Integrating Computer-aided Argument Mapping into EFL Learners' Argumentative Writing: Evidence from Saudi Arabia

Nuha Abdullah Alsmari

Department of English, College of Science and Humanities
Prince Sattam bin Abdulaziz University
Alkharj, Saudi Arabia

Abstract—This paper aims to examine the effects of Computer-Aided Argument Mapping (CAAM) on Saudi EFL learners' argumentative writing performance across the development of writing content and coherence and their self-regulated learning skills. A total of 40 second-year university EFL learners were purposively selected as a one-group of pre- and post-test design. Using a mixed-method approach, three research tools were utilized: pre- and post-writing tests, a Self-regulated Learning Scale (SRLS), and semi-structured interviews. Quantitative results demonstrated that EFL learners' argumentative writing performance made noteworthy gains, as manifested by the statistically significant differences between their pre- and post-test scores. Significant positive correlations were also found between the EFL learners' overall argumentative writing performance and the SRL factor subscales, indicating an increase in the self-regulation mechanism relative to planning, self-monitoring, evaluation, effort, and self-efficacy. Qualitative results indicate that the participants have positively embraced the integration of CAAM to improve their writing skills and self-regulation processes. Recommendations for implementing digital mapping to revolutionize EFL learning classrooms in this digital era are provided.

Keywords—Argumentative writing; argument mapping; computer-aided argument mapping; self-regulated learning; Saudi EFL learners

I. INTRODUCTION

There is a consensus that developing effective writing competency is a challenging task, especially among EFL learners [1]. As English is used as the medium of instruction in various academic fields at higher education institutions in Saudi Arabia and numerous other EFL countries, writing has become a necessary prerequisite for foreign language learners to be successful in other fields that demand a written representation of knowledge [2]. In addition, international students are not permitted to enroll in various academic programs unless they fulfill certain requirements; one is attaining a specific level on a standardized English test (e.g., TOEFL, or IELTS). Some academic institutions impose an extra requirement that entails attaining a minimum score on the writing section, thus increasing the need to master advanced L2 writing skills to achieve success in higher education [11].

The complexity of L2 writing is inherent in the development of effective writing ability that comprises knowledge of the content and task, lexical complexity, cohesion, coherence, and fluency of ideas [7], [8]. Writing genres (such as argumentative writing and expository writing) also contribute to the inherent complexity involved in writing compositions due to the special lexicon and syntactical features as well as the structure [8]. These tasks overburden learners' cognitive loads during the learning process, creating a mental block against acquiring new information [15]. One way to support learners in managing their cognitive learning processes is to adopt certain problem-solving solutions, such as generating maps and diagrams [3], [7], [14].

Mapping or diagramming serves as a learning tool that helps facilitate comprehension when there is an abundance of data to process within a short amount of time. It encourages learners to engage in the process of developing ideas and information, as it activates the schemata necessary to organize ideas and content for writing. Learners will gain a full grasp of their thoughts and produce more developed and coherent outputs, thus stimulating their critical thinking, problem-solving [12], and self-regulation abilities [9]. As a result, they will optimize their learning performance and mental capacity. Writing is a complex skill that requires a strategic approach to accelerate EFL learners' control, confidence, and subsequent proficiency [5], [18]. Presumably, if learners are taught to map their ideas, they will be able to plan, monitor, and evaluate their progress [12].

This study was intended to examine the effects of computer-aided argument mapping (CAAM) on Saudi EFL learners' performance in argumentative writing, as well as their self-regulated learning skills.

II. LITERATURE REVIEW

A. Argument Mapping

Argument maps (AMs) are visual aids that facilitate the comprehension and evaluation of arguments [3]. They are organized in text-based, hierarchical representations in which propositions are displayed in color-coded boxes and linked with arrows to indicate the relationships among them [4], [17]. AMs visualize reasoning in a clear and concise fashion by diagramming the inferential construction of an argument [3]. It is a pedagogical tool that increases the opportunity for

comprehensive learning. Recent studies [3], [7], [12] have revealed the instructive benefits of AMs. For example, AMs have been adopted in language teaching methods in general [14], and in EFL writing in particular [7], [12]. According to [7], a well-constructed argument diagram enhances critical thinking skills and writing performance among EFL learners. AM stimulates EFL learners' schemata, which are essential for the development of argumentative writing.

