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The Impact of Using Computer-aided Argument Mapping (CAAM) on the Improvement of Writing Achievement of Iranian Learners of English

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***Abstract*—In the third millennium, writing skill plays a great role in the foreign language education. Also, current advances in computer technology are affecting the ways the teachers use to develop learners' language skills. The present study investigated the effectiveness of computer-aided argument mapping (CAAM) on the improvement of writing achievement of Iranian learners of English. To this end, after administrating a language proficiency test and an essay writing test, 90 students were chosen as the participants of this study. Next, the participants were categorized randomly into three groups as control, experimental 1, and experimental 2. During the course, as the both experimental groups did their writing tasks with the CAAM software (in person/in pairs), the control group did their assignments with pen and paper. Finally, a post test of essay writing was administered for all participants. Using SPSS version 19 and *One-way ANOVA* statistical procedure, the results showed a statistically significant difference between those who received the technique of CAAM and those who wrote their assignments in traditional way. Also, there was a statistically significant difference between the participants in the both experimental groups. In other words, collaborative learning in a computer hands-on learning environment was effective on writing achievement.**

***Index Terms*—writing and second language learning, computer-aided argument mapping**

I. Introduction

The role of writing in academic settings and social interactions is becoming more and more evident in modern communities. The ability to write in an effective way is becoming increasingly important in our global community. Besides, English writing teachers are better prepared, and language programs recognize the value of second language writing competencies. In the recent years, writing in a second language has become very important as many people are using the Internet and their personal computers for a variety of purposes like personal, educational, and so on. a. In this regard, teaching writing to non-native speakers of English is an enterprise that unfolds in such a countless variety of settings and classrooms around the world and even a considerable variation in how writing is taught. Nowadays, due to the widespread use of the technology in the classrooms, it would be a great negligence to downgrade the role of writing in EFL/ESL situations or to consider it as the least important skill to be acquired.

II. Review of Literature

A. The Significance of Writing in Second Language Learning

In the process of learning a second language, writing skill is a basic communication skill. When one starts to write, his thinking and act of writing are inseparable. In fact, the act of writing has a creative function since it helps the writer find and explore what he wants to say.

In the field of second language education, almost fifty years ago, the experts saw writing as a convention for recording speech and for improving grammatical and lexical characteristics of language (Brown, 2004). Now, it is understood that writing is a unique skill with its own characteristics and conventions. Educators also fully understand the difficulty of learning to write well in any language, even in their own native language.

"The ability to write well is not a naturally acquired skill; it is usually learned or culturally transmitted as a set of practices in formal instructional settings or other environments. Writing skills must be learned through practice" (Myles, 2002). According to Brown (2004), "teachers expect their students learn to express themselves clearly with logical,

well-developed organization that accomplishes an intended purpose as well as write coherent essays with artfully chosen rhetorical and discourse devices" (p. 140).

To formulate new ideas would be a difficult task because it involves transforming of information or reworking it, which is much more complicated than writing itself. When the writer puts the concepts together, he/she engages in "a two-way interaction between continuously developing knowledge and continuously developing text" (Bereiter & Scardamalia, 1987, p. 12). Compared to writing in native language, writing in second language acquires proficiency in the use of the language, as well as writing strategies, techniques and skills.

Besides its significant contribution to second language acquisition (SLA), writing plays a substantial communicative role in academic contexts. Writing is an essential part of thinking and learning in school contexts, particularly in light of 21st Century demands (Johannessen, 2001). Hence, it seems if the students can present concepts and ideas through their writing, they would be more successful in academic and professional fields.

B. Technology and Second Language Writing

Time has now changed. English writing teachers are better prepared and students are more aware of the writing required in school setting. As English second language research and practices have developed, many techniques and methods have proved successful in English L2 writing classrooms:

- "Careful needs analysis to plan curriculum,
- co-operative and group work that strengthen the community of the class and offer writers authentic audiences,
- integration of language skills in class activities,
- learning style and strategy training to help students learn how to learn, and
- the use of relevant, authentic materials and tasks" (Carter & Nunan, 2001, p. 32)

The use of technology in English L2 writing courses may be the most curricular change today. Composition students regularly use word processing which has revolutionized the writing process. By advent of computer to writing task, according to recent studies, writing is not a laborious effort, but a simple and enjoyable trail (Johns, 1997).Today, with the great progress of computer technology; computers can be at the service of second language students' achievements during the learning process. Also, teachers could benefit from a well-designed computer language learning program in order to assess the students and to provide feedback to their learning needs.

