International Journal of Language Education
Volume 7, Number 4, 2023, pp. 633-645
ISSN: 2548-8457 (Print) 2548-8465 (Online)
Doi: https://doi.org/10.26858/ijole.v7i4.36393

Do Mind Maps Really Catalyze EFL Grammar Learning? Conjunction as a Case

Ruba Fahmi Bataineh
Al-Ahliyya Amman University & Yarmouk University, Jordan
Email: rubab@yu.edu.jo

Hiba Ahmad Al-Majali
Yarmouk University, Jordan
Email: hibamajali@gmail.com

Received: 11 September 2022
Reviewed: 21 September 2023 – 1 December 2023
Accepted: 28 December 2023
Published: 31 December 2023

Abstract
This study examines the potential effect of mind mapping-based instruction on Jordanian EFL tenth-grade students' use of additive, adversative, causal and temporal conjunctions. A purposeful sample of two tenth-grade sections was drawn from a public school in Mafraq, Jordan. The two sections were randomly assigned into an experimental group of 14 students, taught through mind mapping, and a control group of 13 students, taught per the guidelines of the prescribed Teacher's Book. Following an eight-week treatment, the data were collected by means of a post-test. The findings revealed that the experimental group scored significantly higher than the control group in the use of the four types of conjunctions and overall. The study concludes with several pedagogical implications and recommendations for further research.

Keywords: Additive; adversative; causal; conjunctions; EFL; grammar; mind mapping; temporal

Introduction
Learning a foreign language is never an easy task, especially when the language is almost never used outside the language classroom. This places greater responsibility on the teacher to craft instructional treatments which would help his/her students not only learn the language but also put it to good use in the classroom and beyond.

Mind mapping, also known as mind maps and thinking maps, is a teaching strategy used to "promote metacognition and improve achievement" (Bataineh & Alqatnani, 2017, p.33). A mind map is an illustrative multi-dimensional outline which helps foster learners' engagement through introducing a topic, managing ideas about it, and establishing connections (Budd, 2004; Stephens & Hermus, 2007; Sturm & Rankin-Erickson, 2002). Mind mapping is reported to catalyze information processing by making use of text, images, and color in a manner that improves not only learning and memory recall but also collaborative and active learning (Bataineh & Alqatnani, 2017; 2019; Budd, 2004; Buzan

& Buzan, 1994; Edwards & Cooper, 2010; Howitt, 2009).

When communicating with others, learners need to transition from one idea to another by means of cohesive devices of which conjunctions are one (Biber, Connor, & Upton, 2007; Chiang, 2003; Halliday & Matthiessen, 2014). Thus, cohesive devices are essential for speech and writing alike because they link fragmented information into discourse to signify both meaning and relationships (Connor, 1984; Klimova & Hubackova, 2014; Zamel, 1983).

Halliday and Hasan (1976) single out cohesion, or the semantic relation between one element and another in a text, as the sole distinction between text and non-text, and define conjunctions as linguistic devices which create cohesion. Conjunctions, also known as *conjuncts* (Quirk, Greenbaum, Leech, & Svartvik, 1985; Zamel, 1983), *connectors* (Granger & Tyson, 1996), *connective adverbs* (Huddleston & Pullum, 2002), *discourse markers* (Fraser, 1999; Schiffrin, 1987), *discourse connectors* (Cowan, 2008), *linking adverbials* (Biber, Johansson, Leech, Conrad, & Finegan, 1999), *logical connectives* (Crewe, 1990), and *logical connectors* (Celce-Murcia & Larsen-Freeman, 1999), are used mainly for linking parts of text. For the purposes of the current research, a conjunction is a word or phrase which conjoins various grammatical units (viz., words, phrases, clauses, or sentences) to construct meaning and maintain the smooth flow of a text.

Different classifications of conjunctions have been put forth, ranging from two to four general types. Grammatically, conjunctions are classified into up to four types: coordinating conjunctions (e.g., *and, nor, but, or, yet*), subordinating conjunctions (e.g., *because*, *before*, *even though, as long as)*, correlative conjunctions (e.g., *both… and, either … or, neither … nor, not only … but also*), and conjunctive adverbs (e.g., *therefore, however, meanwhile, furthermore*). Conjunctions are also classified functionally into *additive, adversative, causal,* and *temporal* (Halliday and Hasan, 1976), which is the taxonomy used in the current research.