The author [4] evaluated the effects of promoting critical thinking through AM compared to a strategy of generating themes from texts and sorting them hierarchically. Although AM training had no significant impact on students' critical thinking skills, the experimental group exceeded the no-instruction control groups on the evaluation and inductive reasoning tests. That is, after the intervention, EFL learners were able to compose more cohesive and developed writing. The study of [10] has further supported the use of AM for developing second-language learners' composition writing. The author [3] contends that "...the process of making an argument map is advantageous since it encourages students to construct and/or reconstruct their arguments with a level of clarity and thoroughness" (p. 115). Fig. 1 presents the main conventions used in AM.

Fig. 1 illustrates the major themes in an argument map. The primary premise is situated at the top. The arguments for the primary premise are represented by green boxes and connected by arrows to the primary premise. The primary premise in the figure has two arguments, 1A and 1B. Individual premises are placed inside white boxes shaded with green. Each premise is presented separately, with its own justification. Linked premises are grouped to support the conclusion. Additionally, claims with objections are marked in red. Writers designate reasons and objections using words such as *"supports"* and *"opposes,"* respectively [3].

B. Computer-Aided Argument Mapping (CAAM)

The advent of computer software has accelerated the task of creating user-friendly AMs. While AM can be taught effectively using pen and paper [7], CAAM can facilitate and speed up the mapping process efficiently, as it employs a number of programs specifically developed to enable users to quickly display arguments and reasons using cells and line diagrams [3], [17]. CAAM is an instructional system intended to promote learners' critical thinking by visually representing reasoning for any subject area [9] as well as offering a convenient workspace and a dashboard for building AMs [17]. Users can construct maps by simply inserting text into cells and then moving them to any desired location on the map using various levels of reasoning boxes. These cells can be modified, eliminated, or transferred to a different location. Although CAAM programs do not analyze or check the soundness of arguments, they help learners analyze and evaluate their arguments in a practical, visual, and professional way. According to [3], CAAM encourages students to compose arguments openly and thoroughly.
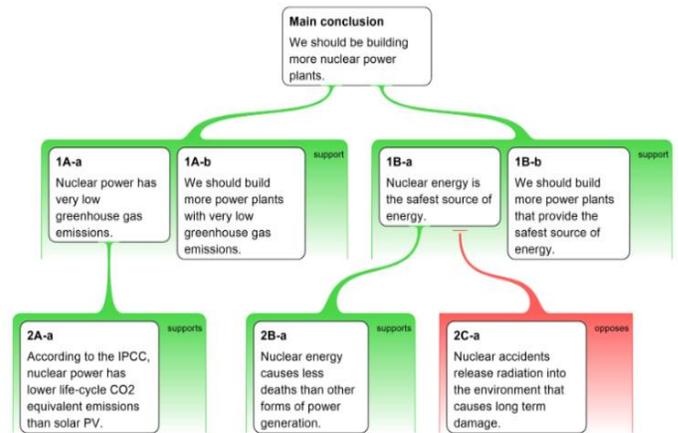

Fig. 1. Argument Mapping Demonstrating the Main Conventions.

CAAM serves as a platform that helps learners form conceptualizations by diagramming and revising reasoning clearly so that knowledge gaps and errors can be identified and reasoning can be reformulated [9], providing a better performance at argument analysis and evaluation. CAAM allows learners to access their previous essays in another panel while simultaneously accomplishing their AM in the panel, as well as helping them to be considerate of cohesion and coherence throughout the mapping process (see Fig. 2). In addition, CAAM offers learners the means for extensive problem-solving and critical thinking practice through activities with varying levels of complexity, which helps them develop these skills [6]. It enables learners to experiment practically with multiple logical structures and move the parts of an argument freely, allowing them to become more aware of the structure of their arguments, which is a prerequisite to critical thinking and self-regulation. Fig. 2 displays an excerpt of a learner's AM conducted via CAAM.

