



## Impacts of Utilizing E-Mind Maps on Iranian Adolescent vs. Adult EFL Learners' Language Learning Strategy Choices

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### Abstract

The purpose of this study was to investigate the probable effects of E-Mind Maps on the prevailing Language Learning Strategy Choices of adolescent versus adult Iranian EFL learners (LLSC). Besides, their preferred strategies were investigated across each dominant LLSC for some volunteer participants through structured interviews. According to a mixed-method design, 76 available Iranian adolescent and adult EFL learners, both male and female, were randomly divided into four equal groups of experimental and control ones. Strategy Inventory for Language Learning (SILL) was conducted for all participants in the pre-and post-intervention phases, followed by a structured interview in just the post-intervention phase in the qualitative phase. The intervention presented the teaching content through E-Mind Maps vs. the conventional way of teaching for 20 sessions. The data were analyzed using descriptive and Chi-Square statistics. The results confirmed that using E-Mind Maps shifted the dominant LLSC of adolescent and adult EFL learners to memory and cognitive strategies. Moreover, preferred strategies across each dominant LLSC were discussed in detail for both groups. The conclusion can provide critical implications for English language teaching, learning, and educational technology in using E-Mind Maps as an effective strategy in EFL classrooms.

**Keywords:** adolescent, adult, E-mind map, Iranian EFL learner, language learning strategy

## **Introduction**

Several advantages have been found for using mind mapping in education, such as helping students memorize and recall information better and faster, improving their summarizing skills, and helping teachers introduce new topics and concepts (Brinkmann, 2003). Arulselvi (2017) mentioned that mind mapping helps individuals brainstorm, generate, and organize ideas inside and outside the classroom. Brinkmann (2003) stated that a mind map was not an idea to improve teaching and learning, but it has a variety of useful applications in this field. Buzan (1972) proposed the notions of mind mapping, and later it was developed by Novak in the early 1970s at Cornell University. Buzan and Buzan (2006) defined a mind map as “an information organizing strategy used to show the relationships between various elements in a visual manner which is clear and enjoyable through utilizing different sketches, colors, pictures and forms” (p. 12).

Different classifications (O'Malley, 1985; Oxford, 1990; Rubin, 1987; Stern, 1992) have been proposed by various researchers, but some are more important because they are more comprehensive, reliable, and are the basis for other recent frameworks. O'Malley et al. (1985) classified LLS into categories of metacognitive, cognitive, and socio-affective. Metacognitive strategies relate to the methods used to plan for and reflect on the processes of learning in this framework. “They are more confined to specific learning tasks and need more direct manipulation of the learning material itself,” according to cognitive methods (Brown, 2007, p.134). Questions for clarification and cooperation are the most effective methods for the socio-affective category (Brown, 2007). The most comprehensive taxonomy of language learning strategies was offered by Oxford (1990), which was classified into two primary categories: direct and indirect language learning procedures. Memory, cognition, and compensatory methods are examples of direct strategies. “All direct procedures necessitate mental language processing.” (p.37). On the other hand, indirect strategies are metacognitive, emotional, and social strategies that indirectly enhance language learning through diverse methods such as arranging, focusing, evaluating, etc. Qingquan, Chatupote, and Teo (2008) stated that based on the results of

some studies in the field of LLS, it was shown that fluctuation in the overall language proficiency is related to the language learning strategy.

The notion of mind mapping has emerged from cognitive psychology, which states that learning happens by assimilating and propositioning new concepts into different frameworks and lists. Novak and Canas (2006) referred to this structure as an individual's cognitive structure, which is formed based on the association of the new knowledge with the knowledge already possessed. A mind map is defined as a visual tool that emphasizes the relationships between various notions to show their primary structure and how those notions are related to the problem in an attractive way for the reader to attract their attention (Tucker, Armstrong, & Massad, 2010).

Based on mind-mapping software, Al-Jarf (2015) suggested a technique for improving EFL freshman students' vocabulary. He used self-designed reliable tests to investigate their levels of English vocabulary both as pretest and post-test. After being exposed to the treatment, The experimental group of EFL students made considerable improvements in vocabulary acquisition and accuracy in vocabulary knowledge. Aljaser (2017) investigated the usefulness of Electronic Mind Maps in improving academic accomplishment in primary school students' English learning. Electronic Mind Maps were used as a treatment vs. a placebo, which was the standard teaching method. There was a statistically significant difference in the post-test mean scores of the experimental and control groups. Their performance was superior to that of those in control groups.

Syafrizal, Fitriani, and Gailea (2018) investigated the effectiveness of applying a mind mapping approach and developing inferences about students' vocabulary achievement. They separated 30 seventh-grade children into two groups, experimental and control, in order to conduct the study. The experimental group taught using a mind mapping method, whereas the control group was instructed traditionally. The mind mapping strategy was found to create a statistically significant difference in inferences made and vocabulary achievement between the two groups.

Alwadi and Ismail (2019). studied the effectiveness of the mind mapping approach for enhancing the speaking abilities of EFL primary school students. They wanted to uncover the difficulties which students are facing while speaking in the classroom. It was found that anxiety was the most

influential factor which affected the speaking of the EFL primary school students. In addition, the mind mapping strategy which made students so motivated was proved to be an effective strategy for EFL primary school students.

