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TEACHING FOR TRANSFER IN ESAP WRITING THROUGH COLLABORATIVE SYLLABUS AND MULTIMODAL INPUT: THE CASE OF IRANIAN ENGINEERING GRADUATES

Abstract

One of the foundational aims of English for Specific Academic Purposes (ESAP) instruction is improving learning transfer from an English course to learners' other courses. Although research on ESAP courses has found evidence of learning transfer, there is still a gap regarding its application at the graduate level. This study explored how discipline-specific academic writing could influence the learning transfer among Iranian graduate engineering students with varied writing proficiency levels. Sixty students from four different engineering majors participated in this study. During a whole academic semester, discipline-specific writing tasks that were collaboratively designed and presented through multimodal inputs were practiced. The variation in participants' writing skills throughout the semester was recorded and analyzed. The final writing tasks were also correlated with participants' initial writing proficiency scores. Results indicated that owing to the collaborative nature of the study and multimodal instruction of the program, the participants could obtain significant levels of academic writing and could finally transfer their acquired instruction to authentic disciplinary practices. Furthermore, a significant correlation was found between participants' writing proficiency levels and their ultimate writing scores. Findings provided strong support for the value of ESAP instruction in the learning transfer of engineering graduates.

Key words

ESAP, learning transfer, multimodality, collaborative syllabus design.

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1. INTRODUCTION

Academic writing, as one way of writing for information transfer, provides students with the opportunity to display their comprehension of acquired knowledge, experience and skills, which is regarded as a focus for university students (Shrestha & Coffin, 2012). There is a high expectation of being excellent in academic writing in higher education. Writing can be a slow and painful process even in our first language. However, writing in one's second language could be extremely challenging (Gilmore, 2009). The studies on academic writing in the field of engineering maintain that students face problems while writing academically, especially when they need to submit theses, articles, and reports (Cusick, 2009). Accordingly, instructors complain about poor performance of engineering students in academic writing (Ibrahim, Yunus, & Khairi, 2017).

Iranian engineering graduate students also face challenges regarding their academic writing (Mousavi & Kashefian-Naeeini, 2011). English is a foreign language in Iran and the main medium of instruction is Persian. Only few hours at schools and universities are allocated to teaching English. In spite of its importance in higher education, no academic writing course has been defined in the graduate programs of engineering disciplines by the Ministry of Science, Research, and Technology. Consequently, generic and rhetorical conventions essential for producing academic texts have received little or no attention. The English courses in these disciplines are confined to a three-credit and a two-credit courses presented in bachelor programs (Mousavi & Kashefian-Naeeini, 2011) that mainly provide practice in reading and translation skills (Naghdipour, 2016).

On the other hand, PhD students are required to publish at least a thesis-extracted paper in a scholarly journal before they are given the permission to formally defend their theses. This condition is, however, optional for MA/MSc students. As English is the primary language of the scientific community, graduate students prefer to submit and publish research articles in high-quality English journals. In this way, they can gain a wider audience and readership. Furthermore, they can share the findings of their works with other researchers around the world and have the opportunity to promote themselves professionally and academically (Arianmanesh & Khani, 2019). This highlights the importance of developing materials that cater for the real needs of thousands of graduate students who need to practice academic writing tasks and strategies (Sajid & Siddiqui, 2015). In addition, it seems that academic writing courses that are presented by language instructors can hardly fulfill this demand, because of lack of a broad understanding of the students' discipline-specific needs. As a result, the collaboration between discipline-specific and language lecturers seems to be a necessity (Bhatia, 2014).

In a collaborative syllabus, instructors work together to create materials (Drits-Esser & Stark, 2015). English for Specific Academic Purposes (ESAP) is focused on the requirements of learners from specific disciplines (Flowerdew, 2016). Despite its efficiency, unfortunately, interdisciplinary collaboration in ESAP

programs has not been practiced sufficiently and effectively in the context of Iranian universities at MSc and PhD levels (Shooshtari, Jalilifar, & Haghighi, 2017). In a study about the development of interdisciplinary competence among engineers Lattuca et al. (2017) found that the emphasis on an interdisciplinary skill in curricular and co-curricular activities significantly relates to students' reported development of interdisciplinary competence. The degree of similarity between the authentic practice of the task and the instructional situation can affect language transfer (James, 2014). Students may not transfer learning outcomes from an ESAP writing course if they do not find a connection between the writing course and other courses (Ford, 2004). Collaboration of instructors from different disciplines can provide a discipline-specific situation through developing instructional materials that are similar to ESAP students' professional settings and suit their educational needs and expectations, and therefore, assist them in transferring their learning from an ESAP course to a content-based context.

