Assisting EFL Learners' Writing Complexity and Accuracy through Computer-Based Concept Mapping

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Abstract. This inspection sought the impacts of Computer-Concept Mapping on English learners' writing complexity and accuracy. To this end, a total of 30 EFL learners aged 14 to 16 years participated and were non-randomly classified into two study groups. A general English placement test was utilized for ensuring the students' homogeneity, a pretest as a writing proficiency test and a post-test of writing were conducted for measuring and comparing the writing of the two groups. ESL Composition Profile developed by Jacobs was used as a criterion for evaluating the students' accuracy and complexity. The experimental group received computer-based concept mapping instruction. One-way ANOVA test using SPSS statistical software 20 was run. The obtained data were analyzed using parametric tests of paired-samples and independent-samples

t-test and Pearson correlation was done for assessing the inter-rater reliability indices for the writing tests. The outcomes indicated that the computer concept-mapping method resulted in a significantly better writing.

1. Introduction

Writing can be utilized through learning and encouraging others (Graham, Gillespie, & McKeown, 2013). It includes high-level processing where thoughts and emotions are conveyed, organized, revised, and evaluated (Gzkk, 2016). Nowadays, writing is a vital communication channel that is used in daily interactions around the globe. It is a vital skill that the learners must fully complete over communicative competence. Within learning and teaching, writing has a leading role by which the learners can be evaluated and regarded as the most difficult among the other skills of the English language. Writing is a multifaceted procedure requiring learners' ability to successfully organize language parts logically (Plakans, 2008). Hence, for this skill, the learners should be more capable of making the most productive communication process.

Defranco-Tommarello, Yablokow, Bilen, & Gordon (2012) assert that while engaging in writing, it is worthy calling its general elements. Basic ideas related to writing include genre, style, structure correctness, vocabulary aspects, and spelling. Based on Rahman and Ambreen (2018), among other skills, writing is regarded as the most significant one from a pedagogical perspective. The learners are required to practice expository essay writing to write fluently and accurately in their university stage ahead. Kellogg (2008) indicated that the writing procedure involves factors such as language production, planning, and reviewing, and taking notes.

Listening and reading are also dependent upon writing (Saed & Al-Omari, 2014). Factors such as shortening, analysis, and critical views are also stimulated by writing tasks by focusing on the constant reflection in goal language (Maghsoudi & Harrison, 2013).

Among the contentious matters viewing the complexity and accuracy is the trade-off impact. Various planning research (on-line planning and pre-task scheme) have designated various proposals in this concern. For instance, Foster and Skehan (1996) suggested that the trade-off is between complexity and accuracy.

The ability to speak like a native is a general objective sought by numerous language learners. Skehan (1998) suggested that this general objective copes with enhancing the main dimensions or areas of performance, such as complexity and accuracy. Hence, if a learner attempts to create a language more precisely, he/she seeks to have mastery over the linguistic elements already obtained. Therefore, it seems logical to represent that inspiring trainees to create more accurate language uses of controlled not, automatic procedures.

Planning time attracted a considerable deal of attention in numerous investigations in producing L1 and L2 (Wigglesworth, 1995). These studies are mainly rooted in L1 research aimed to develop the mental models for oral construction as one of their factors. Based on Novak (2010), Computer Concept-Mapping is an approach for probing learners' comprehension of associations among the concepts. In reality, a computer concept map is a visual organizer that can enrich learners' understanding of a new concept. Using a graphic organizer, students think about the concept in several ways such as sub-branches. (see one example of computer concept map in Figure 1).

Figure 1. An example of a concept map

In Tajeddin & Tabatabaei's (2016) words, Computer Based Mapping can be utilized as a mental instrument in supporting learners to set up

the learnings, and to improve self-awareness via thinking reflectively. In Asoksoy (2019) words, computer concept mapping is an important tool that is used in the field of education to help students in understanding the basic concepts and the relationships between them. This research is significant in the sense that in a rapidly changing world of second language learning, it is essential to educate students who think accurately, visually, critically and analytically. There is a common denominator between visuals and thought and between mind and the pictures since they interact with each other to provide an opportunity for humans to make correct decisions and to have rational thoughts.

After all, this study was attempted to assess the impacts of computerized concept-mapping learning strategy on writing the complexity and accuracy in Iranian intermediate EFL learners.