In the Iranian context, Karami, Sayadian, and Minaeifar (2015) compared the effects of digital mind mapping vs. traditional mind mapping on Iranian students' vocabulary learning. Sixty male students were selected to participate in the study to fulfill the intended objectives. Two groups were formed, one for digital mind-mapping and one for traditional mind mapping. The participants in the group of digital mind mapping outperformed those in the traditional mind mapping group based on the number of vocabularies learned. In addition, it was found that Iranian EFL teachers were not familiar with the effectiveness level of the new strategies in teaching and learning, such as mind mapping and concept mapping.

Heidari and Karimi (2015) conducted another study in the Iranian context, examining the effect of a mind mapping strategy on vocabulary learning and retention in 40 Iranian male first-grader high school students. They were randomly allocated to experimental and control groups of twenty Iranian male students each. The experimental group received language instruction via mind mapping, whereas the control group received conventional instruction. For the pre-and post-tests, a reliable and valid vocabulary examination was used. The experimental group outperformed the control group on the delayed post-test in terms of language acquisition and retention.

Marashi and Kangani (2018) linked idea mapping to mind mapping in Iran's descriptive and narrative writing lessons. Based on the results of a pretest, they chose 60 intermediate EFL students. They were split into two experimental groups at random. The treatment consisted of 14 90-minute sessions to teach concept mapping and mind mapping. The results indicated a statistically significant difference between the two groups, with the mind mapping group outperforming the control group on both descriptive and narrative writing post-tests.

Although several intervention studies have found that students may learn strategies to control their own learning, many issues about how strategies are implemented in real classrooms remain unsolved. Unfortunately, there are not enough studies looking into how strategy instruction and teaching techniques can help L2 students become self-regulated language learners, particularly in English as a foreign language (EFL) learning in Iran. Following the recent request for more diverse learning methodologies, this study was conducted to look into E-Mind Map as a learning method and its effects on the preferred strategy choices of learners which are the affective factors contributing to the EFL learners' learning outcomes.

According to a review of the related literature, no research has been conducted to date to examine the effects of using E-Mind Maps on the preferred scores of language learning strategy choices for adolescent vs. adult EFL learners. Thus, this study attempted to reveal the possible effects of using E-Mind Maps on language learning strategy choices of adolescent vs. adult EFL learners. In addition, the preferred strategy choices of both adolescent vs. adult EFL learners toward using E-Mind Maps were investigated. Therefore, the following research questions were addressed in this study:

**RQ1.** Does utilizing E-Mind Maps affect the language learning strategy choices rated by adolescent EFL learners?

**RQ2.** Does utilizing E-Mind Maps affect the language learning strategy choices rated by adult EFL learners?

**RQ3.** Is there any significant difference in the language learning strategy choices between adolescent vs. adult EFL learners after being taught through E-Mind Maps?

**RQ4.** What are the preferred strategy choices of adolescent vs. adult EFL learners by using E-Mind Maps?

## **Method**

### **Participants**

The participants in this study were 76 male and female Iranian EFL learners who were randomly assigned to one of four groups: two control groups and two experimental groups (each consisting of 19 participants). Thirty-eight participants were adolescents (14-19 years old), and 38 were

adult (26 years old and above) EFL learners. Thus, there were four groups: adolescent experimental group, adolescent control group, adult experimental group, and adult control group. The participants in the experimental groups (both adolescents and adults) were taught through Mind Meister software. Table 1 shows the demographic characteristics of the participants. Due to some limitations (institutes' terms and policies in registering EFL learners), the adolescent participants were selected from HaftEghlim language institute, and the adult EFL learners were selected from Zabansara Language institute.

Table 1.  
*Demographic Characteristics of the Participants (EFL Learners)*

Groups	Experimental	Control	Experimental	Control
Frequency	19	19	19	19
Age	Adolescents	Adolescents	Adults	Adults
Gender	Males: 9	Males:11	Males: 10	Males: 9
	Females: 10	Females: 8	Females: 9	Females: 10
Institutes	HaftEghlim	HaftEghlim	ZabanSara	ZabanSara

Participation in this study was voluntary, and the participants were not forced, whether by researchers or language institutes, as it was not obligatory to participate in the study. All of them were informed of the participation in this study, and they were aware that participation in this study does not have any reward neither by researchers nor language institutes.

### **Instruments**

The pre-and post-tests were conducted using the Strategy Inventory for Language Learning (SILL). Additionally, an interview was conducted to gain a better understanding of the outcomes.

#### ***Strategy Inventory for Language Learning (SILL)***

Oxford (1990) created Strategy Inventory for Language Learning which is used to find language learners' preferred learning styles in many different studies in various countries. It consists of 50 items based on the five-point Likert scale. The whole package includes the items in the form of a questionnaire, answer sheet, profile sheet, and the description of strategies

classification sheet. The questionnaire and answer sheet was used in this study for the distribution among participants. Oxford (1990) categorized SILL into six strategy types, including memory strategies or mnemonics primarily used for storing, remembering, and retrieving information; cognitive strategies mainly focus on mental processes; compensation strategies which are about production in the new language despite the lack of knowledge, metacognitive strategies are about actions in learning which goes beyond the cognitive devices, affective strategies mostly include emotions and attitude; and finally, social strategies which are based on social behavior, and communication among people.