Transfer of learning is "the ultimate goal of education" (Archer et al., 2014: 269) or, as James (2009) states, the ultimate goal of English as a second language (ESL) academic writing courses. Learning transfer occurs "when learning in one context or with one set of materials impacts on performance in another context or with another set of materials" (Perkins & Salomon, 1994: 6452). Traditional teaching methods and techniques were not effective in helping students apply the acquired knowledge in later classes or professional settings (Archer et al., 2014). The question arises as to why we are teaching when students cannot transfer the skills and ideas to later situations. What is the worth of teaching then? This phenomenon is not automatic and may not be easy to stimulate. However, it is possible through instruction designed to promote transfer of learning (Hajian, 2019).

Many students face challenges when they try to apply what they have learned in their writing course to the authentic tasks in their disciplines. Shooshtari, Haghighi, and Bates (2018) investigated how students learning ESAP assessed the four constructs in Learning Transfer System Inventory (LTSI) including ability, motivation, working environment, and trainee characteristics that might facilitate or inhibit the transfer of learning in discipline-specific academic writing programs. LTSI is an empirically derived self-report 16-factor inventory designed to assess individual perceptions of catalyst and barriers to the transfer of learning from work-related training. These authors found that more consideration of work-related factors, including personal capacity, resistance to change, and supervisor sanction, is needed in higher education to enhance transfer of writing outcomes.

Subedi (2004) considered learner characteristics and workplace characteristics as significant factors affecting learning transfer. Students' learning should be meaningful; however, their learning styles are different. Not all learners' acquisition and meaning-making process happen through language and speech. Mostly, ESAP courses do not consider different modes that interact in the process of meaning making. Based on the knowledge-construction view, multimodal learning is an activity of sense-making in which students try to build "a coherent mental

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representation from the presented material" (Mayer, 2009: 17) that is called understanding (vs. remembering). Understanding is the ability to employ the presented material in new situations (i.e. transfer). Therefore, meaningful learning can be distinguished by "good transfer performance as well as good retention performance" (Mayer, 2009: 21).

A multimodal method of teaching that presents material in audio-visual modes can facilitate explanation, comprehension, investigation, and learning participation (Papageorgiou & Lameras, 2017). It can help learners obtain a nuanced comprehension of the subject-matter content, improve the understanding of print-based text, and transfer the acquired knowledge more productively (Choi & Yi, 2016). Thus, multimodal teaching practices can enhance learners' sense of accomplishment (Sun, Yang, & Silva, 2021) and help them engage in learning.

In academic writing, introducing novel disciplinary topics through multimodality may provide the opportunity to address students' discipline-specific language proficiency. Graduate learners develop some levels of implicit consciousness about their disciplinary writing conventions that encourage them to deal with the upcoming writing tasks more professionally (Dressen-Hammouda, 2008). Correspondingly, disciplinary instruction appears to be able to activate learning academic writing skills (Haghighi, Shooshtari, & Jalilifar, 2019). Furthermore, learners' disciplinary writing competencies may enhance the possibility of transfer of academic writing skills (Haghighi et al., 2019). This can be examined via a learner agency approach that focuses on learners' preliminary knowledge (Larsen-Freeman, 2013). Students' initial disciplinary competence can maintain a stable capacity for self-determining learning agency during instruction, practice, and assessment (Marginson et al., 2010).

Yang, Noels, and Saumure (2006) argued that the systematic interaction of target language and competence increases self-confidence which in turn enhances language development. They assumed that this cycle can increase academic success that can lead to higher chance of transfer of knowledge to future practices. Moreover, they realized that self-confidence can contribute to language adaptation because the disciplinary competence triggers self-expression and encourages active participation in ESAP contexts. Lin and Morrison (2021) found a significant relationship between English as a Foreign Language (EFL) learners' motivation in writing and their writing proficiency. Lee and Pulido (2017) also reported that second language proficiency impacts the writing skill. According to Monbec (2020), successful admission to global academy needs the production of high-quality theses and papers. This in turn requires professional academic writing abilities.

Several studies have covered different aspects of ESAP studies in Iran. These studies investigated English academic writing (e.g. Eslami, 2010), learning transfer and LTSI (e.g. Shooshtari et al., 2017), and the effect of multimodality in understanding idioms (e.g. Khoshnevisan, 2019). However, few studies have investigated multimodality in an ESAP writing course (Haghighi et al., 2019; Shooshtari et al., 2018) and no study has taken into account teaching for transfer in

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discipline-specific academic writing of graduate engineering students through multimodal instruction and collaboration.

Given the above-mentioned concerns, this study attempted to examine an approach toward teaching discipline-specific writing practices for four engineering majors through collaboration and multimodal instruction in Ferdowsi University of Mashhad, assuming that the process of skill development and learning transfer would be both facilitated and actualized for the graduate engineering students.

Accordingly, the following research questions were raised:

1. To what extent do a collaborative syllabus design and multimodal teaching facilitate the process of learning transfer of the English academic writing skill in Iranian graduate students of engineering?

2. Which writing outcomes from the multimodal instruction transfer to authentic discipline-specific writing tasks performed by Iranian graduate engineering students?

3. Is there a relationship between the initial level of English academic writing proficiency of graduate engineering students and their ability to transfer their instruction to the final authentic discipline-specific writing tasks?

