing. However, the study extended the research to explore CBGO in argumentative writing as this genre requires finding the facts in the writing passages, which is sometimes difficult for the students (Ghanbari & Salari, 2022). Computer-based graphic organizers assist students in making associations between their ideas and thoughts as a result the fluency of sentences and their combination can be maintained.

Moreover, the present study concluded a distinction between the pre-text and post-text paragraph length. The pre-test paragraphs were short as compared to the post-test lacking the sentence combination writing feature. Due to the structure and guidelines provided in the CBGO, the quantity of the text also improved.

The purpose of this research is to find out if using graphic organizers improves students' writing for Grade 4 and Grade 6. The data shows that teaching students to write a paragraph with a visual organizer intervention is significantly more effective than using traditional methods.

When compared to students who were taught using more traditional techniques, the mean score of students who wrote a paragraph utilizing graphic organizers was significantly higher. The students whose writing is evaluated based on the criteria of Discourser, sentence complexity, and sentence combination in the graphic organizers class produce better work than students whose writing is evaluated based on the usual teaching strategy. The findings of the study have a few consequences. Students that use graphic organizers have shown significant improvement in their writing. Students are able to improve the quality of their writing in relation to the writing components of Discourser, sentence complexity, and sentence combination when they make use of graphic organizers in their work. In addition, graphic organizers have the potential to establish a social group. It is clear from the data shown above that the use of graphic organizers is a useful tool for assisting students in improving their writing. In accordance with the findings of Robinson (2019), it has been discovered that the use of graphic organizers

helps to motivate students to successfully have knowledge when writing essays. The pupils are given plenty of opportunities to practice developing their English vocabulary, particularly in written form. Students are able to improve the development of their paragraphs when they use visual organizers. The other outcome that is illustrated by [Rahmat \(2020\)](#) is that the use of graphic organizers is an excellent learning method that can aid students with the writing process. It is possible to use it to produce better sentences when narrating stories. As a consequence, the paragraph has a structure that is more complex and contains better phrases and clauses. Students who use graphic organizers to improve their writing skills see significant improvement. The students have the ability to improve the quality of their writing in accordance with the writing component of topic, vocabulary, and mechanics. These are the aspects that contribute to the overall quality of the learners' writing. This current study is in line with the research that was carried out by [Khatib and Meihami \(2015\)](#), who discovered that the results of their research on writing components suggest that the significant level. This finding is in line with what was found by [Khatib and Meihami \(2015\)](#), which is supported by the findings of this current study.

Some other investigation, conducted by [Jumariati and Sulisty \(2017\)](#), came to the same conclusion. In accordance with the sentence complexity and combination, the students have improved writing abilities, and it is also possible that it will improve the content of the students' writing ([Mustafa & Samad, 2015](#)). Before beginning to write, the learners might decide what the concept is. According to [Albufalasa \(2019\)](#), the use of graphic organizers can improve students' comprehension by facilitating the flow of significant ideas and enhancing the accompanying relationship between the content and the students' cognitive structure. Therefore, with the utilization of visual organizers, the students are able to articulate their thoughts using the appropriate terminology. Throughout the process of writing, the students are successful in maintaining the concepts in their heads. Additionally, the children demonstrate an organized structure. It is corroborated by the findings of [Vitanofa and Anwar \(2018\)](#), who similarly discovered that graphic organizers help students write better by helping them explore their thoughts based on the topic they are writing about. In addition to this, it ensures that things are written in the correct sequential order. The pupils' writing is extremely nicely organized and presented. The students are doing a better job managing the organization. The students do an excellent job of writing their paragraphs, which include their topic or ideas, topic phrase, supporting sentences, and conclusion sentences ([Maharani, 2018](#)). Another study that was carried out by [Unzueta \(2009\)](#) demonstrates that the use of visual organizers helps pupils improve the overall arrangement of their work. Students have a more logical understanding of how to write in a more organized fashion when they use visual organizers. In addition, [Albufalasa \(2019\)](#) notes that the use of graphic organizers helps students enhance the quality of their writing in all aspects, including the quality of their supporting arguments, their conclusion statements, and their overall writing.

In conclusion, the use of graphic organizers allows the students to get experience in maintaining control over the flow of their writing ideas. The utilization of graphic organizers can result in the formation of social communities. When it comes to building the organizers for their writing, many students collaborate with one another. In an effort to facilitate the pupils' transition from idea generation to written expression, the students encourage one another to develop their very own graphic organizers. This is done on purpose in order to gain an understanding of the complete writing process. It is comparable to what [Khalaji \(2016\)](#) states, which is that graphic organizers can form a social community for better environmental conditions. There is a possibility that some of the students will struggle to draw the graphic organizers, but there are other students who can assist those individuals in creating them. In addition to that, it inspires the kids to learn English in an interactive manner. This scenario is analogous to the practice of putting anything in writing for the purpose of reinforcement. [Tan \(2010\)](#) provides evidence for the idea that it is helpful to have a wide writing portfolio. It has the potential to encourage learners to write, improve the students' writing abilities skills, and strengthen the link that exists between teachers and students. Therefore, graphic organizers have an effect not only on the students' ability to write well but also on their willingness to collaborate and share with their peers. To summarize, the utilization of graphic organizers is an excellent method for creating ideas in written work, which means that it can assist students improve the quality of their written work that they produce. Students are able to improve the quality of their writing in relation to the writing components of Discourser, sentence complexity, and sentence combination when they make use of graphic organizers in their work.

5. Conclusion

From the results of this research, it can be concluded that graphic organizers are effective instruments to develop the students' writing ability. In conclusion, the use of graphic organizers allows the students to get experience in maintaining control over the flow of their writing ideas. The utilization of graphic organizers can result in the formation of social communities. When it comes to building the organizers for their writing, many students collaborate with one another. In an effort to facilitate the pupils' transition from idea generation to written expression, the students encourage one another to develop their very own graphic organizers. This is done on purpose in order to gain an understanding of the complete writing process. It is comparable to what [Khalaji \(2016\)](#) states, which is that graphic organizers can form a social community for better environmental conditions. To summarize, the utilization of graphic organizers is an excellent method for creating ideas in written work, which means that it can assist students improve the quality of their written work that they produce. Students are able to improve the quality of their writing in relation to the writing components of Discourser, sentence complexity, and sentence combination when they make use of graphic organizers in their work.

Recommendations for Future Research

The researcher's purpose was to examine the impact of computer graphic organizers in improving students' writing. This study also informs teachers and principals about implementing computerized graphic organizers. Recommendations for further studies include repeating the study with a larger sample size and across multiple grade levels and providing more lengthy and in-depth training for teachers that allows them to know how to use the graphic organizers in different genre narrative, expository, persuasive.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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