There are different subscales for each strategy in the SILL; each category is better explained based on each subscale's rating percentages to make the obtained data meaningful and more accurate. Table 2 shows the subscale of each strategy in the SILL.

Table 2.  
*Subscale of Each Strategy in the SILL.*

<b>Strategy</b>	<b>Subscales</b>
<b>Memory</b>	Visual – Auditory - Tactile
<b>Cognitive</b>	Skimming & Scanning – Practicing – Analyzing & Reasoning - Summarizing
<b>Compensation</b>	Paraphrasing – Using Gestures – Guessing – Coining Words – Adjusting the Information
<b>Metacognitive</b>	Centering Learning – Evaluating Learning – Planning Learning
<b>Affective</b>	Reducing Anxiety – Encouraging Oneself – Emotional State
<b>Social</b>	Asking Questions – Cooperating with Others – Cultural Awareness

As shown in Table 2, memory strategy consists of three subscales, the cognitive strategy includes four subscales, compensation strategy has five subscales, the metacognitive strategy consists of three subscales, affective strategy has three subscales, and finally, the social strategy includes three subscales. In Table 3, the characteristics of the SILL are presented.

Table 3.  
*Characteristics of the SILL*

No. and Type of Items	50 – Five-Point Likert Scale
<b>Ranges of Likert Scale</b>	Never True of Me, Usually not True of Me, Somewhat True of Me, Usually True of Me, Always True of Me.
<b>Reliability</b>	>0.8

Mohammadi and Alizadeh (2014) investigated the reliability and validity of Oxford's (1990) Strategy Inventory for Language Learning (SILL) in an Iranian university setting. The SILL score demonstrated strong test-retest reliability (Pearson's correlation >0.8) and no statistically significant differences in total scores across administrations. The construct validity of the SILL was investigated using exploratory and confirmatory factor analyses. The data were subjected to confirmatory factor analysis, which revealed that the best-fitting model for the tool was a six-component structure, showing that SILL measures a multidimensional construct.

### ***Interview***

The most frequently used type of interview is a structured or formal interview that includes a set of fixed and stable questions (known as close-ended questions or structured) ordered in a rule-based way. There are some advantages to this type of interview, such as easy replication and quickness of conduction. In addition, there are some disadvantages, including the limitation of asking any new question and lack of comprehensive details. In this study, a researcher-made structured interview was used as a tool to make sure about the findings of the SILL. Eight participants in the experimental groups (four adolescents and four adults) were selected randomly, and their preferred strategy choices after using E-Mind Maps were explored. In terms of the interview structure and its content validity, the Average Congruency Percentage (ACP) from the feedbacks of different



Iranian experts in the field of TEFL and psychometrics was calculated ( $\geq 94\%$ ) which was above the critical value of 90% that showed established content validity of the interviews. Thus, it was decided to keep the two questions for the interview included targeting the preferred adolescent vs. adult EFL Learners' LLSC and whether the utilization of E-mind maps was beneficial for both of the participants in these groups or not.

### **Data Collection Procedure**

Before approaching the participants, the necessary permissions for conducting the study were obtained from the heads of the language institutes. The 76 participants (EFL learners) were randomly assigned to four groups: adolescents in experimental and control groups, and adults in experimental and control groups (each group consisted of 19 participants). The EFL teachers who were supposed to teach in the experimental groups were taught how to use Mind Meister software to present the content of the course via Electronic Mind Maps. The EFL teachers in the control groups were asked to teach English in their own old style (traditional way of teaching). Before exposure to treatment, a pretest including the SILL was administered for all of the participants. The treatment was the use of Electronic Mind Maps by the Mind Meister software. The study for all groups lasted for 20 sessions, each for 90 minutes. A post-test which was like the pretest (SILL), was administered after the treatment was exposed. The average time for completing the SILL was about 30-40 minutes. As some limitations were raised during the study, the hard copy of the questionnaires was available for the participants. Some participants in the experimental groups were selected voluntarily to participate in an interview (eight adolescent and eight adult EFL learners). A pilot test was conducted for 20 EFL learners (10 adolescents and 10 adults) in both language institutes to check the reliability of the SILL in the Iranian context.

A pilot test of the SILL was conducted for 20 EFL learners (10 adolescents and 10 adults). As table 4 shows, the pilot test results showed the value of Internal Consistency as ( $\alpha = .936$ ). According to George and Mallery (2003), if the value of coefficient alpha is 0.9 or higher ( $0.9 \leq \alpha$ ), an excellent internal validity is indicated.

Table 4.