1.1. Purpose and rationale of the study

In this study, a pre-test and post-test design with a control group was used. Ideally, this report sought to fill the gap related to finding a conducive way for improving writing accuracy and complexity. In simple terms, it focused on the impact of computer concept-mapping upon complexity and accuracy writing of Iranian intermediate EFL learners. As such, the following research question raised:

RQ: Does computer-based concept mapping have significant effects on writing complexity and accuracy of Iranian Intermediate EFL Learners? The study null hypothesis was as follow:

RH: Computer-based concept mapping has no significant effects on writing complexity and accuracy of Iranian Intermediate EFL Learners.

2. Literature Review

Writing is a complicated and mental process in which several social and cognitive factors are engaged (MacArthur & Graham, 2016). It is vital to academic achievements since it is the most ordinary assessment measure for academics to evaluate their students, and students' weak writing ability may put their academic success considerably in danger. (Tan, 2011). Based on Javadi Safa (2018), the mastery of writing and its lead-

ing position in showing learners' learning degree is undeniable in second language teaching and research. Writing is viewed as a challenging task, even for native speakers though it is much more threatening for non-natives, especially EFL learners. In 2001, Chenoweth and Hayes conducted research on 13 learners utilizing the concept maps. By measuring the complexity, and accuracy as the number of words written for each minute, they realized that learners with more experience in the language possessed a higher fluency, accuracy and complexity score than those without it. A research carried out by Ahangari and Behzady (2011) dealt with computer-mediated concept mapping on the writing skill of EFL Iranian learners. The elements of writing studied were: content, words, sequence, systems, and language application. The outcomes showed a highlighted impact of concept mapping on writing skills in general and in particular. One other investigation on Iranian students at university was conducted by Fahim and Rahimi (2011) to see the effects of concept mapping on writing skills. The obtained findings manifested that learners in the experimental group performed better than those of the control group. In an experiment conducted by Feizollahi and Zarei (2018), the effect of computer concept mapping was assessed on writing in grammatical accuracy and writing anxiety. The concept mapping group obtained the highest mean followed by the brainstorming group. In one research carried out by Jafari and Zarei (2015) the effect of concept mapping strategy on Iranian EFL learners' argumentative essay writing skill was investigated. This work, employing an experimental methodology, was done among 60 adult EFL learners from a language institute in Isfahan, Iran. Based on the obtained findings, it was found out that concept mapping strategy instruction was much influential in promoting learners' argumentative essay writing.

They add that the employment of concept maps within pedagogy settings assists the instructors to present a clear picture of topics and their relations for learners. Misunderstanding the essential ideas becomes almost unlikely in this regard. The concept maps assist in visualizing the key concepts and summarize the relations. According to Plotnick (2018), concept mapping can be easily in access, and the potential benefits increase with computer employment. There are many benefits of

computer-based concept mapping as compared to paper-based maps, such as the capability of automatically add concept boxes, correct erroneous placements without redrawing, recording sounds, add video, and connection concept maps. Chandler asked two Asian groups of learners to write an autobiographical assignment with 5 chapters. The investigator marked the student-made errors in the experimental group at the end of each chapter, and the learners corrected the errors before beginning the next chapter. The control group only corrected their errors at the end of the experiment. Complexity and accuracy were measured based on the time length used to create each chapter. The outcomes revealed that when correcting the errors, by viewing computer concept mapping by the students during the experiment, their accuracy significantly increased. It indicated that the error correction by the students performed throughout the writing exercise led to the incremented accuracy without reduced fluency.

Chandler (2003) also investigated the impressions of error correction types on the writings of the students by assessing the alteration in investigated accuracy and complexity of their writings. Findings revealed that correction of underlining with a description of the error type culminated in fewer errors in the students' succeeding written work over the experiment, with complete enhancement in both accuracy and complexity.

According to Alosaimi (2016), the map is thorough since it begins in a central question that starts a root proposition. The map then formed by engaging in the knowledge base of learners, adding new plans and connecting them to previously created ones, and explaining the retrieved knowledge within a network like a mode. Also, concept maps have their impact on science training. Watson, Pelkey, Noyes, and Rodger (2014) assert that concept maps contribute to instruments in evaluating learners' prior knowledge, misconceptions, and sustainability of their meaningful learning. Wang, Wu, Kirschner, and Specto (2018) states that concept mapping is the most commonly employed strategy in instructing concepts and acknowledging and removing the misconceptions of education. The procedure of making a concept map can be tiresome and boring for students. Wu, Hwang, Milrad, Ke, and Huang (2012) ana-

lyzed the effect of giving feedback through computer-based mapping on the learning performance of nursing learners. Hwang, Wu, and Ke (2011) examined the computer-based concept mapping in one natural sciences course in a primary school, and found out that it is contributive to improving learners' learning achievement.