According to Halliday and Hasan (1976, p.239), additive conjunctions introduce discourse units which repeat and emphasize key point or add new information (e.g., ***and, both… and, not only … but also*****)** whereas adversative conjunctions (e.g.**,** ***but, nevertheless, however, whereas*****)** introduce information that mark corrections, contrasts, and opposites of previously given information. Causal conjunctions (e.g., *because, therefore, hence, as a result*) introduce information which constitutes a result or consequence of the preceding discourse. Temporal conjunctions (e.g., *before, after, now (that), until*) relate two discourse units with sequential, simultaneous, or preceding relations. These four categories reflect four semantic relations between sentences in a text, which makes it imperative for learners to understand their role organizing a text.

Research suggests that the proper use of cohesive devices constitutes a challenge for foreign language learners (e.g., Altenberg & Tapper, 1998; Bolton, Nelson, & Hung, 2002; Chen, 2006; Granger & Tyson, 1996). More specific to the scope of the current research, evidence abound on the problems involving the overuse, underuse and misuse of conjunctions in the foreign language classroom (e.g., Abdalwahid, 2012; Al Shamalat & Abdul Ghani, 2020; Granger & Tyson, 1996; Hamed, 2014; Darweesh & Kadhim, 2016; Kiany & Khezri Nejad, 2001; Martínez, 2015; Meisuo, 2000; Mudhhi & Hussein, 2014). According to Zamel (1983), making sense of ideas would be difficult without conjunctions which are vital for both listener and reader to anticipate the ideas which follow. Thus, the

appropriate use of conjunctions has been reported as essential for language learning (e.g., Karahana, 2015; Sanders and Noordman, 2000).

Empirical research has reported conflicting findings on the relationship between the use of cohesive devices and writing proficiency. Some research (e.g., Amayreh & Abdullah, 2021; Ting, 2003) reported no statistically significant difference in the number of cohesive errors between the essays of proficient and non-proficient writers; other research (e.g., Sanchez Sanchez, 2019) reported a positive statistically significant relationship between writing proficiency and conjunction use; a third group (e.g., Kalajahi & Abdullah, 2015) reported a negative statistically significant difference between writing proficiency and conjunction use; and a fourth group (e.g., Al Shamalat & Abdul Ghani, 2020) reported a negative statistically insignificant relationship between writing proficiency and conjunction use.

Previous empirical research also seems to suggest that errors in the adversative and, to a lesser extent, additive conjunctions tend to outnumber those in the causal and temporal conjunctions (e.g., Hamed, 2014; Martínez, 2015; Ting, 2003). This can be readily explained, as the former are used a lot more frequently than the latter and, thus, the likelihood of errors is greater.

Problem, purpose, and significance of the study

As foreign language practitioners at both the school and tertiary levels, the researchers have observed their students' errors in conjunction use which they attribute to insufficient knowledge of their proper use and distribution. They have further observed their students, at both levels, misuse, underuse, or overuse certain conjunctions, which instigated this research aiming to determine the potential utility of mind mapping in developing Jordanian EFL tenth-grade students' knowledge and use of additive, adversative, causal, and temporal conjunctions. More specifically, this research seeks to answer the question, *are there any statistically significant differences (at α=0.05) in Jordanian EFL tenth-grade students' use of conjunctions which can be attributed to instruction (mind mapping vs. conventional)?*

Conjunctions have received a lot of attention, and research abound on their use and distribution within and across languages. However, to these researchers' best knowledge, very little research, if at all, addresses the effect of mind mapping in particular on students' use of conjunctions. Previous research seems to suggest that mind mapping is a viable strategy for teaching language skills (e.g., Bataineh & Alqatnani, 2017; 2019 on creative and critical reading; Naghmeh-Abbaspour & Rastgoo, 2020 on writing), grammar (e.g., Abdul Aziz & Yamat, 2016), lexis (e.g., Borovková, 2014; Heidari & Karimi, 2014), and spelling (e.g., Al-Jarf, 2011). The current research seeks to not only add to the existing research on conjunctions but also to look for viable strategies which may catalyze the mastery of this challenging part of speech

Research method

The research used a quasi-experimental design, as two intact tenth-grade sections from a purposefully selected all-male public school in Mafraq, Jordan, were randomly distributed into one experimental (n=14) and one control (n=13) groups. The control group was taught per the guidelines of the prescribed teacher's book whereas the experimental group was taught using an eight-week instructional program, which involved the redesign of the 23 writing activities revealed

by a content analysis of modules 5 and 6 of the prescribed textbook, *Action Pack 10,* using mind maps, as detailed in Table 1 below.