*Case Processing Summary and Reliability Statistics of the SILL in Iranian Context*

Cases	N	P%	Cronbach's Alpha	N of Items
Valid	20	100.0	.936	50
Excluded	0	0		
Total	20	100.0		

**Data Analysis Procedure**

Statistical Package for the Social Sciences (SPSS) was used to analyze the data obtained from the SILL. To investigate the effectiveness of utilizing E-Mind Maps on language learning strategy choices of adolescent and adult EFL learners (first and second research questions), descriptive statistics such as frequency and percentage of the control and experimental group were cross-tabulated across each strategy for both pretest and post-test. Chi-square statistical procedure was used to find out whether there was any significant difference in the ratings of the language learning strategy choices of adolescent vs. adult EFL learners (third research question). The content of the data extracted from the interview was analyzed to make sure about the results obtained from the SILL questionnaire and to check the participants' preferred strategy choices as the objective of the last research question.

**Design**

This study employed a mixed-method design, including a pretest, a post-test, two experimental, and two control groups for the quantitative phase and an interview for the qualitative phase. In this study, the participants were randomly distributed across four equal groups: adolescent experimental group, adolescent control group, adult experimental group, and adult control group, each consisting of 19 participants. An interview was conducted to ensure the validity and reliability of the results, particularly the post-test, which was about the participants' preferred language learning strategies.

## Results

### Quantitative Results

The frequency and percentage of the adolescent EFL learners' ratings across experimental and control groups in the pretest were calculated to find the answer for the first research question that was about the possible effectiveness of utilizing E-Mind Maps on the language learning strategy choices rated by adolescent EFL learners. Table 4 shows the cross-tabulation for the frequency and percentages of the SILL among adolescent EFL learners (control group and experimental group) in the pretest. In this table, NT stands for never true of me, UNT stands for usually not true of me, ST stands for sometimes true of me, UT stands for usually true of me, and AT stands for always true of me.

Table 5.  
*Cross-Tabulation for the Frequency and Percentages of The SILL among Adolescent EFL*

	Strategy	Group	Frequency and Percentage									
			NT		UNT		ST		UT		AT	
			F	P%	F	P%	F	P%	F	P%	F	P%
Adolescents (Pretest)	Memory	C	2	2.6	10	13.2	31	40.8	22	28.9	11	14.5
		E	3	3.9	5	6.6	30	39.5	25	32.9	13	17.1
	Cognitive	C	4	5.3	29	38.2	25	32.9	10	13.2	8	10.5
		E	5	6.6	34	44.7	19	25.0	12	15.8	6	7.9
	Compensation	C	1	1.3	6	7.9	12	15.8	25	32.9	32	42.1
		E	2	2.6	4	5.3	13	17.1	22	28.9	35	46.1
	Metacognitive	C	28	36.8	25	32.9	9	11.8	8	10.5	6	7.9
		E	31	40.8	27	35.5	10	13.2	6	7.9	2	2.6
	Affective	C	3	3.9	8	10.5	11	14.5	30	39.5	24	31.6
		E	4	5.3	9	11.8	10	13.2	33	43.4	20	26.3
	Social	C	3	3.9	8	10.5	14	18.4	17	22.4	34	44.7
		E	2	2.6	9	11.8	15	19.7	19	25.0	31	40.8

*Learners (Control Group and Experimental Group) in the Pretest*

According to Table 5, most adolescent EFL learners in the pretest, both in the control and experimental groups, rated 'social' and 'compensation' strategies as 'always true of me.' For the 'affective' strategy, the adolescent EFL learners in the pretest, both in the control and experimental groups, mostly rated 'usually true of me.' The 'memory' strategy is most frequently rated by the adolescent EFL learners in the pretest, both in the control and experimental groups as 'somewhat true of me.' For the 'cognitive' strategy,

the adolescent EFL learners in the pretest, both in the control and experimental groups, mostly rated ‘usually not true of me.’ Finally, most adolescent EFL learners in the pretest, both in the control and experimental groups, rated the ‘metacognitive’ strategy as ‘never true of me.’ The exact order of the rated strategies for the control and experimental groups among adolescent EFL learners in the pretest shows the homogeneity and appropriate selection of adolescent EFL learners.

To check the post-test results for adolescent EFL learners in both the control and experimental groups, their SILL ratings were calculated. Table 6 is a cross-tabulation for the frequency and percentages of the SILL among adolescent EFL learners (control group and experimental group) in the post-test. In this table, NT stands for never true of me, UNT stands for usually not true of me, ST stands for sometimes true of me, UT stands for usually true of me, and AT stands for always true of me.