Chu, Hwang, and Liang (2014) proposed a collaborative computer-based concept mapping approach to assist with interpreting and organizing the data collected in web-based information searching activities. The students' attitude, self-efficacy, and success remarkably improved through this approach. Shams Uddin, Minu, Shamsiyya, and Adamu (2017) analyzed the impression of the computer-assisted concept mapping teaching upon learner performance in a chemistry class. As a result of this, it became evident that this strategy wasinfluential since the performance of both genders enhanced remarkably. In one experimental research carried out by Nobahar, Nemat Tabrizi and Shaghaghi (2013) on the impact of CBCM on writing, trainees in the experimental group treated by concept map construction after writing each task, and organized their pre-writing activities such as doing exercises, and reflective practices based on constructed maps. A posttest of writing and an efficacy questionnaire administered to all the participants, and the pair sample t-test, and independent sample t-test were used to answer the study questions. The obtained results indicated that concept mapping had a significant effect on self-efficacy and expository writing accuracy.

3. Method

3.1. Participants

To select a representative sample of subjects, two naturally occurring girl-classroom of an institute in Ilam, Iran, were chosen as the study participants. They compromised 30 intermediate English learners, each fifteen students were assigned in one classroom as the experimental and control groups within the age range of 14 to 16 years' old who were pursuing their English studies for approximately six semesters including 16 sessions each of which lasted 60 minutes. All subjects' home language was Persian. Truly, the selection of these participants in this quasi-experimental study was due to the institute's willingness to cooperate

in the study. The conduction of the study took place in the 2019-2020 academic year of Iran.

3.2. Instruments

The present research used tools to meet the required objectives of the study: Quick Placement Test (QPT), writing proficiency pretest, and posttests, and ESL Composition Profile based on compositions of L2 writers developed by Jacobs (1981) used as a criterion for evaluating the students' writing accuracy and complexity.

3.3. Procedure for data collection

To accomplish the objective of the study, the project pursued following procedures: Based on data analysis using SPSS, the participants homogenized in writing skills, and general English proficiency an intermediate level using Quick Placement Test (QPT). Based on the results, learners were put into two groups of experimental and control through. This quasi-experimental study, with pretest-treatment-posttest design, was carried out with intermediate EFL learners. Only, it followed a quasi-experimental design adopting a quantitative approach to investigate the goal of the study. A one-way analysis of variance (ANOVA) conducted to statistically reveal the effectiveness of computer concept-mapping on learners' accuracy and complexity. This study was conducted in 2020 in an English language institute in Ilam, Iran. Each group received the same items for their pretest, and posttest. After being given a QPT, both groups took a pretest in writing without concept mapping. A sample test conducted for the participant selection process. The test covered reading, writing, and vocabulary. As this research was focused on the writing ability of the learners, the speaking section of the PET was not administered. Clearly speaking, the test contained 50 items. For the assessment, the researchers used the PET general mark scheme, which is used as a rubric for a summative score. The criteria included language range, variety, complexity message communication, grammatical structure, vocabulary, spelling, punctuation, content points, length, and target reader. After this stage, the two groups began the treatment. The treatment for both groups was run for eight weeks (16 sessions, two sessions per week). The experimental group received instruction for writ-

ing using a computer concept mapping strategy, which included explanations and practices on writing with various topics and numerous tasks. In contrast, the control group used the conventional technique of learning writing, which encompassed similar tasks as the experimental group. Based on Harini, Nilakusmawati, and Astawa (2017), a concept map is a visual thinking instrument that applies to all mental functions, mainly to memory, learning, creativity. The analysis concept mapping is a structured process, concentrated on a topic or constructed of interest, including input from one or more participants, that produces an interpretable pictorial view of their ideas and concepts and how these are interrelated. Concept mapping is an essential tool that is used in the field of education to help students in recognizing the basic concepts and the relationships between them. However, the students went ahead step by step in writing a text; from short paragraphs to long essays of five precise paragraphs. Students practiced to write about simple topics and tried tasks like writing six to eight sentences about a topic and then attached them and turn it into a united text.

When the participants had the area and a persistent problem or question in this area, the next step was to recognize the critical ideas applied to this domain. The more concepts that a participant can provide, the better she can construct her map and her writing. Usually, 15 to 25 concepts are sound. The students had to list the concepts. Then they are supposed to make a hierarchical list from it. This list relied upon the most inclusive and general concept for this particular situation or problem at the top of the list and the least general and the most specific concept at the bottom of the list. This step helped to start the map construction process. Students moved these concepts from the list into the concept map and defined where its consistency. Some concepts remained in the list since by completing the map existing no useful link for these with other perceptions in the map, the student could not find a right place for them.