2. METHODOLOGY

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2.1. Study design

To answer the research questions, the researchers set up a quasi-experimental, purposive, and thus nonrandomized study (Mackey & Gass, 2012) to examine the effect of learning transfer from multimodal ESAP courses to authentic discipline-specific writing tasks of graduate students of mechanical, civil, computer, and electrical engineering from the Faculty of Engineering at Ferdowsi University of Mashhad. The pre-test–post-test design employed in this study did not include a control group due to the limited number of existing students in the context of the study. According to Salkind (2010), quasi-experimental pre-test–post-test studies may or may not include control groups.

The writing tasks that aimed to develop general and discipline-specific writing skills instruction were selected after sessions of negotiation with specialized lecturers of the mentioned disciplines for practice and test sessions. They were selected using the works presented for academic writing tasks by Swales and Feak (2012) and Bailey (2011) as well as the engineering writing skill tasks presented by Beer and McMurrey (2014) and Berger (2014). In order to examine the success of transfer from a treatment, James (2009) suggested that researchers instruct new skills through new topics, different from skills and subject matters students learned in their disciplines. To this end, the presence of content lecturers who propose new and relevant topics seems necessary. Internet of Things Technology and Extended

Finite Element Method are two examples of the topics proposed by the discipline instructors.

James's (2009) checklist of writing outcomes was followed in this study to analyze participants' writing tests. The checklist comprises 15 writing outcomes that target three categories, organization (items 1-7), content (items 8-12), and language use (items 13-15). Some examples of expected learning outcomes are writing an introduction and conclusion, using logical sequence, using connectives and cohesive devices, and avoiding sentence fragments.

2.2. Participants

In collaboration with Ferdowsi University of Mashhad, ESAP writing courses were presented for every discipline separately. Sixty male and female graduate engineering students (age range 23-40) from four disciplines attended these courses voluntarily. The number of participants varied in each group: 18 mechanical, 11 civil, 20 computer, and 11 electrical engineering students. They were PhD and master's students who were in different years of their studies. Prior to the study, all participants had completed a three-credit course of general English, which generally aimed to provide practice in reading and translation skills. Subsequently, they were required to pass another four-credit discipline-specific English course that aimed to enable students to read and comprehend discipline-specific texts. Accordingly, it was assumed that the participants were relatively ready to take a writing course in English. Considering the emphasis of this study on writing practices, the engineering students could voluntarily participate in the courses regardless of their general English proficiency levels. Nevertheless, to determine the initial levels of participants' English academic writing, a proficiency test was administered.

2.3. Materials

Materials for each session of instruction were adopted from four academic writing textbooks (Bailey, 2011; Beer & McMurrey, 2014; Berger, 2014; Swales & Feak, 2012) after consulting two English academic writing experts. The authors of the books acknowledged that the sources were developed to meet the academic writing needs of graduate nonnative learners.

During the instruction program, multimodality through audio and visual modes was practiced. The video excerpts related to the selected topics of the writing tasks were put on display. Afterwards, an explanatory text covering the same topic was presented to the participants. Diverse discipline-specific writing models were instructed, exemplified, and practiced. However, the focus was on the tasks and models presented in the aforementioned academic writing books. They included

abstracts, justification of claims in arguments, argumentation of premises, specifications, reports, instructions, and research paper structures.

2.4. Data collection instrumentation

2.4.1. Test of academic English writing proficiency

Given the purpose of the current study and the absence of listening and speaking skills in the English courses offered at Iranian universities, a test of academic English writing proficiency was administered. This test measured the participants' ability to write academically in English. In the present study, the writing proficiency scores were not regarded as the criterion for the exclusion or inclusion of participants; in fact, the final score was documented for each participant to see whether there would be a significant relationship between the future act of learning transfer and the writing proficiency levels. The test required the participants to study a research article about a subject matter related to their field of study. The article did not include an abstract. Then, they were asked to write an abstract for the studied article.

The practicality and reliability of the test were checked through a pilot study on 60 students of the same disciplines. The consistency in scoring was maintained through using the criterion-referenced scoring guide. Raimes's (1985) scheme was used in this study to evaluate the task items such as word choice, grammar usage, punctuation, sentence structure, verb form/tense, spelling, and text structure, development and organization, rating the participants' abstracts on a scale of 1 (low) to 6 (high). However, to make the description of each level more concrete, the levels were titled after the Test of Written English (TWE) scoring guide released by Educational Testing Service in 2015. One of the researchers scored the abstracts. To check the consistency of assessment, 20 percent of the abstracts were scored by an experienced EFL writing researcher in Teaching English as a Foreign Language (TEFL) at Shahid Chamran University of Ahvaz. The extent of the raters' agreement on the ratings assigned to the abstracts was calculated using the Pearson product-moment correlation which reflected their overall agreement on the given scores ($r = 0.916$, n = 12, $p < 0.01$). The second measure reported was Cronbach's alpha (0.79), which provided an estimate of the internal consistency of the final scores.