Table 6.  
*Cross-Tabulation for the Frequency and Percentages of The SILL among Adolescent EFL*

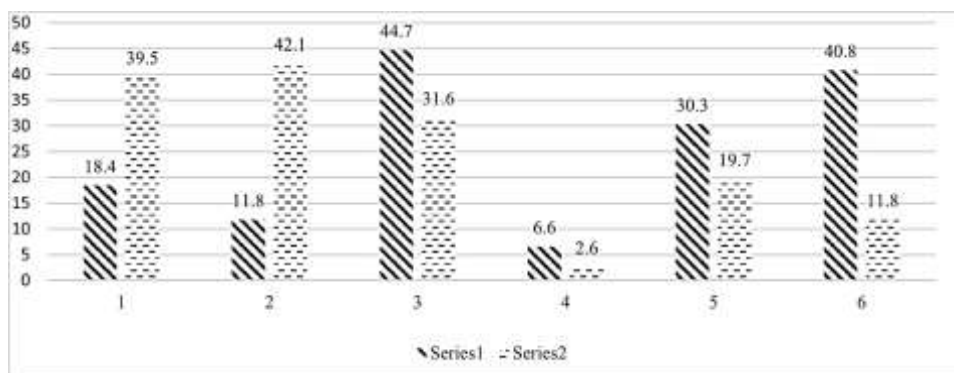
Adolescents (Post-Test)	Strategy	Group	Frequency and Percentage									
			NT		UNT		ST		UT		AT	
			F	P%	F	P%	F	P%	F	P%	F	P%
Memory	C	4	5.3	9	11.8	28	36.8	21	27.6	14	18.4	
	E	2	2.6	8	10.5	10	13.2	26	34.2	30	39.5	
Cognitive	C	5	6.6	25	32.9	23	30.3	14	18.4	9	11.8	
	E	1	1.3	3	3.9	13	17.1	27	35.5	32	42.1	
Compensation	C	2	2.6	7	9.2	10	13.2	23	30.3	34	44.7	
	E	2	2.6	10	13.2	13	17.1	27	35.5	24	31.6	
Metacognitive	C	27	35.5	23	30.0	13	17.1	8	10.5	5	6.6	
	E	30	39.5	27	35.5	12	15.8	5	6.6	2	2.6	
Affective	C	4	5.3	8	10.5	13	17.1	28	36.8	23	30.3	
	E	2	2.6	3	3.9	31	40.8	25	32.9	15	19.7	
Social	C	3	3.9	11	14.5	13	17.1	18	23.7	31	40.8	
	E	6	7.9	29	38.2	20	26.36	12	15.8	9	11.8	

*Learners (Control Group and Experimental Group) in the Post-Test*

According to Table 6, the same frequency order of the pretest for the rated strategies of the adolescent control group is repeated in the post-test. It shows no difference in the language learning strategy choices of the

adolescent EFL learners in the control group in the pretest and the post-test. On the other hand, the frequency order of the language learning strategy choices of the adolescent EFL learners in the experimental group has been changed after exposure to the treatment.

As seen in Table 6, the majority of adolescent EFL learners in the experimental group of the post-test assessed their 'cognitive' and 'memory' strategies as 'always true of me.' In the post-test, the majority of adolescent EFL learners in the experimental group rated 'generally true of me' for the 'compensation strategy'. In the experimental group of the pretest, adolescent EFL learners most frequently assess the 'affective' strategy as 'somewhat true of me.' In the post-test, the majority of adolescent EFL learners in the experimental group rated 'generally not true of me' for the 'social' strategy. Finally, the majority of adolescent EFL learners in the experimental group in the post-test judged the 'metacognitive' strategy as 'never true for me.'



*Figure 1.* The total comparison of the preferred language learning strategy choices among adolescent EFL learners in the post-test

As Figure 1 shows, the most frequently rated strategies for the adolescent EFL learners in the control group of the post-test are 'compensation strategy', 'social strategy' and 'affective strategy', respectively. On the contrary, the adolescent EFL learners in the experimental group of the post-test mostly rated the category of 'cognitive strategy', 'memory strategy' and 'compensation strategy' respectively. Furthermore, the least frequently rated strategy for the adolescent EFL learners in the control group of the post-test is 'metacognitive strategy', which is the same for the adolescent EFL

learners in the experimental group. It was discovered that applying E-Mind Maps altered adolescent EFL learners' preferred language learning strategy. The favored language learning strategy of adolescent EFL learners has shifted away from social and compensatory strategies and toward cognitive and memory strategies.

The frequency and percentage of the adult EFL learners' ratings across experimental and control groups in the pretest were calculated to find the answer for the second research question about the possible effectiveness of utilizing E-Mind Maps on the language learning strategy choices rated by adult EFL learners. Table 7 shows the cross-tabulation for the frequency and percentages of the SILL among adult EFL learners (control group and experimental group) in the pretest. In this table, NT stands for never true of me, UNT stands for usually not true of me, ST stands for sometimes true of me, UT stands for usually true of me, and AT stands for always true of me.

Table 7.