Numerous studies have demonstrated empirical evidence for the efficacy of CAAM in developing students' writing skills [3], [9], [14] and critical thinking skills [3], [12], [17]. The author [17] conducted a study using one-subject CAAM-based interventions during a three-month course and reported that courses teaching AM increased critical thinking performance. The authors [9] examined the effects of implementing CAAM to improve EFL students' self-regulated writing. After completing the self-regulation pretest in writing skills, the respondents were randomly divided into two experimental groups and a control group. The experimental groups who carried out their writing composition via CAAM software during the course of the training outperformed the control group and enhanced the self-regulation of their writing.
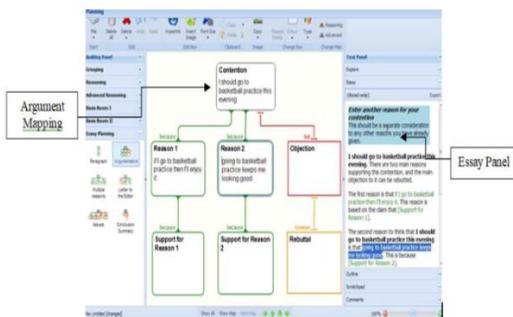
Fig. 2. Example of a Student's Argument Map (AM) Produced in CAAM.

C. Self-Regulated Learning

A number of empirical studies [16], [13], [14], [19] have viewed SRL as a valuable new construct in the field of education. For example, the authors [16] described SRL as an active process in which learners are able to self-regulate by setting goals for their learning, monitor their learning processes, control and regulate their own thinking, and evaluate and reflect on their learning. The author's [19] view asserts that self-regulated learners actively adopt motivational, behavioral, and metacognitive approaches and dynamically engage in their learning processes.

Researchers have further revealed that learner-related factors, such as learning styles, personality traits, self-regulation, beliefs, and motivation, can substantially influence language learning progress [8], [14]. The author [16] argued that learners who self-regulate need to strategically consider how to approach a task, monitor their own progress while performing the task, assess the process and output after completing the task, review what they have accomplished and failed to accomplish, and further develop more strategies to use, which provide them more opportunities to execute tasks the next time. However, apart from understanding what areas to optimize and how to optimize them, self-regulated learners need to be stimulated to progress [19]. The authors [9] claimed that self-regulatory capacity can interact with cognitive factors since, as underscored by [14], learners who self-regulate can set goals, monitor, self-reflect, and assess their progress. The procedures involved in argument mapping are structured by planning and monitoring throughout the task, which helps raise learners' self-reflection and self-evaluation. With reflection and critical thinking, learners can maximize their self-regulated learning potential because they have fully acknowledged their role in the task.

A number of studies have been conducted that relate to teaching and learning EFL writing, such as critical writing using digital diagramming [7], descriptive writing achievement via CAAM [8], and teaching reasoning via CAAM [3]. However, to the researcher's knowledge, no study has focused on the effectiveness of CAAM in developing EFL learners' performance in argumentative writing and promoting SRLSs, particularly in the Saudi EFL context. The study is significant because it contributes pertinent information to higher education institutions in EFL contexts. It is hoped that the findings will help EFL teachers gain better knowledge of language learning from the learners' perspectives and provide additional insights into the advantages of teaching English

writing with CAAM, thereby aiding EFL learners' argumentative writing skills and their ability to self-regulate their learning. Accordingly, the current study sought to answer the following research questions:

1) How does the CAAM intervention affect Saudi EFL learners' argumentative writing performance and self-regulated learning skills?

2) Is there a significant correlation between Saudi EFL learners' performance in argumentative writing composition and their ability to self-regulate their learning after the CAAM intervention?

3) How do Saudi EFL learners perceive the CAAM intervention?

III. METHODOLOGY

A. Research Design and Participants

The study employed a mixed-methods approach on a single group of pre- and post-test designs. The quantitative measures were used to explore the extent to which the integration of CAAM affected EFL learners' argumentative writing skills relative to the development of writing content and coherence, and self-regulated learning variables. The qualitative measures served to reveal how respondents perceived the experiment and the advantages relative to their argumentative writing tasks. The intervention was conducted over 11 weeks. The study sample consisted of 40 English majors at Prince Sattam bin Abdulaziz University who enrolled in the Essay Writing 2 course (3 credits), which was intended to promote EFL learners' academic writing and critical thinking.