Table 1. Content and duration of the instructional treatment

Week	Day	Unit Title	Outcome
One	One Two Three	Weather and Climate	1. The teacher (T) uses pictures to introduce the topic. 2. T defines mind mapping and explains its importance through examples. 3. Students (Ss) use mind mapping for a brainstorming session about the weather and the climate. 4. T defines persuasive writing and its aim. 5. Ss write sentences to show agreement and disagreement.
Two	One Two Three Four		6. Ss identify world disasters and draw mind maps to connect them with useful words. 7. Ss demonstrate understanding of conjunctions and their categories. 8. Ss demonstrate understanding causal conjunctions and cause and effect. 9. After arranging ideas using a mind map, Ss write 2-3 sentences on the causes and effects of climate change.
Three	One Two Three	Earth	10. Ss and T discuss the importance of climate change to the future of Earth. 11. Ss develop understanding of how to write a thesis statement and an introduction in a persuasive essay. 12. Ss draw mind maps to outline information and ideas to be included in the writing task. 15. Ss write a one-paragraph introduction for an assigned topic.
Four	One Two Three	Tourist Attractions	16. Ss and T discuss a mind map about tourism. 17. Ss analyze tourist brochures as an example of persuasive writing. 18. Ss demonstrate understanding of additive conjunctions and their functions. 19. Ss write a paragraph to promote a tourist attraction in Jordan.
Five	One Two Three		20. Ss revise the definition and parts of persuasive writing. 21. Ss and T discuss a text on the Dead Sea. 22. Ss demonstrate understanding of an argument in persuasive writing. 23. Ss design mind maps on places for health tourism. 24. Ss write a postcard to a friend convincing him/her to visit Jordan.

Week	Day	Unit Title	Outcome
Six	One Two Three	Cultural Tourism	25. Ss express their thoughts on what the word *culture* means by drawing a mind map. 26. Ss and T discuss the concept of cultural tourism. 27. Ss draw a mind map to show the work and/or achievement of their favorite artist and/or inventor. 28. Ss demonstrate understanding of adversative conjunctions and their functions and study some examples on them. 29. Ss identify some conjunctions used for expressing opinions. 30. Ss write two paragraphs to persuade the reader that their favorite artist or inventor is the best.
Seven	One Two Three		31. Ss and T discuss the benefits of cultural tourism in Jordan. 32. Ss identify cultural tourist attractions in Jordan. 33. Ss develop understanding of a conclusion in persuasive writing. 34. Ss demonstrate understanding of temporal conjunctions. 35. Ss draw mind maps on activities to enjoy in cultural tourist attractions. 36. Ss and T discuss a conclusion example. 37. Ss write a conclusion on one of the topics they have already written about.
Eight	One Two Three Four		38. Ss and T discuss the importance of having people from around the world visit Jordan. 39. Ss draw a mind map to show the fields that would be positively affected and how. 40. Using what they have learned about conjunctions over the past eight weeks, Ss write an invitation to a friend abroad convincing him/her to visit Jordan.

As detailed in Table 1 above, for the experimental group, the treatment commenced by presenting and illustrating mind mapping and the meaning and functions of the four types of conjunctions. By contrast, the control group was taught the same writing activities per the guidelines of the teacher's book through introducing and writing the topic on the board for the students to complete their essays in class. The instructor reviewed the four types of conjunctions in the pre-writing phase because they were taught in seventh-, eighth-, and ninth grades. Over eight weeks, the participants wrote about the topics in their textbook, and drafts were assessed, using a scoring rubric which addressed both writing mechanics (viz., *organization, goal/thesis, reasons and support, attention to audience,* and *word choice*) and grammar (*use of additive, causal, adversative* and *temporal conjunctions*) and returned to participants for further development.

A test was administered to the participants of both groups to assess their respective use of conjunctions before and after the treatment. At the end of the treatment, the participants of both

the experimental and control groups were post-tested. Two raters also scored the essays using the rubric.

Both the instructional program and the pre-/post-tests were validated by a jury of ten foreign language teaching practitioners (five university professors and five school supervisors). The reliability of the pre-/post-test was also established by test-retest of a pilot sample of 13 students, from outside the main sample of the research, with a two-week lapse between the two administrations. A reliability coefficient of 0.87 was deemed appropriate for the purposes of the research.