In the first step, the teacher wanted the learners to write twenty words or phrases related to making paper out of wood. He asked them to prepare the words in the order of concepts and steps that occur from a field or a jungle to the paper factory or mill. The students prepared vari-

ous words for the process. Then, they were supposed to define and determine what connections or cross-links are between them. After they wrote twenty other words that would connect the concepts, the teacher asked them to write the words on a paper and write links between them. As the next stage, the students needed to prepare the appropriate concept-map. The teacher requested them to connect the step-by-step concepts and link them with the appropriate cross-links. Based on the provided concept maps, the students were then required to prepare their writings. The teacher asked them to write a sentence for each step. Each sentence consisted of two concepts related to each other by a link.

The students wrote sentences one after another. As the final step, the teacher requested them to prepare their writing essays in terms of the sentences. The teacher asked to revise these sentences into the form of a well-written text. To edit and revise the text, they had to add adverbs, connecting words, punctuation marks, and alike to make the writing acceptable. The process mentioned earlier was what consisted of the most part of the treatment process of the experimental group. The students practiced these steps every session and tried to make their writings better and better.

3.1 Measurement

Complexity and accuracy concepts have been supposed in many studies as the critical criteria to show the exactness and the complicatedness of written and oral production of the learners. Hence, the data coded for accuracy and complexity constructs. Since the contributors were intermediate, the coding shortened. Therefore, for complexity that can be divided into the quantity of embedding, length, and frequency of definitely sophisticated structures, we took into account only the definition quantitative aspect, which is the length of the T-unit exclusive of the qualitative aspects. For accuracy, error-free T-units per total number of T-units' ratios calculated. Coding the data was performed as:

- Complexity: Mean length of T-units
- Accuracy: Error free T-units per overall T-units' ratio

Selecting the T-unit is motivated empirically, including one main clause, any subordinate clauses, and the attached non-clausal units or sentence

fragments. It is simply computed; therefore, it permits high inter-rater reliability. No punctuation problems also included since sentence boundaries are vital. Finally, it captures the linguistic maturity well by charting precise increments in complexity and length.

The written texts of the participants delivered to two coders of the author as the first coder, and a specialist instructor with six years of teaching experience as the second coder who has presented the coding information. The English texts were coded by the author, and the same texts were coded by the French teacher. Nevertheless, primarily, the two coders coded ten same texts so that inter-rater reliability reached 0.92. The coders then discussed the inconsistencies and obtained an agreement of 100%. Ultimately, the quantitative data were drawn in Microsoft Excel charts and converted them into line graphs for visualization of the dynamic and complex development within the second language writings of the participants.

3.2 Measurement of accuracy

As Edwards and Willis (2005) claim, accuracy is using the goal language based on norms. In this inquiry, it was determined as 1. Clauses with no error, which is the ratio of error-free clauses to the general used clauses. 2. Accurately used verbs, which is the percentage of correctly utilized verbs intense, modality, and subject-verb consistency within each written statement. For accuracy, error-free T-units per total number of T-units' ratio were taken into account to be calculated to communicate in real-time. In reality, accuracy was determined by calculating of the number of clauses without errors and the number of errors for one-hundred words. The errors in morphology, lexical choice, and syntax were calculated. The same measures were utilized in some former studies (Mehnert, 1998 and Tavares, 2008).

3.3 Measurement of complexity

Ellis (2009) stated complexity encompassing both grammatical and lexical complexities. Structural complexity was recognized by estimating the ratio of clauses per T-units produced by the students (Foster & Skehan, 1996; Gillian Wigglesworth & Storch, 2009; Yuan & Ellis, 2003). Lexical complexity has functioned as the ratio of MSTTR. After Yuan & Ellis