B. Research Instruments

Data were collected using four instruments: (1) a pre- and post-writing test, (2) a self-regulation learning scale (SRLS), and (3) semi-structured interviews. In the pre- and post-writing tests, the respondents developed an argumentative essay of at least 250 words in one hour. The topic was chosen from a list of the topics typically used for IELTS writing task 2 and aligned with topics they were studying in their Essay Writing 2 course. Prior activities, such as brainstorming, posing questions, and reading text to accelerate learners' schemata, which took an hour, were also performed. The scoring rubric evaluated four components: conclusion, premises, evidence, and counter-arguments. The topics were screened by three English lecturers at the University for their cognitive and cultural appropriateness prior to distribution.

Pre- and post-writing tests were checked for elements such as writing content and coherence, and marks were awarded based on a four-factor rubric including a conclusion, premises, evidence, and counter-arguments. "Conclusion" received 1 mark if the respondent stated the conclusion of the argument properly and zero mark if not. "Premises" received a mark that reflected the number of premises the respondent could give based on the topic. "Counter-arguments" received a mark that reflected the number of counter-arguments the respondent could include. "Evidence" received a mark that reflected the number of premises that were supported by facts. Similarly, under writing coherence, "Logical connections 1" received a

mark that reflected the number of connections between a premise and the conclusion the respondent could make. "Logical connections 2" received a mark that reflected the number of connections between premises. "Signposts" received a mark that reflected the number of signposts that were properly and correctly used, and zero marks were awarded if no signposts were used. One point was rewarded if the signposts were weak, and two points if the signposts were strong. The writing rubric was screened by three English lecturers at the University for its Cognitive Appropriateness prior to use.

The self-regulation learning scale (SRLS) was distributed before and after the intervention to assess self-regulation as a fairly constant trait across various learning settings. The scale was originally devised by [16] and comprised 46 items grouped into six categories: planning (9 items), self-monitoring (8 items), effort (10 items), reflection (5 items), evaluation (8 items), and self-efficacy (10 items). The planning, self-monitoring, effort, and self-efficacy subscales were revised and converted into a five-point Likert scale ranging from (1) strongly agree to (5) strongly disagree, and the reflection subscale ranging from (1) never, (2) rarely, (3) sometimes, (4) very often to (5) always. The subscales' reliability scores were 0.85, 0.82, 0.84, and 0.80, respectively. A pilot study was conducted to examine the reliability of the survey involving 30 participants from the same population, but who were not part of the study sample. A reliability value of 0.85 was reported.

The semi-structured interviews were carried out at the end of the intervention to gain more information about how often and when the CAAM was used, as well as how this instructional intervention aided EFL learners' argumentative writing processes across the development of writing content and coherence.

C. Intervention

Using CAAM, participants were trained to analyze and evaluate one or more issues from multiple perspectives and eventually construct their own arguments by writing essays once a week. The invention consisted of weekly one-hour sessions over an 11-week period and utilized three stages: planning, monitoring, and evaluation; corresponding tasks undertaken at each stage. The first session was the introduction, in which argumentative writing was presented and key concepts of CAAM were demystified, described, and discussed. The three stages were completed within the 2nd to 11th sessions.

During the planning stage, the activities included advanced organization and schema building. The teacher introduced the writing topic to be discussed and asked the participants to brainstorm and share their thoughts with their peers.

During the monitoring stage, learners constructed argument maps and were asked to share them with their peers to refine their ideas prior to writing and solve issues concerning inconsistent premises, inaccurate counter-arguments, and the like. Meanwhile, the researcher provided feedback to those who encountered difficulties during their work.

The evaluation stage was composed of submission, discovery, and reflection parts in which participants composed their essays and sent their argument maps via CAAM software to the researcher. Indirect corrective feedback was also provided to monitor the respondents' writing processes. When essays were handed back to the respondents, they had the chance to self-reflect and self-evaluate their performance as well as negotiate their written work with peers. Thus, they shared some possible solutions for issues they may encounter in the future. Finally, revising and editing checklists were also provided to help participants revise and edit their writing products.