Results

To answer the research question, the means and standard deviations of the experimental and control group participants' overall use of the conjunctions were calculated, as shown in Table 2.

Table 2. Means and standard deviations of overall conjunction use on the pre- and post-test across groups

	Group	Pre-test		Post-test	
		Mean*	SD	Mean*	SD
Conjunction Use	Control	7.15	1.34	9.62	1.80
	Experimental	7.50	1.61	12.79	1.37
	Overall	7.33	1.47	11.26	2.25

*Out of 16 (4 for *Additive*, 4 for *Causal*, 4 for *Temporal*, and 4 for *Adversative* conjunctions)

Table 2 shows that the experimental group scored higher than the control group in the overall use of conjunctions. Table 2 also shows that the post-test mean scores of the experimental and control groups are 12.79 and 9.62, respectively. To determine whether or not the observed difference in overall conjunction use is statistically significant (after controlling the effect of overall pre-test scores), One-Way Analysis of Covariance (ANCOVA) was used, as shown in Table 3 below.

Table 3. ANCOVA of the effect of instructional strategy on overall conjunction use

Source	Type III Sum of Squares	df	Mean Square	f	Sig.	η_p^2
Pre-test	0.19	1	0.19	0.07	0.79	0.00
Instructional Modality	65.91	1	65.91	25.01	0.00	0.51
Error	63.24	24	2.64			
Total	3554.00	27				
Corrected Total	131.19	26				

Table 3 shows that the experimental group's mean score of overall conjunction use is significantly higher than that of the control group. The partial eta squared value of 0.51 indicates that the instructional strategy explains 51% of the variance in overall conjunction use, which indicates that the use of mind mapping has potentially improved the participants' overall conjunction use.

The adjusted and unadjusted means of the overall conjunction use by the two groups were also calculated. Table 4 shows the means, standard errors, and standard deviations of the two groups in overall conjunction use before and after controlling the

pre-test scores.

Table 4. Adjusted and unadjusted means and variability of overall conjunction use per instructional modality (pre-test scores as covariate)

Group	Unadjusted Means		Adjusted Means	
	Mean	SD	Mean	SE
Control	9.62	1.80	9.63	0.45
Experimental	12.79	1.37	12.78	0.44

Table 4 shows a difference between the two groups in overall conjunction use after the differences in overall pre-test scores were controlled, which suggests that mind mapping improves students' overall conjunction use. To test whether or not mind mapping also affects the participants' use of each type of conjunctions (viz., additive, adversative, causal, and temporal), the means and standard deviations of the participants' pre- and post-test scores were calculated for the two groups, as shown in Table 5.

Table 5. Means and standard deviations of the pre- and post-test scores of the two groups in the use of the four types of conjunctions

Conjunctions Categories	Group	Pre-test		Post-test	
		Mean*	SD	Mean*	SD
Additive	Control	1.77	0.60	2.69	0.63
	Experimental	1.86	0.86	3.36	0.50
	Total	1.81	0.74	3.04	0.65
Temporal	Control	2.31	0.75	2.62	0.96
	Experimental	2.43	0.85	3.71	073
	Total	2.37	0.79	3.19	1.00
Causal	Control	1.77	0.44	2.85	0.38
	Experimental	1.86	0.66	3.43	0.51
	Total	1.81	0.56	3.15	0.53
Adversative	Control	1.31	0.48	1.46	0.52
	Experimental	1.36	0.50	2.29	0.47
	Total	1.33	0.48	1.89	0.64

*The maximum score is 16 (4 for additive, 4 for causal, 4 for temporal, and 4 for adversative conjunctions).

Table 5 shows observed differences in the two groups' use of the four types of conjunctions, as the mean scores of the participants in the experimental group are considerably higher than those of the participants in the control group. The participants' mean score are 3.26, 3.71, 3.43, and 2.29 for the experimental group and 2.69, 2.62, 2.85, and 1.46 for the control group in the use of additive, temporal, causal, and adversative conjunctions, respectively. To determine whether or not these differences in the use of the four types of conjunctions across the two groups (brought about by instructional modality after controlling the effect of the pre-test) are statistically significant, One-way Multivariate Analysis of Covariance (MANCOVA) using a Multivariate Test (Hoteling's Trace test) was used, as shown in Table 6.