In a word, computer technology also provides "the interdisciplinary and multicultural learning opportunities for students to carry out their independent studies" (Lai, 2006, p.3). Teachers understand that using computer technology and its related language learning programs can be convenient to create independent as well as collaborative learning environments and provide students with language experiences when they move through the different stages of second language acquisition (Kung, 2002). Recent studies show that students have positive attitudes toward writing with computers and less apprehension-anxiety about writing respectively (Warschauer, 1996a).

C. Computer-aided Argument Mapping

Meaningful learning results when a person consciously and explicitly links new knowledge to relevant concepts that she or he already possesses. By storing information in long-term memory in association with similar and related pieces of knowledge, we learn it meaningfully. With rote learning, on the other hand, there is "little or no integration of new knowledge with existing knowledge" one already knows (Novak, 2002, p.553). Generally, in order to have a meaningful learning, the learner should have prior knowledge, the utilizing material should be meaningful by itself, and the learner should decide to learn meaningfully (Novak & Cañas, 2006) It seems mapping would be a tool for learners to achieve meaningful learning by connecting new concepts to already acquired knowledge. As Novak and Gowin (1984) assert, meaningful learning needs a person links new concepts with prior knowledge intentionally. As mapping support meaningful learning rather than rote learning, the information seems to be retained longer (Rafferty & Fleschner, 1993).

Argument mapping as one of the types of mapping permits the learners to "display inferential connections between propositions and contentions, and to evaluate them in terms of validity of argument structure and the soundness of argument premises" (Davies, 2010, p.2). Argument mapping is concerned with "explicating the inferential structure of arguments" (Davies, 2010, p.8). Argument mapping advocates believe that argument mapping seems to be beneficial for learners, as well as teachers. According to Van Gelder (2009), mapping a complicated argument supports clarity and awareness, more accurate and complete articulation, and a better evaluation. In the classrooms, teachers can benefit from argument mapping to instruct their students to learn basic concepts, to understand argument construction, and to develop reasoning skills. Argument mapping would be an effective way to enhance general critical thinking skills, as well (Twardy, 2003).

Computer-aided argument mappings (CAAM) are instructional programs which aim to improve thinking by providing an easy way to diagram reasoning on any topic. *Rationale*, as one of these programs helps the users to have better thinking and reasoning. Mapping arguments in this way helps to have a fully diagrammatic refined conception of reasoning in the mind without using a process of drafting and revision. In other words, the diagrammatically clear reasoning which is prepared in advance assists the users to recognize gaps, errors, unknown facts, and so on for prompting reformulation.

According to Davies (2010), in CAAM, "arguments are understood in the philosopher's sense of statements (premises) joined together to result in claims (conclusions). At the first (top) level of the argument there is the contention. This is followed by a supporting claim (under the link word *because*) and an objection (under the link word *but*). These are, in turn, supported by more claims of support or objection (which become rebuttals when they are objections to objections). Finally, basis boxes which provide defense for the terminal claims are provided at the end of the argument tree. Objections and rebuttals to objections can be added at any point in the map (in different colors for easier visual identification). The *basis* boxes at the terminal points of the argument also require evidence in place of the brackets provided. Some evidence has been provided like *statistics*, *expert opinion*, and *quotation"* (p.8). Figure 1 shows a sample of CAAM editor page provided in *Rationale* software (2012).