2.4.2. Pre-test of writing skills

To check the level of participants' awareness of the basic and essential models of writing for their disciplines, pre-tests of writing skills were conducted for each discipline in classes. Participants were supposed to write an argument about the discipline-specific topic suggested by the content lecturers. The video excerpts related to the topic in focus were also displayed. In addition, an explanatory text covering the same topic was shown. The participants were given 30 minutes to

complete the task and deliver their argument paragraphs to the language lecturer. The selected writing outcomes, based on James's (2009) scale, were used by the researchers as a reference to score the test results.

The consistency of assessment was checked by inviting another experienced EFL writing researcher to score 20% of the test papers using James's (2009) checklist of 15 writing outcomes that target three categories organization (including using a conclusion, logical sequence, cueing statements, connectives and cohesive devices, introducing the topic, and following the rhetorical pattern in focus), content (including describing, exemplifying, comparing/contrasting, defining, and classifying), and finally language use (including avoiding missing commas after introductory elements, avoiding fused sentences, and avoiding sentence fragments). To assess the use of each of these learning outcomes, James (2009) developed a four-point scale (i.e. 0 = no use of learning outcome; 1= minimal use; 2 = moderate use; 3 = extensive use). For example, for the learning outcome using cueing statements, a point 3 meant that cueing statements were used regularly and they were functional and explicit. A point 2 indicated that cueing statements were used everywhere they could be, but they were not always substantive and explicit. A point 1 indicates that cuing statements were used, but in some places, they were missing. Finally, a point 0 indicated that no identifiable cueing statements were used. The raters independently scored each of the argument paragraphs for the employment of the 15 learning outcomes and calculated the sum for each argument. The researcher's decisions (as the first rater) were compared to the other rater's scoring decisions and inter-coder reliability was calculated using Pearson correlation coefficient (r = 0.841, n = 12, *p* < 0.01). To check the validity of the scoring procedure, the construct validity of James's (2009) checklist of writing outcomes was established through the employment of a *differential-groups experiment* procedure proposed by Brown (2005). In order to show the construct validity of a measurement instrument based on this procedure, the instrument could be employed to assess the ability it claims on two different groups. One group "obviously has the construct that is being measured and another that clearly does not have it" (Brown, 2005: 227). If the group, which had the construct, scored high on the test, while the other group scored low, it could be concluded that the measurement instrument is assessing what it is supposed to measure and hence it is valid. Accordingly, in order to show the construct validity of the James's check list in this study, it was applied to two different groups (an undergraduate group and a graduate group of engineering students other than the participants of the treatment program) whose performances on what the checklist measures appeared to be different, because graduate students enjoyed more experience regarding their background in map projects and reports that were partly in English. A discipline-specific topic was assigned to these two different groups, each consisting of 30 participants selected randomly by the content lecturers. The writing outcomes of the two groups were scored using James's (2009) scoring schemes and then an independent *t*-test was run on the results. There was a significant difference

between the mean scores of the first group (M = 1.28, SD = 0.42) and the second group [M = 2.06, SD = 0.44; t (58) = 6.95, *p* = 0.00].

2.4.3. The instruction program

For the purpose of this study, 16 training sessions were designed for each discipline with the aim of instructing, practicing, and testing the selected writing tasks and skills through multimodal inputs. Two-hour treatment sessions were held twice a week by the language lecturer. The discipline-specific writing tasks (abstracts, justification of claims in arguments, argumentation of premises, specifications, reports, instructions, and research paper structures) and disciplinary genres (arguments and expositions) proposed by Beer and McMurrey (2014) and Berger (2014), were introduced, exemplified, and analyzed through audio-visual aids (video clips). Other elements of writing including cause and effect, comparison, generalizations, and problems and solutions were also introduced and exemplified. Language issues and accuracy in writing including lexis, grammar, cohesion, and coherence were instructed and practiced based on the elements proposed by Bailey (2011), Berger (2014), and Swales and Feak (2012). The sessions of writing instruction and practice were held separately for each group of the participants from the beginning to the end of the program.

During the practice sessions, a novel topic, recommended by the content lecturer, was introduced. Surfing the internet, the language instructor chose three video clips and sent them to the content lecturer to select one on the basis of relevance, comprehensibility, and novelty. The participants watched the chosen video and it was replayed when they asked for more exposure. Considering that not all the participants may appreciate audio-visual input, an explanatory text covering the same topic was presented to them. The procedure for selecting an appropriate text was similar to the one for videos. The text was not meant to be an exact transcription of the video excerpt; instead, it explained the topic in further technical details. After ensuring that participants were ready to begin their writing practice, they started writing the task within 30 minutes. They were supposed to write arguments and expositions about the topics proposed by the content lecturers. The written tasks were checked and returned to the participants a session later. Each mentioned step was repeated for all the practice sessions to the end of the semester.