Table 6. The effect of instructional modality on the use of the four types of conjunctions

	Value	f	Hypothesis df	Error df	Sig.	η_p^2
Instructional Modality	1.46	6.56	4	18	0.00	0.59

Table 6 shows a significant main effect for instructional modality (Hoteling's Trace test = 1.46, F (4, 18) = 6.56, p<.001, Multivariate eta square = 0.59), which suggests that the linear combination of the four types of conjunctions (viz., additive, temporal, causal, and adversative) differs by group. The partial eta square value of 0.59 indicates that 59% of the variance in the combination of the four types of conjunctions may be readily attributed to instructional modality. To determine whether or not the differences in the use of the four types of conjunctions are statistically significant across groups, a follow-up Univariate Analysis (tests of between-subject effects**)** was conducted, as shown in Table 7.

Table 7. Follow-up univariate analysis (between-subject effects) on the use of the four types of conjunctions

Source of Variance	Type	Sum of Squares	df	Mean Square	f	Sig.	η_p^2
Pre-Additive (covariate)	Additive	0.17	1	0.17	0.61	0.45	0.03
	Temporal	0.01	1	0.01	0.01	0.91	0.00
	Causal	0.35	1	0.35	1.56	0.23	0.07
	Adversative	0.09	1	0.09	0.40	0.53	0.02
Pre-Temporal (covariate)	Additive	2.00	1	1.96	7.00	0.02	0.25
	Temporal	0.02	1	0.02	0.03	0.87	0.00
	Causal	0.00	1	0.00	0.01	0.91	0.00
	Adversative	0.15	1	0.15	1.68	0.42	0.03
Pre-Causal (covariate)	Additive	0.01	1	0.01	0.03	0.87	0.00
	Temporal	0.83	1	0.83	1.03	0.32	0.05
	Causal	0.00	1	0.00	0.00	0.96	0.00
	Adversative	0.28	1	0.28	1.25	0.28	0.06
Pre-Adversative (covariate)	Additive	0.46	1	0.46	1.63	0.22	0.07
	Temporal	0.15	1	0.15	0.18	0.67	0.01
	Causal	0.00	1	0.00	0.01	0.95	0.00
	Adversative	0.82	1	0.82	3.63	0.07	0.15
Instructional Modality	Additive	2.74	1	2.74	9.79	0.01	0.32
	Temporal	8.35	1	8.35	10.41	0.00	0.33
	Causal	2.15	1	2.15	9.60	0.01	0.31
	Adversative	4.69	1	4.69	20.74	0.00	0.50
Error	Additive	5.78	21	0.28			
	Temporal	16.86	21	0.80			
	Causal	4.71	21	0.22			
	Adversative	4.75	21	0.23			
Corrected Total	Additive	10.96	26				
	Temporal	26.07	26				
	Causal	7.41	26				
	Adversative	10.67	26				

Table 7 shows statistically significant differences in the use of additive, temporal, causal, and adversative conjunctions. As such, students in the experimental group scored significantly higher than their control group counterparts in the use of the four types of conjunctions. The partial eta squared values of the use of the four types of conjunctions were 0.32, 0.33, 0.31, and 0.50, which means that instructional modality explained 32%, 33%, 31%, and 50% of the variance in the use of additive, temporal, causal, and adversative conjunctions, respectively. Adjusted and unadjusted means in the use of the four types of conjunctions across the two groups were also calculated (before and after controlling the pre-test scores), as shown in Table 8.

Table 8: Adjusted and unadjusted group means and variability in the use of the four types of conjunctions (pre-test scores as covariate) per instructional modality

Type of Conjunctions	Group	Unadjusted Means		Adjusted Means	
		Mean	SD	Mean	SE
Additive	Control	2.69	0.63	2.70	0.15
	Experimental	3.36	0.50	3.35	0.14
Temporal	Control	2.62	0.96	2.60	0.25
	Experimental	3.71	0.73	3.73	0.24
Causal	Control	2.85	0.38	2.85	0.13
	Experimental	3.43	0.51	3.42	0.13
Adversative	Control	1.46	0.52	1.45	0.13
	Experimental	2.29	0.47	2.29	0.13

Table 8 shows persistent differences between the experimental and control groups' post-test performance after controlling for the pre-test scores. As such, mind mapping has improved the student's performance in the use of the four types of conjunctions, more so for temporal than causal, additive, and adversative, respectively.