*Cross-Tabulation for the Frequency and Percentages of The SILL among Adult EFL Learners (Control Group and Experimental Group) in the Pretest*

Adult (Pretest)	Strategy	Group	Frequency and Percentage									
			NT		UNT		ST		UT		AT	
			F	P%	F	P%	F	P%	F	P%	F	P%
Memory	C	31	40.8	15	19.7	13	17.1	10	13.2	7	9.2	
	E	28	36.8	16	21.1	14	18.4	11	14.5	7	9.2	
Cognitive	C	4	5.3	10	13.2	28	36.8	19	25.0	15	19.7	
	E	5	6.6	11	14.5	25	32.9	17	22.4	18	23.7	
Compensation	C	2	2.6	5	6.6	12	15.8	19	25.0	38	50.0	
	E	2	2.6	7	9.2	10	13.2	22	28.9	35	46.1	
Metacognitive	C	3	3.9	3	3.9	13	17.1	25	32.9	32	42.1	
	E	3	3.9	4	5.3	15	19.7	24	31.6	30	39.5	
Affective	C	4	5.3	29	38.2	20	26.3	13	17.1	10	13.2	
	E	6	7.9	25	32.9	22	28.9	15	19.7	8	10.5	
Social	C	2	2.6	4	5.3	15	19.7	29	38.2	26	34.2	
	E	3	3.9	5	6.6	17	22.4	27	35.5	24	31.6	

According to Table 7, the majority of adult EFL learners regarded 'compensation' and 'metacognitive' strategies as 'always true of me' in the pretest, both in the control and experimental groups. Adult EFL learners in

the pretest, both in the control and experimental groups, generally rated 'usually true of me' for the 'social' strategy. The 'cognitive' strategy is most frequently rated as 'somewhat true of me' by adult EFL learners in the pretest, both in the control and experimental groups. Adult EFL learners in the pretest, both in the control and experimental groups, largely rated 'usually not true of me' for the 'affective' strategy. Finally, the majority of adult EFL learners, both in the control and experimental groups, evaluated the 'memory' strategy as 'never true of me' during the pretest. The identical order of rated strategies for the control and experimental groups of adult EFL learners in the pretest demonstrates the learners' homogeneity and proper selection.

To check the post-test results for adult EFL learners in both the control and experimental group, their ratings in the SILL were calculated. Table 8, is a cross-tabulation for the frequency and percentages of the SILL among adult EFL learners (control group and experimental group) in the post-test. In this table, NT stands for never true of me, UNT stands for usually not true of me, ST stands for sometimes true of me, UT stands for usually true of me, and AT stands for always true of me.

Table 8.  
*Cross-Tabulation for the Frequency and Percentages of The SILL among Adult EFL Learners (Control Group and Experimental Group) in the Post-Test*

Adult (Post-Test)	Strategy	Group	Frequency and Percentage									
			NT		UNT		ST		UT		AT	
			F	P%	F	P%	F	P%	F	P%	F	P%
Memory	C	29	38.2	17	22.4	12	15.8	10	13.2	8	10.5	
	E	2	2.6	5	6.6	12	15.8	27	35.5	30	39.5	
Cognitive	C	5	6.6	9	11.8	30	39.5	18	23.7	14	18.4	
	E	1	1.3	1	1.3	14	18.4	25	32.9	35	46.1	
Compensation	C	1	1.3	6	7.9	14	18.4	21	27.6	34	44.7	
	E	1	1.3	9	11.8	15	19.7	29	38.2	22	28.9	
Metacognitive	C	3	3.9	5	6.6	15	19.7	23	30.3	30	39.5	
	E	4	5.3	6	7.9	30	39.5	21	27.6	15	19.7	
Affective	C	4	5.3	31	40.8	18	23.7	16	21.1	7	9.2	
	E	29	38.2	23	30.3	13	17.1	8	10.5	3	3.9	
Social	C	3	3.9	6	7.9	12	15.8	31	40.8	24	31.6	
	E	24	31.6	30	39.5	12	15.8	8	10.5	2	2.6	

According to Table 8, the same frequency order of the pretest for the rated strategies of the adult control group is repeated in the post-test. It shows no difference in the language learning strategy choices of the adult EFL learners in the control group in the pretest and the post-test. On the other hand, the frequency order of the language learning strategy choices of the adult EFL learners in the experimental group has been changed after exposure to the treatment.

As seen in Table 8, the majority of adult EFL learners in the experimental group of the post-test assessed their 'cognitive' and 'memory' strategies as 'always true of me'. Adult EFL learners in the post-test experimental group primarily rated 'generally true of me' for the 'compensation' strategy. Adult EFL learners most frequently rate the 'metacognitive' method as 'somewhat true of me' in the experimental group of the post-test. Adult EFL learners in the experimental group of the post-test generally rated 'usually not true of me' for the 'social' technique. Finally, the majority of adult EFL learners in the experimental group evaluated the 'affective' strategy as 'never true of me' on the post-test.

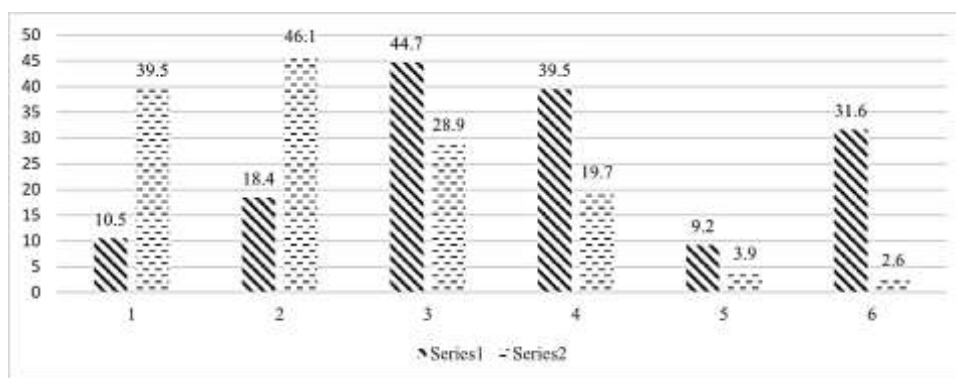


Figure 2. The total comparison of the preferred language learning strategy choices among adult EFL learners in the post-test