For example, to introduce an argument, first, the aims, patterns, and features were presented. Moving to higher levels of argument, the combining paragraphs to argue for a premise and the combining premises to argue for a thesis were instructed. In the next step, sample premises for research proposals and journal submissions were exemplified and analyzed. Justification of claims in an argument was also instructed using examples. Finally, in the practice session, authentic samples of arguments from disciplinary journal papers were discussed and analyzed. When the participants were ready, they were required to write an argument about a disciplinary topic proposed by the content lecturer. After about

30 minutes, the participants submitted their paragraphs to the language lecturer. They were checked, commented, and returned to the individuals a session later.

2.4.4. Post-test of writing skills

To check the participants' achievements after the discipline-specific writing instruction, a post-test parallel to the pre-test was administered for every discipline. The steps taken for choosing the topic and administrating the test were the same as the steps in the pre-test. The participants were required to write an argument about a discipline-specific topic suggested by the content lecturers. To check the test reliability (r = 0.939, n = 12, $p < 0.01$) and construct validity (t (58) = 11.93, $p = 0.00$), the same procedures as in the pre-test session were followed.

2.4.5. Delayed post-test

To scrutinize the participants' ability to successfully actualize their learning from the multimodal instruction to authentic domain-specific settings, a delayed post-test of writing, similar to those of pre- and post-tests, was administered with one month interval after the instruction phase. Participants were required to write an argument about a discipline-specific topic recommended by the content lecturers. The test reliability (r = 0.867, n = 12, $p < 0.01$) and construct validity (t (58) = 11.28, $p = 0.00$) were checked following the same procedures as in the pre-test session.

The tests results were analyzed using descriptive and inferential statistics including the mean scores, SD, Pearson correlation, and ANOVA. To answer the first research question the mean scores obtained from the three tests were compared through ANOVA. Regarding the second research question, the writing strategies that were employed consistently in the participants' submissions during the treatment from the pre-test sessions to the delayed post-test were checked. The final scores for each test for all the participants were recorded for detailed examination. To answer the third research question, Pearson correlation was calculated.

3. RESULTS

To answer the first research question (To what extent do a collaborative syllabus design and multimodal teaching facilitate the process of learning transfer of the English academic writing skill in Iranian graduate students of engineering?), the mean scores obtained from the three tests were compared through ANOVA. Table 1 summarizes the average scores of the participants in the pre-test, post-test, and delayed post-test sessions.

	Groups	N	Mean	Std. Deviation	Variance
Pre-test	Mechanical Engineering	18	1.34	0.31	0.10
	Civil Engineering	11	1.64	0.39	0.15
	Computer Engineering	20	1.49	0.36	0.13
	Electrical Engineering	11	1.29	0.46	0.22
Post-test	Mechanical Engineering	18	2.63	0.23	0.05
	Civil Engineering	11	2.72	0.20	0.04
	Computer Engineering	20	1.80	0.09	0.01
	Electrical Engineering	11	2.66	0.22	0.05
Delayed Post-test	Mechanical Engineering	18	2.65	0.22	0.05
	Civil Engineering	11	2.71	0.15	0.21
	Computer Engineering	20	2.81	0.17	0.03
	Electrical Engineering	11	2.65	0.19	0.03

Table 1. Descriptive statistics of performance on pre-, post- and delayed post-tests

According to Table 1, the overall mean scores of all the four groups of participants increased from the pre-test to both the post-test and the delayed post-test. The mechanical and computer engineering students obtained higher mean scores in the delayed post-test. The total mean scores of the civil and electrical engineering groups reduced slightly from the post-test to the delayed post-test.

Subsequently, an ANOVA was run to pinpoint any meaningful difference between the participants' performances on the pre-test, the post-test, and the delayed post-test. Table 2 sums up the results of each group's performance.

Disciplines	**df**	**Eta Squared**	**F**	**Sig.**
Mechanical Engineering	2	0.96	218.375	0.000
Civil Engineering	2	0.97	150.154	0.000
Computer Engineering	2	0.95	171.923	0.000
Electrical Engineering	2	0.94	84.145	0.000

Table 2. ANOVA: Comparison of groups' mean scores on pre-, post-, and delayed post-tests

As Table 2 indicates, there were statistically significant differences between the three sets of tests for the four groups of mechanical engineering ($F(2) = 218.375$, $p < .0005$, multivariate partial eta squared = 0.96), civil engineering ($F(2) = 150.154$, $p < .0005$, multivariate partial eta squared = 0.97), computer engineering ($F(2) = 171.923$, $p < .0005$, multivariate partial eta squared = 0.95), and electrical engineering students ($F(2) = 84.145$, $p < .0005$, multivariate partial eta squared = 0.94). Post hoc analysis with a Bonferroni adjustment revealed a statistically significant difference between the

pre-test and the post-test (civil: M = 1.685, computer: M = 1.313, electrical: M = 1.370, mechanical: M = 1.289, CI = 95%, *p* < .05), and between the pre-test and the delayed post-test (civil: M = 1.673, computer: M = 1.317, electrical: M = 1.364, mechanical: M = 1.307, CI = 95%, *p* < .05), but not between the post-test and the delayed post-test (civil: M = 0.012, computer: M = 0.003, electrical: M = 0.006, mechanical: M = 0.019, CI = 95%, *p* < .05). These findings showed that the academic writing skills of the four groups of participants significantly improved and they meaningfully transferred the acquired skills to the authentic academic settings. The partial eta squared scores obtained in this study (mechanical engineering = 0.96, civil engineering = 0.97, computer engineering = 0.95, and electrical engineering = 0.94) suggested a very large effect size.