D. Data Analysis

Quantitative data were statistically analyzed using descriptive and inferential statistics, including means, frequency, and percentage. Paired-sample t-tests were conducted to compare the means of two sets of tests to reveal the effects of the intervention and verify whether there was a significant difference between the pre- and post-test writing tests. The Pearson correlation coefficient was also calculated to examine the relationship between the use of CAAM and respondents' argumentative writing across the development of writing content and writing coherence, as well as their SRLSs. Qualitative data were analyzed, coded, and interpreted using thematic analysis to capture the respondents' opinions and understanding of the use of CAAM to process their argument writing. Accordingly, the following themes were identified: theme 1 pertains to the benefits of using CAAM, theme 2 includes quality practice, theme 3 includes learners' perceptions of CAAM integration, and theme 4 pertains to the enhanced SRL of the respondents.

IV. RESULTS AND DISCUSSION

A. Quantitative Analysis

1) EFL learners' argumentative writing performance before and after the CAAM intervention: Results from the t-test analysis revealed that participants' argumentative writing differed significantly with respect to the development of content and coherence before and after the CAAM intervention. As shown in Table I, statistical comparisons of the overall mean scores before the intervention (M = 8.93, p < .000) and after the intervention (M = 18.36, p < .000) indicate statistically significant differences as manifested by p-values that are less than the 0.05 level of significance. That is, the performance of EFL learners' argumentative writing with respect to the development of content and coherence improved substantially after the CAAM intervention.

Table II shows the statistical differences in EFL learners' argumentative writing across the four components constituting the development of writing content (premises, conclusion, evidence, and counter-arguments) on the pre- and post-writing tests. All four components were significantly higher on the post-test scores, as manifested by p-values of less than the 0.05 level of significance. The "counter-argument" part was the most improved element (M = 5.61), while the "conclusion" part demonstrated the least improvement (M = 4.35).

TABLE I.   PAIRED-SAMPLE T-TEST OF EFL LEARNERS' ARGUMENTATIVE
WRITING PERFORMANCE ACROSS DEVELOPMENT OF WRITING CONTENT AND
COHERENCE BEFORE AND AFTER CAAM INTERVENTION

Components	Pretest		Post-test		t-value	Sig. (2-tailed)
	Mean	Std	Mean	Std		
Development of writing content	6.22	1.22	12.33	1.73	-20.54	0.000
Development of writing coherence	4.11	1.15	8.96	1.11	-17.52	0.000
Overall	10.35	1.79	21.30	2.07	-19.31	0.000

TABLE II.   PAIRED-SAMPLE T-TEST OF EFL LEARNERS' ARGUMENTATIVE
WRITING PERFORMANCE ACROSS DEVELOPMENT OF WRITING CONTENT IN
THE PRE- AND POST-WRITING TEST

Development of writing content	Pretest		Post-test		t-value	Sig. (2-tailed)
	Mean	Std	Mean	Std		
Conclusion	1.44	0.35	4.35	0.60	-6.74	0.000
Premises	1.45	0.39	5.45	0.71	-13.62	0.000
Evidence	1.63	0.30	5.50	0.96	-11.38	0.000
Counter-arguments	1.69	0.31	5.61	0.74	-16.92	0.000
Overall	6.22	1.22	21.30	2.07	-22.66	0.000

Table III provides the statistical differences of EFL learners' argumentative writing in terms of coherence on the pre- and post-tests. This component consists of three elements: (a) Logical connections 1 (referring to logical relations between the premises and the conclusion), (b) Logical connections 2 (referring to logical relations between premises), and (c) Signposts. The three components of argumentative writing differ significantly before and after the strategy intervention, as indicated by p-values of 0.000, which are less than the 0.05 level of significance. The logical connections 1 component was the most improved element (M = 3.01) compared to the pre-test score, whereas the "logical connection 2" component was the least improved (M = 2.87).