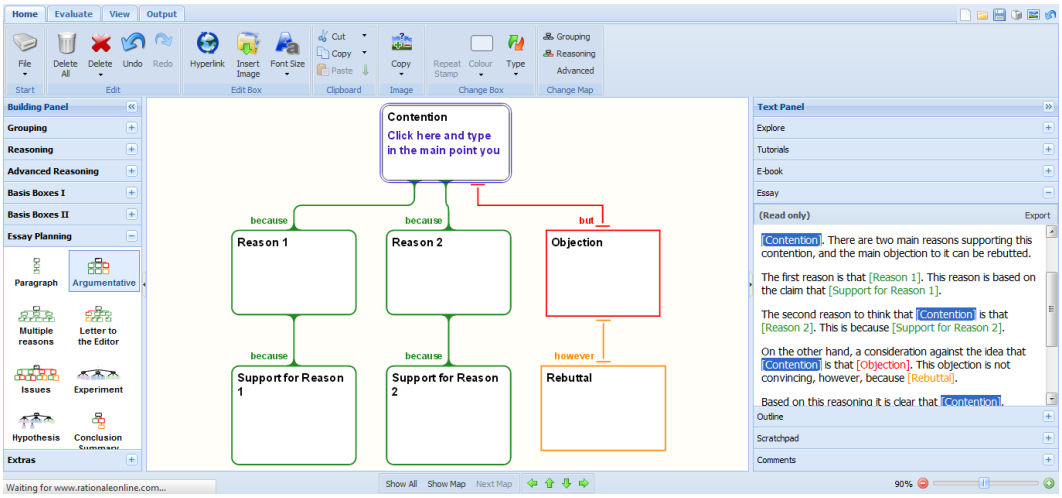

Fig.1 CAAM editor page in Rationale (2012)

Writing is a complex, recursive, and dynamic nonlinear process and writing experts have developed and tested instructional methods and techniques, yet other factors can be influential in the success of second language writers. In this study, the researchers were concerned to investigate the impact of using computer-aided argument mapping (CAAM) on the writing improvement of Iranian learners of English.

III. Method

A. Design

As the nature of the current research was to seek the impact of using computer-aided argument mapping (CAAM) on the improvement of Iranian EFL learners' writing achievement, the selected participants in the experimental group 1(EG1) and 2 (EG2) were exposed to the treatment conditions, that was, accomplishing homework assignments through their CAAM environments either individually or in pairs. The participants in the control group, on the other hand, followed the traditional treatment (using pen and paper) for accomplishing the same homework assignments. Due to the lack of true randomization of the participants, this research had a quasi-experimental design. As such, it was dealing with following variables:

1. Independent variable, which was the technique of using computer aided argument mapping (CAAM) in the English language classes in order to do essay writing activities.
2. Dependent variable which was writing achievement.

B. Participants

All the participants of this study were male and female senior university students in English translation at Islamic Azad University, Karaj and Qazvin Branches. By administrating Oxford Placement Test (OPT), as well as an essay writing test to all the students and calculating the results, 90 out of 127 students who enjoyed upper-intermediate language proficiency level, were chosen to be the participants of this study. In this regard, 30 students were considered to be in the control group, 30 students in the experimental group 1(EG 1), and 30 students in the experimental group 2 (EG 2).

C. Instrument

The following tests and devices were utilized as the instruments in this present study:

A test of English general proficiency was used for homogenizing the students regarding their language proficiency level. Among the standardized tests, Oxford Placement Test (OPT) was chosen for measuring language proficiency from beginning to upper-intermediate.

An essay writing test consisting of four topics was used. All students had to choose one topic for writing a five paragraph essay serving as a pre-test. The topics included as explaining the reasons of choosing English translation at

university, explaining a dream house, explaining the advantages and disadvantages of migration to other countries, and explaining the ways a person can be successful in education.

A test of written English was used in the form of a five paragraph essay writing in argumentation text type, serving as a post test for all participants in the three groups.

All participants in the experimental groups used a CAAM software *Rationale*. Also, all participants in the experimental groups were required to do their homework assignments in the CAAM environment.

The TOEFL Writing Scoring Guide (2007) provided by ETS was used in order to score the writing scripts in the control group and the experimental groups.

IV. Procedure

After selecting the eligible participants for the present study, the following steps were taken to accomplish the purpose of the study during the research process:

Writing instruction and tasks: This study was conducted for 12 sessions, 1.5 hours each. The participants in all three groups were assigned to write eight five paragraph argumentative essays on the given topics. The course materials and course contents were the same for all three groups. Then the participants in the experimental groups were guided how to install the CAAM software and how to work with it. Literacy in computer was not a condition for taking part in this course; a rudimentary familiarity was sufficient. For all groups, for five sessions, the instructor described the correct format of argumentative text type in a five paragraph essay format, relevant to the course syllabus: how to write an introduction paragraph, body, and conclusion paragraph. Then all the learners had some practices in the classroom. In the practicing part, the teacher proposed a topic and discussed the issues relevant to that topic. All the learners started writing their introduction paragraphs. Next, the students were required to write an outline of the main points/reasons, as well as supporting ideas for the body. For the experimental groups, this activity was done by drawing maps. Finally, all were required to write their concluding paragraphs. In this regard, they could write their sample essays with the help of the teacher. One or two of the samples were read in the class in order to reveal the areas of possible problems by the learners' participation and the teacher's comments and correction. At the end of the sixth session, the teacher proposed 2-3 topics to students in order to write their homework assignments (a five paragraph essay). The learners were required to choose one of those topics to write their assignments at home and at free pace.