(2003), first, the narrative productions were divided into sections with nearly 40 words. Moreover, the type-token ratio of every section was calculated by dividing the total number of different words by the overall number of words in the segments. The MSTTR was then calculated by adding of the mean score of the sections and dividing the total by the total segments in the narrative text for every learner. Foster and Skehan (1996) indicated that global units represented a more realistic accuracy. Therefore, the writing statements' accuracy calculated by estimating the number of error-free T-units divided by the total T-units (EFT/T) (Gillian Wigglesworth & Storch, 2009). A further measure of accurateness was the EFC/C (proportion of error-free clauses of all clauses). The two proportions stated by percentages (Alavi & Ahmadi, 2017; Gillian Wigglesworth & Storch, 2009; Yuan & Ellis, 2003). Spelling errors endured when preserving the word meanings. When counting, they were not considered in case repeated on the later incidences. Errors of punctuation, prepositions, capitalization, and lexical choice errors were not calculated unless they hindered comprehension (ibid). Complexity was defined by Ellis and Barkhuizen (2005) as the capability for using more advanced language. Ellis and Barkhuizen (2005) stated that this elaborated language could be considered in two different senses: first, as the cutting edge of developing the language of the learners, and hence, the not fully automatic part; and second, as the readiness of the learner to utilize various linguistic structures. They stated tha t complexity is a learner's eagerness function to examine novel linguistic knowledge in oral performance.

For complexity construction, which can be divided into length, the quantity of embedding, and repetition of definitely complicated structures like non-finite clauses, only the quantitative feature of the definition that is the length of the T-unit, excluding the qualitative features such as quantity of embedding and frequency of definitely complicated structures were considered. Productions complexity was assessed by determining the number of clauses per AS-unit and the number of words per AS-unit. The AS-unit was proposed by Foster, Tonkyn, and Wigglesworth (2000) as a standard instrument for analyzing the spoken data in foreign and second language success research. It was examined ,which

is determined as one independent clause and the dependent attached clauses (Richard, Platt, & Platt, 1992) to cope with the elliptical nature and fragmentary of oral discourse. Foster et al. considered it as a single utterance encircling a sub-clausal unit or an independent clause along with any associated subordinate clause(s). The current assessment (Ahmadian, 2011; Norris & Ortega, 2009; Tavakoli & Foster, 2011; Vercellotti, 2012) indicated the applicability and accessibility of the AS-unit to experimental spoken data. Moreover, Ellis & Barkhuizen (2005) utilized it in segmenting monologue oral narratives created by university-level L2 learners.

4. Findings and Discussion

This report was formed with the purpose of considering the impacts of using computer concept-mapping on the students' writing accuracy and complexity achievement at an institution, Ilam, Iran. The arisen results of the research revealed that computer concept-maps have a positive significant effect on students' accuracy and complexity writing achievement. Before reporting the results of testing the hypothesis, some useful descriptive information is presented in this section. Both the control and experimental groups took a pretest in writing. After completing the treatment, in the last session, a posttest that was the same for both groups was administrated in to determine the students' writing accuracy, complexity. The test type and time were precisely the same for the two groups.

Before the start of the treatment, a pretest to determine the initial state of writing skill of the participants was administered which is then supposed to be compared with the post-test results of determining the level of improvement in writing skill. Both the CG and EG took the same pretest. The test includes two sections.

The first section required the students to read a passage since the focus was on writing. Then they had to write an essay related to the passage and according to the instructions provided. The essay was supposed to be between 250 to 300 words. The passage was a 10-line text about different aspects of A Perfect Universe.

The remaining part of the pretest included a topic given to the participants upon which learners were supposed to write an essay of 300 words about. Only one topic was given to the students; instead, several topics to choose from. If the writings were of different topics, then the scoring, rating, and evaluating of the 50 writings and comparing them would be of less accurate. The topic given for this part was "What is the first thing people notice about you? And why do you think it is?". The participants prepared their written text within 60 minutes.

After determining scores from both parts of the pretest, the scores were added up and the final scores for all the participants' pretest became clear. Table 1 represents the data for the pretest. The data were analyzed using parametric tests of paired-samples and independent-samples t-test and Pearson correlation.

Table 1: Pretest Final Results

Pretest Total		Results Experimental Group	Results Control Group
Participants Number		15	15
Test Total score		100	100
Mean	Mean	68	67
	Std. Deviation	4.25	5.47
Most Extreme	Positive	94	90
Differences	Negative	44	46

By ending the strategy, the participants took a post-test of writing. This post-test was of determining the external (after-treatment) state of writing skill of the participants, which was compared with the pretest results to determine the level of improvement in writing skill. Both the control and experimental groups took the same posttest. Same as pretest, the posttest consisted of two parts. The Passage-Based section of the posttest, here, was a 10-line text with the topic, "What would you do if time travel was possible? "Besides, the Topic-Based section had one topic, "Write a scary story." Table 2 shows the results.