TABLE III.   PAIRED-SAMPLE T-TEST OF EFL LEARNERS' ARGUMENTATIVE
WRITING PERFORMANCE ACROSS WRITING COHERENCE IN THE PRE- AND
POST-WRITING TEST

Development of Writing Coherence	Pretest		Post-test		t-value	Sig. (2-tailed)
	Mean	Std	Mean	Std		
Logical connection 1	1.67	0.58	3.01	0.82	-10.23	0.000
Logical connection 2	1.23	0.41	2.87	0.69	-8.31	0.000
Signposts	0.99	0.67	2.0	0.39	-9.11	0.000
Overall	3.89	1.04	7.88	1.11	-17.53	0.000

B. Correlations between EFL Learners' Argumentative Writing Performance and SRL after CAAM Intervention

To confirm whether there were any correlations between EFL learners' argumentative writing performance and SRLSs, the Pearson correlation was computed. Table IV indicates that SRLS is significantly correlated with the EFL learners' overall argumentative writing performance ($r = 0.53$, $p < 0.01$). Specifically, strong positive correlations exist between the EFL learners' overall argumentative writing performance and the planning ($r = 0.65$, $p < 0.01$), self-monitoring ($r = 0.52$, $p < 0.01$), evaluation ($r = 0.45$, $p < 0.01$), effort ($r = 0.71$, $p < 0.01$)., and self-efficacy ($r = 0.55$, $p < 0.01$) subcategories. There was a moderate positive correlation with the reflection ($r = 0.35$, $p < 0.01$) subcategory. Overall, using CAAM as an instructional tool to improve argumentative writing influenced EFL learners' SRLSs.

TABLE IV.   CORRELATIONS BETWEEN THE EFL LEARNERS'
ARGUMENTATIVE WRITING PERFORMANCE AND SRLSS AFTER CAAM
INTERVENTION

	SRLSs	Pearson correlation
Argumentative writing performance	Planning	0.65**
	Self-efficacy	0.55**
	Self-monitoring	0.52**
	Effort	0.71**
	Evaluation	0.45**
	Reflection	0.35**
	Overall	0.53**
** $p < 0.01$		

V. QUALITATIVE ANALYSIS

A. EFL Learners' Perceptions of the CAAM Intervention

Twenty-eight respondents from the study sample participated in the semi-structured interviews. The findings revealed several themes related to EFL learners' perceptions of the benefits of using CAAM to compose their argumentative writing compositions. The sub-themes cover effective visualization of arguments, reducing cognitive overload, assuring quality in practice, and activating SDLSs.

When EFL learners were interviewed about the role of CAAM in processing their argumentative writing tasks, they responded that CAAM aided them in forming better visualizations of their arguments. It enabled them to construct their arguments quickly and easily, including evidence, objections, and counter-arguments, using box and line diagrams [3] with the possibility of generating, modifying, or transferring these boxes to a new position as needed. The participants exploited this CAAM feature effectively to regulate their writing performance, as one respondent noted:

1) CAAM helped me identify complex arguments quickly. I can divide them into smaller sections. I can distinguish the support and objections of my arguments as well as my conclusion.

Argumentative writing is often open-textured and sometimes ambiguous [3], thus, distinguishing conclusions, support, and objections requires more time and effort due to the lexical complexity of the text itself. The use of CAAM

helped participants distinguish conclusions and premises, and thereby facilitated a better flow of knowledge in the brain that avoided mental overloading, as one described:

2) CAAM allowed me to map graphically my arguments, and enabled me to interpret them correctly without overloading my mind with a lot of information.

Using CAAM offered ample opportunities for quality practice and online feedback, ensuring that the tasks were enjoyable and effective. Some respondents reported feeling motivated in constructing these activities, as they were directed gradually in using CAAM to map their arguments, which inspired them to successfully write down their arguments into text composition.

3) CAAM helps improve my writing skill because it made me practice purposefully. It also guided me throughout the process by informing us what to do next and what to avoid. I enjoyed the gradual complexity of the tasks in CAAM (R18, 78-81).

CAAM integration not only improved participants' writing output but also enhanced their self-regulation learning skills as they were inclined to plan, self-monitor, reflect on, and evaluate their learning processes. As one participant stated:

4) With CAAM, I can have an overview of my work and monitor by double checking to see if my writing content and conclusions are correct and free of mistakes and contradictions.

The use of CAAM activated brainstorming techniques, which helped participants activate prior knowledge and create new ideas that they may associate with their writing tasks. It also promoted EFL learners' self-monitoring processes by motivating them to double-check their ideas and arguments two or three times, edit their work more closely, or compare it to other arguments as these participants contended:

1) The brainstorming activity triggered my background information and helped me link to the new topic to be developed.