In the control group, the learners had to bring their paper-based assignments to the class for the next session. However, the learners in the experimental groups followed a different path. Participants in the experimental group 1 (EG1) were required to do their assignments individually in their computer hands-on learning environment, while the participants in the experimental group 2 (EG2) did their assignments in collaboration with each other in CAAM environments in the period between two sessions. The teacher received the paper-based assignments from the participants in the control group, and the hard copies of assignments from all participants in the experimental groups, done either in person or in pairs. The participants in the experimental groups could share their hard copies and save their writing files with each other in order to receive the peers' feedback(s). Hence, every learner in the control group had also the chance to read his/her peer's assignments, and give comment(s).For all groups, the previous writings were accessible as the portfolio; for the experimental groups, there were hard copies of the assignments which the researchers saved them in different folders with the name of each participant, and for the control group, there were the paper assignments which were kept in their personal file prepared for them by the researchers. Consequently, all groups had the chance of reviewing their previous assignments in order to assess their writing achievements. This procedure continued until the course finished.

Feedback and scoring procedure: Giving correct feedback to writing scripts is a critical issue, in which it can promote better writing or even it may hinder future writing. In this study, the teacher attempted to be a facilitator. After collecting all assignments from the three groups (papers from the control group, and copies of writings of those in the experimental groups), all the assignments were read by the teacher. In giving comments to all groups, the teacher did not dictate anything to the students, but to give them some feedbacks to repair the parts where communication had broken down. An indirect type of feedback was provided to the students. In other words, the teacher indicated that an error existed but did not provide the correction. The teacher just mentioned some important issues like grammatical errors (such as word order), punctuation errors, and errors in the organizational patterns and wrote them at the bottom of the papers for preventing those errors in future writings. Also, the learners were presented and introduced some references to read and find the correct form of any given comment. Besides, for all groups, not only the teacher but also other peers could give their comments to each writing script. The peers' comments included grammatical correction, suggestions on developing ideas, and diction. In the experimental groups, the teacher, as well as the peers could give their comments in the written form or using the symbols like √, ×, *or Mmmmm*? which were available in the section of *Evaluate* in the toolbar of CAAM editor page as a type of indirect feedback, as well. To the experimental groups, because the fact of keep going on writing in CAAM environment was an important issue, the researchers introduced some other capabilities of this software like graphics, colorful boxes, and images to make the writing activity more enjoyable. The students could choose any relevant graphics or box. In addition, they could also receive positive feedback on their extra activities in CAAM environment as a creative use of technology. At last, all the assignments were scored according to TOEFL scoring profile (2007) by the researchers.

V. Data Analysis and Discussion

In this study, the researchers used the oxford placement test (OPT) in order to select the participants with upper-intermediate language proficiency level. Table 1shows descriptive statistics of the placement test.

TABLE1.
DESCRIPTIVE STATISTICS OF OPT

	N	Mean	Std. Deviation
OPT	127	44.35	7.48

As the obtained distribution of scores did not significantly differ from the normal distribution, 70 % of the participants were selected, those standing between X ± 1 SD. Therefore, 90 students who scored between 37 and 52 were selected for the study.

In addition to OPT, all participants took a pre-test of essay writing. In order to obtain inter-rater reliability, all scripts were read by three raters, and the correlation among scores marked by each rater was calculated. Table 2 shows the correlation of all writing scores marked by three raters obtained in the pre-test according to TOEFL scoring guide for assessing essay writing.