As for the second research question (Which writing outcomes from the multimodal instruction transfer to authentic discipline-specific writing tasks performed by Iranian graduate engineering students?), the writing strategies that were employed consistently in the participants' submissions during the treatment from the pre-test sessions to the delayed post-test were checked using James's (2009) checklist of writing outcomes. Following Shooshtari et al. (2017), the mostly- and rarely-followed writing outcomes of the four engineering disciplines are summarized in Table 3.

Category of writing outcomes	Writing outcomes	Number of participants who observed the strategies consistently in their test papers Mostly followed				Number of participants who did not observe the strategies consistently in their test papers Rarely followed			
		Me.	Ci.	Co.	El.	Me.	Ci.	Co.	El.
Organization	1. Introducing the topic	9	4	11	7	3	-	1	1
	2. Using a conclusion	4	3	11	4	-	-	1	-
	3. Using logical sequence	14	10	18	10	-	-	-	-
	4. Using cueing statements	16	8	18	10	-	1	-	-
	5. Using connectives	7	7	15	6	2	1	2	3
	6. Using cohesive devices	14	10	14	8	-	-	1	-
	7. Following the rhetorical pattern	11	10	10	11	-	-	-	1
Content	8. Describing	10	10	11	7	1	-	-	-
	9. Exemplifying	12	10	18	9	1	-	-	-
	10. Comparing/contrasting	6	6	14	4	4	-	1	3
	11. Defining	14	10	14	5	1	-	-	-
	12. Classifying	10	9	16	8	5	-	1	1
Language use (accuracy)	13. Avoiding missing commas after introductory elements	8	5	14	6	-	1	-	1
	14. Avoiding fused sentences	16	8	18	7	-	1	-	1
	15. Avoiding sentence fragments	11	10	12	9	-	-	3	-

*Me. stands for Mechanical, Ci. for Civil, Co. for Computer, and El. for Electrical engineering participants.

Table 3. Frequency of practiced writing outcomes

As illustrated in Table 3, *using logical sequence* was practiced by all the four groups of participants. *Using a conclusion*, *cueing statements*, *cohesive devices*, *following the rhetorical pattern*, *describing*, *exemplifying*, and *defining* were also consistently

practiced. Only one student out of 60 failed to accomplish these tasks. Less frequent but still notably practiced writing strategies were *avoiding missing commas after introductory elements*, *avoiding fused sentences*, and *sentence fragments.* Other strategies including *introducing the topic*, *using connectives*, *comparing/contrasting* and *classifying* were the least practiced among the writing outcomes of the participants.

Regarding the third research question (Is there a relationship between the initial level of English academic writing proficiency of graduate engineering students and their ability to transfer their instruction to the final authentic discipline-specific writing tasks?), the results of the test of English academic writing proficiency administered to determine the participants' initial writing proficiency levels are summarized in Table 4. Level 1 test papers contained severe errors in writing and were underdeveloped; level 2 test papers were flawed by serious disorganization and errors in sentence structure; level 3 test papers demonstrated noticeably inappropriate word forms or choice of words as well as accretion of errors in sentence structure and usage; level 4 test papers demonstrated adequate but inconsistent facility with usage and syntax; level 5 test papers displayed facility in the use of language and demonstrated some range of vocabulary and syntactic variety. Finally, level 6 test papers demonstrated clear competence in writing on both syntactic and rhetorical levels. Based on the six levels of the scoring guide, the scores demonstrated relatively developing and minimal competence in English academic writing. Only 5 out of the 60 test papers demonstrated acceptable competences in English writing.

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	Mechanical Engineering	Civil Engineering	Computer Engineering	Electrical Engineering
Writing Proficiency Levels	N	N	N	N
(1) Demonstrate incompetence	2	-	-	1
(2) Suggest incompetence	3	3	2	1
(3) Demonstrate developing competence	7	4	7	5
(4) Demonstrate minimal competence	6	3	7	4
(5) Demonstrate competence	-	1	4	-
(6) Demonstrate clear competence	-	-	-	-

Table 4. Participants' writing proficiency levels

Pearson correlation was conducted to find possible relationships between the participants' scores on the proficiency test and their scores on the delayed post-test.