2) I can double-check my arguments by simply moving the elements of an argument with multiple logical structures to another position. Also, group sharing drew my attention to points of misunderstanding or not fully understood. Collaboration gave me inspiration and guidance about my arguments (R6, 98-101).

Some respondents further reported that evaluating their writing performance based on whether the arguments were correct made them more determined to keep writing and to use the right argumentative markers in the future. It also helped them trace their performances.

1) Mapping my arguments helped me examine my performance, whether or not I got the correct arguments and evidences. I also self-evaluate my work after receiving feedback from my peers. If I didn't succeed, I challenge myself to do better in the future.

Collaboration via CAAM further allowed EFL learners to reflect on their contributions, whether they successfully or unsuccessfully grasped the argument, and whether they used effective or ineffective approaches. One participant expressed her opinion regarding this:

1) CAAM gave me the chance to assess the quality of my writing performance. I also consider the views my peers suggested on my text.

VI. Conclusion

The study findings revealed that Saudi EFL learners' use of CAAM accelerated their argumentative writing performance with respect to the development of content and coherence. Given the useful features of CAAM, EFL learners' reasoning skills have been enhanced substantially, which is considered a potential factor for successful argumentative writing. CAAM provided them with more enjoyable and productive experiences throughout the entire writing process, down to the final product. It offered not only a stimulating environment for writing but also served as a reliable scaffold for the writing and editing process. Through CAAMs, maps can be constructed easily and edited freely; therefore, learners can engage in many practical exercises, which consequently enable them to engage in self-regulated learning because they are able to practice different argument structures to determine which works best for them. CAAM facilitates the production of coherent paragraph texts since these mappings serve as a support tool to aid EFL learners in their English writing.

Results have also demonstrated a significant correlation between EFL learners' overall writing performance and the implementation of CAAM, as confirmed by the marked improvement in their writing output after the intervention. As for writing content, EFL learners were able to provide various premises to back up their theses and distinguish their argument conclusions as well as present supporting evidence and counter-arguments. They also demonstrated writing coherence by logically connecting their premises with their conclusions, as well as using their linguistic signposts more effectively on the writing post-tests, resulting in more coherent and cohesive essays. The study findings coincide with [8], who reported the effectiveness of implementing CAAM on descriptive and expository writing in an EFL context and found that CAAM improved coherence, cohesion, grammar, and task achievement. This study focused on how EFL learners compose the argumentative content of their writing, emphasizing the conclusion statement and how it can be reinforced with evidence and counter-arguments. It also examined the use of coherence markers to determine whether EFL learners are able to make logical relations between their premises and conclusions as well as between premises.

By using CAAM, learners develop better critical attitudes toward arguments, evaluate arguments better, and become more open-minded in their thinking processes [7]. A learner who is able to think analytically and learn independently is more likely to be purposeful, strategic, and persistent in learning [19]. Results have further revealed that the learners became more aware of their self-regulated learning, as reflected in their inclinations toward planning, self-efficacy,

self-monitoring, effort, and self-evaluation. These results are consistent with [14], who argued that the use of CAAM involves well-planned and well-monitored processes that help raise learners' self-evaluation and self-reflection. Similarly, the authors [7] claimed that if CAAM is often used, learners' critical thinking will be enhanced and self-reflection can be optimized, which may foster learners' SRL because self-regulated learners have acknowledged their role in the task.

Pedagogically speaking, the study findings have implications for EFL materials development, which contributes to learners' improvement of argumentative writing skills and a better comprehension of their self-regulated learning procedures in general and EFL writing in particular. Identifying learners' personality traits and offering them facilities to promote their performance can lead to remarkable accomplishments in EFL instruction. Likewise, the findings provide thoughtful insights into utilizing CAAM within writing courses to revolutionize EFL learning classrooms in this digital era, especially since educators are dealing with tech-savvy learners who often enjoy utilizing technological-based platforms for more effective and meaningful learning. Further research needs to be conducted on the utilization of CAAM in different disciplines to further strengthen the many benefits of CAAM.

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