As Figure 2 reveals, the most frequently rated strategies for the adult EFL learners in the control group of the post-test are 'compensation strategy', 'metacognitive strategy' and 'social strategy', respectively. On the contrary, the post-test adult EFL learners in the experimental group mostly rated the



category of ‘cognitive strategy’, ‘memory strategy’ and ‘compensation strategy’ respectively. Furthermore, the least frequently rated strategy for the adult EFL learners in the control group of the post-test is in the category of ‘metacognitive strategy’, which is the same for the adult EFL learners in the experimental group. It was revealed that utilizing E-Mind Maps has changed the preferred language learning strategy of adult EFL learners. A shift in adult EFL learners' preferred language learning strategy has emerged from the paradigm of compensation and metacognitive strategies to a paradigm of cognitive and memory strategies.

Although the frequencies of rated language learning strategy choices varied between adolescent and adult EFL learners, a Chi-square statistical procedure was used to determine whether there was a possible significant difference in the language learning strategy choices of adolescent and adult EFL learners after being taught using E-Mind Maps.

Table 9.

*Chi-square for the Difference of Rated Language Learning Strategy Choices Between Adolescent vs. Adult EFL learners*

	Value	df	Asymptotic Significance (2-sided)
<b>Pearson Chi-Square</b>	444.425 <sup>a</sup>	45	.000
<b>Likelihood Ratio</b>	439.915	45	.000
<b>Linear-by-Linear Association</b>	43.802	1	.000
<b>N of Valid Cases</b>	912		

a. 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 7.17.

As shown in Table 9, there was a statistically significant difference in the rated language learning approach choices between adult and adolescent EFL learner  $\chi^2(45) = 444.425, p \leq 0.05$ . The significance value (0.000) for this comparison was smaller than the p-value, as indicated in the preceding table (0.05). The findings indicate a substantial difference in language learning approach preferences between teenage and adult EFL learners who were taught using E-Mind Maps.

### **Qualitative Findings**

The last research question of this study was posed to investigate adolescent, and adult EFL preferred language learning strategies through interviewing to elicit the required data. To this end, eight EFL learners in the experimental groups (four adolescents and four adults) were selected

randomly, and the effects of E-Mind Maps on their language learning strategy choices were explored. The content analysis of the data obtained from the four adolescent EFL learners' interviews is presented in Figure 3.

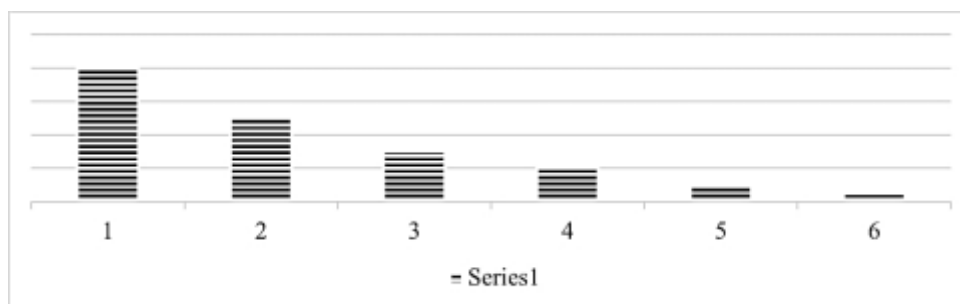


Figure 3. The most proffered language learning strategy choices across each category for the adolescent EFL learners

According to Figure 3, the most preferred language learning strategy for adolescent EFL learners after being taught through E-Mind Maps via Mind Meister software was summarizing in the first category, ‘cognitive strategy’. For the second category, ‘memory strategy’, most adolescent EFL learners reported improvement in their focus through their vision. Using gestures, a subscale in the category of ‘compensation strategy,’ was used by adolescent EFL learners as the most frequently used skill. Reducing anxiety was the top choice in the category of ‘affective strategy’. For the category of ‘social strategy’ and ‘metacognitive strategy’, the adolescent EFL learners reported cooperating with others and evaluating their learning as their preferred language learning strategy.