Discussion

This research examined the effect of mind mapping on Jordanian EFL tenth-grade students' use of conjunctions. The findings revealed that the experimental group outperformed the control group in the use of the four types of conjunctions and overall. However, the participants were found to have more difficulty using adversative conjunctions than additive, causal, and temporal conjunctions, respectively. These findings are consistent with those of previous research (e.g., Hamed, 2014; Martínez, 2015; Ting, 2003) which reported that the number of errors in adversative and additive conjunctions outnumbered those in causal and temporal conjunctions.

The superior performance of the experimental group may be attributed to the meticulous content and design of the treatment through which the participants were made aware of the *meaning*, *types*, and *functions* of the four types of conjunctions in richly contextualized examples, which may have been unprecedented before the treatment. Even though conjunctions are addressed throughout the modules of this and previous textbooks and specific pedagogical guidelines for teaching them are provided in the Teacher's Book, the participants, albeit partially familiar with them, manifested considerable weakness in proper use and deployment of these conjunctions.

The researchers have observed students, at both school and tertiary levels, struggle with conjunctions in speech and writing alike. This struggle has caused students to fluctuate between improper use and complete avoidance of conjunctions. The treatment has not only provided the participants with clear instruction on the types and

functions of conjunctions but have also used mind mapping to facilitate learning them in a contextualized manner that explicated both meaning and connections. As the instructor/ first researcher progressed with her instruction of the types and functions of conjunctions, the participants have become more accustomed to conjunctions and the connections they create among other parts of speech. Most of the participants were also working with mind mapping for the first time, which instead of adding to the learning load, has sparked their interest and encouraged them to work harder on their tasks.

Several participants were at first skeptical and unsure of their ability to learn conjunctions through mind mapping, but, by the second of the eight weeks of the treatment, the participants were gaining momentum not only in learning grammar but also in drive and willingness to take responsibility for their own learning. The novelty of the treatment, which started off as an added challenge, turned into a conduit for competition as to who can come up with the most interesting ideas, illustrate them in one's own mind map, and use the proper conjunctions to convert them into comprehensible discourse.

The participants were afforded a conducive learning environment supported by the visual capabilities of mind mapping, as they were encouraged to explore and take risks to construct knowledge. Mind mapping has not only allowed the participants to use conjunctions appropriately, but also helped them to be more engaged and in control of their own learning. The more the participants engaged in the process, the keener they were to share their work with their teacher and fellow students, especially as they started to realize that they were actually learning and producing maps and discourse, which boosted their learning, confidence, and satisfaction.

Conclusion

The findings suggest that mind mapping instruction is a viable catalyst for the participants' proper use of conjunctions, which has been further corroborated by the researchers' observations of the participants' progress and enthusiasm over the course of the treatment. Proper use of conjunctions is necessary for both effective communications and student success in language learning, and mind mapping seems to lend itself readily as a conduit to better language teaching and learning.

Based on this and previous research findings that provided empirical evidence to the utility of mind mapping in language teaching and learning, the authors call for the integration of mind mapping in teaching not only grammar but also the various language skills. However, without allowing teachers training opportunities that would expose them to tried and tested pedagogical innovations and encourage them to seek further professional development, it would be a bit unreasonable to hold them accountable for not making use of a multitude of pedagogical tools of which mind mapping is one.

The findings of the current research are preliminary at best, and further research is needed before definitive conclusions can be drawn as to the effectiveness of mind mapping in grammar instruction. Given the novelty of mind mapping in the Jordanian EFL context, relatively little research has been conducted on its utility in language teaching. However, the current research establishes an understanding, albeit tentative, of the effectiveness of mind mapping as a tool for teaching/learning grammar in general and conjunctions in particular. Further research is recommended not only to further test mind mapping as a promising alternative but also to raise teacher awareness of the viability of alternative instructional strategies in the foreign language classroom.

The limitations of the current study constitute opportunities for future researchers to examine the effectiveness of mind mapping at a larger scale, using a larger sample and involving variables such as age, gender, subject matter, and curricular constraints. Further research is recommended not only to corroborate the current findings but also to expand their scope to encompass the potential utility of mind mapping in teaching and learning across disciplines.

Declaration of conflicting interest
The authors declare no potential conflicts of interest.

Funding acknowledgements
The research received no funding from any external entity.

References

Abdalwahid, A.S. (2012). *Cohesion Features in Argumentative Essays Written by Libyan Tertiary EFL Students (Arabic-speakers) at Omar Al-Mukhtar University in Libya.* Unpublished Master's Thesis. Griffith University, Queensland, Australia.