Disciplines	Correlation writing proficiency levels & delayed post-test scores	Sig. (2-tailed)
Mechanical Engineering	0.830	0.000
Civil Engineering	0.652	0.030
Computer Engineering	0.837	0.000
Electrical Engineering	0.777	0.005

Table 5. Correlations between the participants' writing proficiency levels and transferred academic writing skills

As Table 5 illustrates, positive correlations were found between the proficiency levels and the final outcomes of the four groups of participants. Computer engineering students with r = 0.837, n = 20, and *p* = 0.000 showed the strongest positive correlation. The scores of the mechanical engineering students ranked the second highest correlation (r = 0.830, n = 18, *p* = 0.000). Electrical engineering students (r = 0.777, n =11, *p* = 0.005) and civil engineering students (r = 0.652, n = 11, *p* = 0.030) also demonstrated a significant correlation.

4. DISCUSSION

The present study explored the influence of instruction through multimodality and collaboration on learning transfer of engineering graduates with diverse proficiency levels. Overall, the results indicated that the impact of an integrated bridging ESAP writing course for graduate engineering students allowed them to improve the structure and organization of their writing from pre- to post-training.

The syllabus designed in the present study was based on the collaboration of both a general English language instructor and a discipline-specific instructor who attempted to bridge the gap between what ESAP presents and what participants need in the engineering disciplines including gaining the links between the language skills and the specific professional knowledge and developing writing communicative competence (Maletina, Karmanova, & Kashpur, 2015). Considering the impact of the collaborative syllabus design, the findings are in line with Drits-Esser and Stark's (2015) idea of the success of a collaborative syllabus in fostering acquisition and developing reflection of the students. Furthermore, the findings correspond with Huisman et al.'s (2019) view that the development of an effective language learning syllabus may positively affect professional development.

The embedding of the course in a setting directly related to the authentic tasks and the disciplinary genres (arguments and expositions) that graduate students encountered during this study seems to highlight its relevance. Kasper (2009) viewed that collaboration of instructors in preparing materials and tasks, can raise students' awareness of the audience, concepts, and the aim of their academic disciplines. In harmony with Catana's (2014) study, the collaboration of instructors

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in the present study opened up the opportunity to develop a syllabus and instructional materials that suited ESAP students' professional and educational needs and enhanced the motivation to learn which in turn led to transferring acquired knowledge of the ESAP course to authentic settings. The findings of this research supported James's (2014) view that the degree of similarity between an instructional situation and authentic practice of the task can affect language transfer. Collaboration to create a context similar to the discipline-specific context, as Archer et al. (2014) emphasized, helped participants apply the acquired knowledge in later professional works. The present study provided a situation similar to the target context in which the outcomes of the ESAP program could be used.

The multi-representation approach displays information in different forms, making it simpler for learners to comprehend the subject matter in various modes (Rahman, Doyan, & Sutrio, 2021). Representational competence fosters learners' construction of mental models of concepts; thus it is essential to consider this competence while developing instructional resources (Ferreira & Lawrie, 2019). Applying multimodality to the instruction phase of this study provided opportunities for the instructor to present the core content in different modes and cater for different learning styles of participants. In line with Moreno and Mayer's (2007) study, this assisted ESAP participants in the process of meaning making and allowed them to transfer their knowledge to authentic writing tasks more effortlessly. Adopting a constructivist view of learning, Mayer (2009) argued that multimedia do not simply deliver information, but rather are a cognitive aid for knowledge. He also maintained that learning would be more comprehensive and meaningful if instead of using texts alone, resources and tools were interactively employed. Consequently, the learning strategies invoked by instructors do not improve the critical thinking skills of students if lecture is the only means of teaching (Ramdani et al., 2021). Therefore, the teacher, as a facilitator, can improve students' learning outcomes by creating a multi-directional and an active learning atmosphere (Rahman et al., 2021).

As a corollary, representations play a vital role in the expression and development of knowledge in Science, Technology, Engineering, and Math (STEM) (Kozma, 2020). STEM experts use multiple representations to express understanding, negotiate meaning, solve problems, and warrant claims (Kozma, 2020). The experimental study by Taramopoulos and Psillos (2017) found that in STEM learning multiple representations were more effective than single representations. Using learning videos during the instruction program of this study made it easier for participants to understand the subject matter as the clips covered various representations including sounds, images, and illustrations of events from the material being taught and studied.

The findings of this study indicated that transfer of writing outcomes from the multimodal instruction to the authentic discipline-specific writing tasks did occur; however, it was considerable for some outcomes but restricted for others. Fortunately, during the treatment and in the final test, the four groups of

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participants were successful in transferring five out of seven writing outcomes that addressed essay organization, including using a conclusion, logical sequence, cueing statements, and cohesive devices as well as observing the rhetorical patterns. Regarding the five outcomes that were practiced to develop the content of the writing tasks, the four groups of participants transferred the received instruction excluding the techniques of comparison and contrast. As the findings demonstrated, the three techniques of describing, exemplifying, and defining were positively exercised to develop the elaborations of the topics. Considering the language use and accuracy, it seems that the four groups of participants avoided missing commas after introductory elements, sentence fragments, and fused sentences in their writing tasks. Considering the literature on the transfer of writing skills, such improvement in transferring discipline-specific content outcomes subsequent to language courses has scarcely been reported (Shooshtari et al., 2017). Therefore, this can be considered as a valuable achievement for the current study and indicates that the participants had valued the design of the ESAP multimodal course.