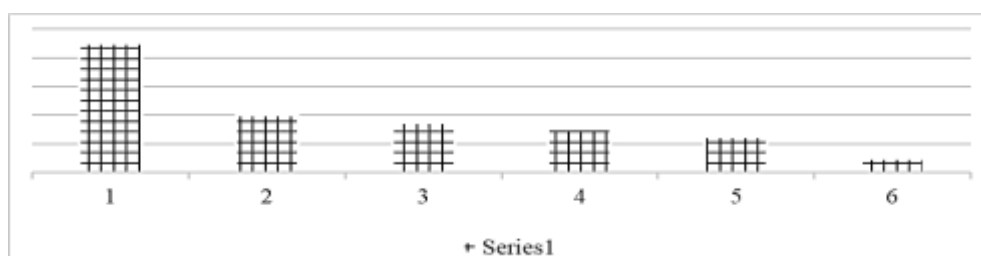


Figure 4. The most proffered language learning strategy choices across each category for the adult EFL learners

According to Figure 4, the most preferred language learning strategy for adult EFL learners after being taught through E-Mind Maps via Mind Meister software, in the first category, ‘cognitive strategy’, was analyzing and reasoning. For the second category, ‘memory strategy’, most adult EFL learners reported improvement in their focus through their vision. Adjusting the information that is a subscale in the category of ‘compensation strategy’ was used by adult EFL learners as the most frequently used skill. Planning learning was the top choice in the category of ‘affective strategy’. For the ‘social strategy’ and ‘metacognitive strategy’ categories, the adult EFL learners reported cultural awareness and encouraging oneself as their preferred language learning strategy.

### **Discussion**

To our knowledge, no research has been undertaken to date to explore the effects of Electronic Mind Maps on language learning approach choices among adolescent and adult EFL learners. Most of the studies in this field have analyzed the effects of traditional mind maps on EFL learners' different qualities, such as their motivation or achievement. Thus, the discussion of the results was limited.

The first three research questions of this study were posed to check whether utilizing E-Mind Maps affect the language learning strategy choices of adolescent, adult and, adolescent vs. adult EFL learners or not. It was shown that using E-Mind Maps changed the preferred language learning strategy of both adolescent and adult EFL learners. Furthermore, the findings revealed that both adolescent and adult EFL learners selected the same order of language learning strategy after exposure to the E-Mind Maps. In addition, there was a significant difference in the language learning strategy choices between adolescent vs. adult EFL learners after being taught through E-Mind Maps.

The results of this study are in line with a study conducted by Wang, Lee, and Chu (2010), in which the effectiveness of using mind maps on youngsters ‘critical thinking was investigated. It was revealed that using mind maps motivates youngsters and helps them develop their critical thinking. In this study, adolescent EFL learners changed their preferred

language learning choices toward cognitive-based and memory-based ones after using E-Mind Maps.

The fourth research question in this study examined the chosen language learning strategies of adolescent and adult EFL learners in terms of the effect of E-Mind Maps on their preferred language learning technique. After the exposure to treatment, both groups shifted to the language learning strategies, which were mainly based on cognition and memory.

The findings of the present study corroborate those of Amine (2013), who looked at the effectiveness of employing mind maps to help EFL students summarize lessons. It was discovered that using mind maps helped EFL students improve their summarizing abilities. As in this study, the adolescent EFL learners mentioned in the interview that their summarizing skill has been improved, and it has become one of their favorite language learning strategies. Furthermore, the findings of this study agree with those of Malekzadeh and Bayat (2015), who assessed the effectiveness of a mind mapping approach for deciphering implicit information in EFL reading texts. It was revealed that using the mind mapping strategy helped EFL learners to comprehend and retrieve critical and implicit information easily. In this study, the adult EFL learners mentioned in the interview that they use adjusting information strategies more than before in language learning.

Learners used strategies more frequently in an E-mind mapping-focused setting, demonstrating the value of technology-induced activities and learning processes in enabling autonomous learning and learner strategy development. Participants in this study have already had a learning experience that differs from that of a traditional teacher-led classroom, which means that the way Iranian EFL learners learn and the strategies they employ may change in the future. On the other hand, modifications that benefit learners in developing autonomous learning and associated learner strategies will not occur unless and until the educational system undergoes significant structural changes that place a greater emphasis on the learning process than on evaluation. This may also require a shift in teacher and learner perspectives on learning, as well as pedagogical innovations in material and task design (technology-assisted and learner-controlled) to

facilitate the development of conceptual and curriculum-level learning strategies.

These findings have implications for EFL learners' comprehension and design of the E-mind mapping technique, as well as for the establishment of acceptable self-directed learning techniques. This presents difficulties not only for classroom teachers in terms of reducing their dominant role in the classroom but also for curriculum designers and content curators in terms of maintaining control over the authenticity of learning materials and the usability of technology and brain-based learning.

The current study found that using E-Mind Maps through Mind Meister software has changed the preferred language learning strategy choices of both adolescent and adult EFL learners. Furthermore, the findings revealed that both groups of EFL learners have shifted toward cognitive strategies and memory strategies for learning the language after being taught through E-Mind Maps. The results of this study might have some implications for curriculum designers, policymakers, and EFL teachers. It is recommended for all of the mentioned groups to consider and investigate the hugely positive effects of using E-Mind Maps on whether adolescent or adult EFL learners. For further research, the effects of using E-Mind Maps on different types of EFL learners can be investigated such as introverts vs. extroverts with larger sample size. Another potential subject is to explore the possible impacts of using E-Mind Maps on males vs. females or other variables which are important in the process of EFL learning.

**Declaration of interest:** none

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