TABLE2.
INTER-RATER CORRELATION MATRIX

	rater1	rater2	rater3
rater1	1.000	.539	.768
rater2	.539	1.000	.422
rater3	.768	.422	1.000

Moreover, to find out intra-rater reliability, ten scripts of the participants were selected randomly, and were scored in other time without writing any score on them. Next, the data were analyzed statistically to achieve Intra-rater reliability. Accordingly, the researchers could homogenize the selected sample. In order to find the answer of the research question and investigate the accuracy of the null hypothesis, the researchers analyzed the data. By using the SPSS software version 19, the researchers used *one-way ANOVA* among the mean scores obtained from the control group and the experimental groups on the writing post-test in order to find out whether using CAAM in essay writing classes promotes writing achievement. Table 3 shows the descriptive statistics of writing scores in post-test obtained from all three groups.

TABLE3.
DESCRIPTIVE STATISTICS OF WRITING SCORES IN THE POST-TEST

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
control group	30	3.9743	.62987	.11500	3.7391	4.2095	3.00	5.00
experimental group1	30	4.6403	.51766	.09451	4.4470	4.8336	3.33	5.66
experimental group2	30	5.0523	.54690	.09985	4.8481	5.2565	3.66	6.00
Total	90	4.5557	.71661	.07554	4.4056	4.7058	3.00	6.00

Table 4 shows there is a significant statistical difference of mean scores between and among all learners in three groups at the level of 0.05. Accordingly, using CAAM definitely improves the writing skill of Iranian learners of English.

TABLE4.
ONE-WAY ANOVA STATISTICS OF WRITING SCORES IN THE POST-TEST

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.754	2	8.877	27.631	**.000**
Within Groups	27.950	87	.321		
Total	45.704	89			

Furthermore, by using the *Post Hoc tests*, the researchers wanted to find out whether the learners in a computer hands-on learning environment perform better when they do their assignments in collaboration or in person. The finding results revealed that doing tasks in collaboration improves the learners' writing achievement better than doing writing assignments individually. Table 5 illustrates the statistical difference between two experimental groups who did their assignments in pairs or in person.

TABLE5.
POST-HOC TESTS BETWEEN TWO EXPERIMENTAL GROUPS

(I) students	(J) students	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
control group	experimental group1	-.66600*	.14635	.000	-1.0150	-.3170
	experimental group2	-1.07800*	.14635	.000	-1.4270	-.7290
experimental group1	control group	.66600*	.14635	.000	.3170	1.0150
	experimental group2	-.41200*	.14635	**.016**	-.7610	-.0630
experimental group2	control group	1.07800*	.14635	.000	.7290	1.4270
	experimental group1	.41200*	.14635	**.016**	.0630	.7610

*. The mean difference is significant at the 0.05 level.

VI. CONCLUSION

Nowadays, as Olshtain (2001) points out within the communicative framework of language teaching, the skill of writing has a significant status. It is a communicative social activity in which a person can exchange a variety of information and messages to a closer or distant, known or unknown reader(s). Such communication is extremely important in the modern world. Whether the interaction takes the form of traditional pen and paper writing or through the most advanced electronic facilities, it needs to be encouraged and nurtured during the language learners' course of study. In this regard, teachers and practitioners try to benefit from any helpful tools in order to facilitate the process of language learning for their students. Computers and instructional software programs as one of these tools have been used in language writing classes in recent years (Trenchs, 1996; Warschauer, 1996b; Lewis, 1997; Goldberg, 2002).

The main goal of this research was to investigate the impact of using computer-aided argument mapping (CAAM) on the writing achievement of Iranian learners of English. After selecting and grouping the participants into three groups, two experimental groups used CAAM for doing writing tasks while the control group did their writing assignments with pen and paper. At the end of the course, all three groups took part in an essay writing test. Based on findings, the researchers concluded there was a statistically significant difference at the level of 0.05 among those participants who did their writing assignments in a computer hands-on learning environment, i.e., CAAM and those who did their writing tasks in the traditional way, i.e., pen and paper. Furthermore, collaborative learning through computers has been focused in previous studies (Kessler, et al., 2012; Yarling, 2011). The statistically significant difference between two experimental groups shows those who did their writing tasks in collaboration had better writing achievement than those who did their writing assignments individually. To sum up, using computers and proper instructional programs in writing classes could reveal areas for students' comments on their peers, positive regulation of effective factors for better achievement like teacher's feedback for keeping on writing, learners' self-monitoring and assessment, co-operative learning, learning autonomy, and computer literacy as an essential factor in our global communication.

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