Regarding the text organization, two factors (introducing the topic and using connectives) were problematic for the participants of this study. This difficulty could be ascribed to the participants' inadequate linguistic knowledge of cohesive devices, the academic diction, and the structure and organization of an academic writing text. Al Badi (2015) found that one of the most common academic writing difficulties of postgraduate students is related to language use as well as cohesion and coherence. Wenyu and Yang (2008) indicated that producing logically related sentences and clearly expressed ideas is the basic goal of writing. They noted that supervisors attribute the source of students' difficulties in writing to the lack of knowledge and understanding of structural and rhetorical requirements.

The core micro-genres of engineering writing, which were emphasized in this study, include arguments and expositions (Crossley et al., 2017). This can justify why the comparing/contrasting technique was rarely employed by some of the participants. Classifying technique was another writing outcome that was less practiced particularly by mechanical engineering students. It can be related to the topic of the final writing task which did not need any classification. The possible reason that might account for the rare employment of comparison/contrast or classification could be the inadequate experience and knowledge about the conventions of academic writing and the expectations of the institution in which they were studying. An unsupportive transfer climate can play a crucial role in failure of transferring learning outcomes (Haskell, 2000). In line with the 'transfer climate' concept suggested by James (2010), the environment was considered important in this research. This concept highlights the impact of the participants' perceptions of the present discourse and the skills they acquire in the transfer process. Whether learners have the opportunity to practice the acquired skills or whether they feel that the learned skills are useful are examples of the transfer climate (Hill , Khoo, & Hsieh, 2020).

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As stated earlier, positive correlations were found between the proficiency levels and the final writing outcomes of the engineering students. According to Haghighi et al. (2019), this positive relationship can be rewarding for collaborative teaching approaches, specifically in ESAP contexts where learners often lack a satisfactory level of language readiness to acquire academic writing skills, let alone obtain transferable knowledge. Low language proficiency might obstruct academic writing (Al Badi, 2015). Ghabool, Mariadass, and Kashef (2012) considered low language proficiency as the main source of the challenges students may face in their writing. Shafie et al. (2010) also argued that novice EFL writers find academic writing more challenging especially when establishing an effective discussion in the target language. Poor English and an impoverished argument can become inextricably intertwined. With poor understanding of English usage, it is difficult, if not impossible, to develop a highly intellectual and sophisticated argument.

In accord with Al Fadda's (2012) study, the graduate engineering students of the present study faced difficulties in combining sentences. The poor level of the English proficiency of EFL students, as was also reported by Bitchener and Basturkmen (2006), could be a hindrance to the development of a clear linkage between ideas. Learners with poor language proficiency often cannot compose an effective discussion in the target language. In other words, as Cahyono and Rahayu (2020) explain, writing quality is closely tied with the EFL students' motivation in writing and their writing proficiency.

In sum, as Haghighi et al. (2019) also concluded, the writing proficiency level affected participants' discipline-specific agency and subsequently enhanced their self-confidence; consequently, self-confidence increased their linguistic adaptation that was a requirement for learning transfer processes. That is, students' language proficiency levels can be boosted through being exposed to discipline-specific ESAP instruction, which in turn may positively affect their self-confidence, linguistic adaptation, and finally their ability to transfer learning processes. Accordingly, as DePalma and Ringer (2011) stated, preparing a confident climate in academic writing practices may trigger adaptive transfer involving intuitive processes of reshaping acquired writing knowledge in new situations. As Dressen-Hammouda (2008) argued, graduate learners can develop implicit consciousness about their disciplinary writing conventions and genres that encourages them to manage the upcoming writing tasks more strategically.

5. CONCLUSION AND IMPLICATIONS

Based on the findings of this study, a range of learning outcomes from an ESAP writing course can transfer to disciplinary writing practices. Furthermore, students' diverse writing proficiency levels can influence their academic writing performance. Giving learners authentic disciplinary samples to identify their organizations and structures can play an important role in achieving the writing objectives and making

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learners familiar with the writing styles and elements of genres of their disciplines. Instructors should identify the most recent interdisciplinary teaching methods that can motivate learners to actively participate in completing the assigned tasks. In addition to students' skills, institutional conventions are also essential to more practical writing. Therefore, academic writing needs to be an integral part of the engineering studies curriculum and students should have access to sufficient and relevant references.

The findings of this study may be practical for any university programs for which the English academic writing skill is a prerequisite to producing well-developed texts for publication in higher education. However, considering the contextual factors of the present study, where English is considered as a foreign language, further research in second language learning settings and in other disciplines is needed to substantiate the results of the current study.

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