Aziz, A., & Yamat, H. (2016). The use of mind mapping technique in increasing students' vocabulary list. *Journal of Education and Social Sciences, 4*, 105-113.

Al Shamalat, R.Y.S., & Abdul Ghani, C.A. (2020). The effect of using conjunction as cohesive device on the undergraduates' quality of writing in argumentative essays of Jordanian EFL learners. *Arab World English Journal, Special Issue* (6). 290-301. DOI: https://dx.doi.org/10.24093/awej/call6.19.

Al-Jarf, R. (2011). Teaching spelling skills with a mind mapping software. *Asian EFL Journal, 53*, 4-16.

Altenberg, B., & Tapper, M. (1998). The use of adverbial connectors in advanced Swedish learners' written English. In S. Granger (Ed.), *Learner English on Computer* (pp. 80–93). Harlow, England: Addison Wesley Longman.

Amayreh, K.S.A., & Abdullah, A.T.H. (2021). The role of grammatical cohesion in the text quality among Jordanian EFL students in expository essays. *International Journal of Education, Psychology and Counselling, 6*(42), 299-306. DOI: https://doi.org/10.35631/IJEPC.642025.

Bataineh, R.F., & Alqatnani, A.K. (2017). The effect of a thinking maps-based instructional program on Jordanian EFL tenth-grade students' critical reading skills. *Asian EFL Journal, 101*(2), 31-61.

Bataineh, R.F., & Alqatnani, A.K. (2019). How effective is Thinking Maps® instruction in improving Jordanian EFL learners' creative reading skills? *TESOL Journal, 10*(1), e00360. DOI: https://doi.org/10.1002/tesj.360.

Biber, *D.,* Connor*, U., &* Upton, T.A. *(2007). Discourse* on the *Move*: *Using Corpus Analysis* to *Describe Discourse* Structure. Amsterdam: John Benjamins Publishing Company.

Biber, D., Johansson, S., Leech, G., Conrad, S. & Finegan, E. (1999). *Longman Grammar of Spoken and Written English.* Harlow, England: Longman.

Bolton, K., Nelson, G., & Hung, J. (2002). A corpus-based study of connectors in student writing: Research from the International Corpus of English in Hong Kong (ICE-HK). *International Journal of Corpus Linguistics, 7*(2), 165-182.

Borovková, P. (2014). *Application of Mind Maps in ELT with the Emphasis on Lexis in One-to-One Courses, Groups and Self-Teaching*. Unpublished Thesis. Charles University in Prague, Czech Republic.

Budd, J.W. (2004*).* Mind maps as classroom exercises. *Journal of Economic Education, 35*(1), 35-46.

Buzan, T., & Buzan, B. (1994). *The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential.* New York: Dutton.

Celce-Murcia, M., & Larsen-Freeman, D. (1999). *The Grammar Book: An ESL/EFL Teacher's Course.* Boston: Heinle and Heinle Publishers.

Chen, C. (2006). The use of connective adverbials in the academic papers of advanced Taiwanese EFL learners. *International Journal of Corpus Linguistics,1*(1), 113-130. DOI: https://doi.org/10.1075/ijcl.11.1.05che.

Chiang, S. (2003). The importance of cohesive conditions to perceptions of writing quality at the early stages of foreign language learning. *System, 31*(4), 471-484. DOI: https://doi.org/10.1016/j.system. 2003.02.002.

Connor, U. (1984). A study of cohesion and coherence in English as a second language students' writing. *Paper in Linguistics, 17*(3), 301-316. DOI: https://doi.org/10.1080/08351818409389208.

Cowan, R. (2008). *The Teacher's Grammar of English*. Cambridge: Cambridge University Press.

Crewe, W.J. (1990). The illogical of logic connectives. *ELT Journal, 44*(4), 316-325.

Darweesh, A.D., & Kadhim, S.A. (2016). Iraqi EFL learners' problems in using conjunctions as cohesive devices. *Journal of Education and Practice, 7*(11), 169-180.

Edwards, S., & Cooper, N. (2010). Mind mapping as a teaching resource. *The Clinical Teacher, 7*(4), 236-239.

Fraser, B. (1999). What are discourse markers? *Journal of Pragmatics, 31*(7), 931-952.

Granger, S., & Tyson, S. (1996). Connectors usage in the English essay writing of native and non-native EFL speakers of English. *World Englishes, 15*(1), 17-27. DOI: https://doi.org/10.1111/j.1467-971X.1996.tb00089.x.