Table 2: Topic-Based Writing Post-Test results

Topic-Based Writing Test		Results EG	Results CG
Participants Number		15	15
Test Total score		50	50
Mean	Mean	43	35
	Std. Deviation	3.35	6.89
Most Extreme	Positive	48	45
Differences	Negative	27	24

A comparison between the pre- and post-tests shows that there have been significant changes in EG. Compared to the pretest results, the obtained statistical results of post-test revealed that there were differences between the control and the experiment groups proving that the computer concept-mapping has been effective, and in fact the null hypothesis was rejected. The mean score for experimental group was 33 in the pretest and is 43 in the posttest, which is a 10-score increase in the mean score. Whereas the mean for control group was 31 in the pretest and was 35 in the post-test, which shows a small 4-score increase. Thus, the Computer Concept-mapping group showed significant improvement in the Topic-Based Writing test.

However, in designing of institutions and school books related to English education in Iran, matters of technology-based instruction trends and their significance and impact on the learning should be seriously brought into consideration and maybe it is due to reasons that there are still not well-done and sufficient studies in this area. This research allows one to see the potential, relation and the importance of using the latest and one of the best tech-based and well-prepared methods of language instruction on using and skill in language learning.

By the same token, the educational programmers, and instructors must be more careful perceptive about this education procedure type. Ignoring the latest techniques and methods and technologies in education can have unwelcome outcomes on the learning and the feelings of that student. And, this is while the teacher can make the class activities much more beneficial and pleasant to the students.

Teenage students, with their unique interest and enthusiasm and also knowledge about the new techs will enjoy the new-methods and tech-based classes such as a writing class with computer concept-mapping. They look at everything with special care and alert (Obikwelu, 2017). Young students are so alert and sensitive toward any new thing, subject, method, or lesson. This feature of the young students should come into use within the educational environments. This idea is enriched and proved even more when we remember the more a student with technological intelligence, the more learning skills he/she will have Trochim and McLinden (2017).

The data analysis from the tests indicates that the application of tech and planning activities will be influential and will be viewed positively by the students in order to develop the language learning process among Iranian intermediate EFL students.

The sole impacts of the computer-concept mapping of writing were to activate the previous personal knowledge and introduce its content to them. The concept map of a student preparing his/her writing plan is made after constructing and brainstorming a categorization map. Then, this map is made and prolonged by additional information obtained from additional self-knowledge elicitation and reading the textual sources and can provide the writing plan so that learners can produce lengthy writings with unlimited words.

5.Conclusion

The building stone of the study was one basic question that sought the effects of concept mapping learning strategy, as the independent variable, on the experimental group students' writing accuracy and complexity. Given the tremendous global expansion of information communication technology, the use of computers in education is becoming indispensable. This inquiry was developed based on using computer concept mapping on learners' writing accuracy and complexity. According to Tarbiat (2012), concept maps help visualizing the main thoughts and summarizing the concepts and their relations. Based on the research results, the research questions could be answered. With regards to the

research raised question, that is., "Does computer-based concept mapping have any significant effect on writing complexity and accuracy of Iranian Intermediate English Learners"? it can be inferred from the data analyses and statistical results of the calculations, including the mean differences in experimental and control group and also the differences in High and Low extreme scores, that there existed a meaningful relationship between the EFL learners' complexity and accuracy in writing skill and the concept-mapping strategy.

Overall, according to what has been discussed and understood relevant to this study, the concept-mapping strategy in teaching English writing accuracy and complexity is significantly effective in enhancing students' writing achievements.

The primary results and outcomes of the investigation were discussed. some pedagogical implications of the findings for pedagogy are drawn, which are as follows:

First, a meaningful improvement from the application of planned and computer concept-map instruction of writing lends strong support to the effectiveness and importance of regarding such aspects of teaching methodology for writing instruction. This being the case, in order to improve language learning and learning achievements in general, and essay writing in specific, it is highly recommended that teachers provide the students with various encouragements and use very well-thought delicate techniques to improve and awaken the students' different kinds of intelligence and creativity to use technology in education. It is worth noting that various techniques based on technological theories can be influential in providing enough motivation and get the best benefit in achieving language knowledge for intermediate EFL learners.

Second, these outcomes also remind the teachers of the significance of using the latest and newest options and other tools of education for the learners that should be treated seriously during the process of teaching English. Consequently, teaching and teaching-training programmers can make use of these findings and can make necessary shifts in materials, equipment, and course books to somehow focus on the best methods of education. Third, it is presumed the results of this paper can be of some help in all aspects of language learning, from vocabulary and grammar

to listening and reading skills.

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