Halliday, M.A.K., & Hasan, R. (1976). *Cohesion in English*. London: Longman.

Halliday, M.A.K., & Matthiessen, C.M.I.M. (2014). *Halliday's Introduction to Functional Grammar.* London: Routledge

Hamed, M. (2014). Conjunctions in argumentative writing of Libyan tertiary students. *English Language Teaching, 7*(3), 108-120. DOI: http://dx.doi.org/10.5539/elt.v7n3p108.

Heidari, A.A., & Karimi, L. (2014). The effect of mind mapping on vocabulary learning and retention. *International Journal of Educational Investigations, 2*(12), 54-72.

Howitt, C. (2009). 3D mind maps: Placing young children in the center of their own learning. *Teaching Science, 55*(2), 42-46.

Huddleston, R.D., & Pullum, G.K. (2002). *The Cambridge Grammar of the English Language*. New York: Cambridge University Press.

Kalajahi, S.A.R., & Abdullah, A.N. (2015). Discourse connectors and cohesion in writing. *Mediterranean Journal of Social Sciences, 6*(3/S2), 441-447. DOI: https://doi.org/10.5901/mjss.2015.v6n3s2p441.

Karahana, P. (2015). A diagnostic analysis of ELT students' use of connectives. *Procedia - Social and Behavioral Sciences, 199*, 325-333.

Kiany, G.R., & Khezri Nejad, M. (2001). On the relationship between English proficiency, writing ability, and the use of conjunctions in Iranian EFL learners' compositions. *ITL - International Journal of Applied Linguistics, 133*(1), 227-239. DOI: https://doi.org/10.1075/itl.133-134.03kia.

Klimova, B.F., & Hubackova, S. (2014). Grammatical cohesion in abstracts. Procedia - Social and Behavioral Sciences, 116, 664-668.

Martínez, A.C.L. (2015). Use of conjunctions in the compositions of secondary education students. *Procedia-Social and Behavioral Sciences, 212*, 42-46. DOI: https://doi.org/10.1016/j. sbspro.2015.11.296.

Meisuo, Z. (2000). Cohesive features in the expository writing of undergraduates in two Chinese universities. *RELC Journal, 31*(1), 61-95. DOI: https://doi.org/10.1177/003368820003100104.

Mudhhi, S.K., & Hussein, R.F. (2014). A corpus-based study of conjunctive adjuncts in the writings of native and non-native speakers of English. *English Linguistics Research, 3*(2), 18-32. DOI: https://doi.org/10.5430/elr.v3n2p18.

Naghmeh-Abbaspour, B., & Rastgoo, V**.** (2020). Analysis for finding the effect of mind mapping technique on the Iranian English as foreign language learning' writing skills. *Texto Livre: Linguagem e Tecnologia, 13*(2), 102-116. DOI: https://doi.org/10.35699/1983-3652.2020.24559.

Quirk, R., Greenbaum, S., Leech, G., & Svartvik, J. (1985). *A Comprehensive Grammar of the English Language.* London: Longman.

Sanchez Sanchez, S.L. (2019). *The Use of Discourse Markers in Argumentative Essays by Learners of Spanish as a Foreign Language*. Unpublished Master's Thesis. University of Alberta, Canada.

Sanders, T.J.M., & Noordman, L.G.M. (2000). The role of coherence relations and their linguistic markers in text processing. *Discourse Processes, 29*(1), 37-60. DOI: https://doi.org/10.1207/S15326950dp2901_3.

Schiffrin, D. (1987). *Discourse Markers*. Cambridge: Cambridge University Press.

Stephens, P., & Hermus, C. (2007). Making art connections with graphic organizers. *School Arts: The Art Education Magazine for Teachers,106*(8), 55.

Sturm, J.M., & Rankin Erickson, J.L. (2002). Effects of hand-drawn and computer-generated concept mapping on the expository writing of middle school students with learning disabilities. *Learning Disabilities Research & Practice*, *17*(2), 124-139. DOI: https://doi.org/10.1111/1540-5826.00039.

Ting, F. (2003). *An Investigation of Cohesive Errors in the Writing of PRC Tertiary EFL Students. Unpublished* Master's *Thesis*. National University of Singapore, Singapore.

Zamel, V. (1983). Teaching those missing links in writing. *ELT Journal,* 37(1), 22-29.