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Learning Style and Task Performance in Synchronous Computer-Mediated Communication: A Case Study of Iranian EFL Learners

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ABSTRACT

The study reported here explores whether English as a foreign Language (EFL) learners' preferred ways of learning (i.e., learning styles) affect their task performance in computer-mediated communication (CMC). As Ellis (2010) points out, while the increasing use of different sorts of technology is witnessed in language learning contexts, it is worth studying the conditions in which the most second language (L2) production would be accomplished. The participants were 40 advanced-level Iranian EFL learners enrolled at a language institute in Tehran. Learners' individual learning styles were probed by Felder-Soloman (1991) Index of Learning Style (ILS) and they were categorized into 8 groups, within 4 dimensions: Active vs. Reflective, Sensing vs. Intuitive, Visual vs. Verbal, and Sequential vs. Global learners. Then, the participants were given the opinion-gap tasks in 6 consecutive online chat sessions within a 3-week period. The participants' produced language was analyzed at two levels: vocabulary, and grammar. Independent samples t-test were conducted to check if the differences between the groups were significant. The results reveal that the Reflective learners and Visual Learners produced grammatically more complex and lexically denser sentences than the other groups, which suggests that learners' learning styles may affect their task performance in synchronous computer-mediated communication.

Keywords

Learning style, Synchronous computer-mediated communication, Task-based language teaching, Opinion-gap task, Felder-Soloman index of learning style

Introduction

Recently, studies on Task-based Language Teaching (TBLT) have lent credence to investigation of TBLT in technology-mediated contexts to find out the technology's impact on task performance, and at the same time, to discover the potential opportunities that technology would offer for more effective TBLT courses. Similar to face-to-face TBLT, many factors and conditions influence the quality and quantity of task performance in technology-mediated TBLT; for example, task complexity (Robinson, 2001), corrective feedback (Loewen & Erlam, 2006), task type, teacher factors, learner factors (Oxford, 2006), and so forth. Ellis (2010) points out that for implementation of technology in TBLT environment, there must be a full understanding of the conditions in order to prepare the best design to foster learners' learning. Accordingly, a well connection is needed among theory, research and practice to set the best condition for the favorable synergy between technology and task-based approaches.

As was mentioned above, one of the factors which influence the task performance is learner factor (Oxford, 2006). It includes, as Oxford (2006, p. 17) states, "different task roles for learners as well as individual learning styles." Considering the distinction between task, as the work plan, and activity, as the communication which results from the performance of the task, learners interpret the work plan in terms of their own needs, characteristics and motives. So, a single task may result in various activities when performed by different learners or even by the same learners on different occasions and in different contexts (Ellis, 2010). On the other hand, while tasks are done in a technology-meditated environment, more options are available for language learners and this phenomenon could lead to more variant interpretations of a single task as a workplan. This study aimed to investigate the relationship between learners' individual learning styles and their task performance in technology-mediated context based on lexical density and diversity (types-token ratio), and syntactic complexity and accuracy to find out which learning styles contribute to better task performance.

Literature review

During the last fifty years, it has been witnessed that the application of technology in language learning has been more apparent than ever before and it can be traced back in the development of computer, the Internet and software. In more recent years, a synergy between Task-based Language Teaching and technology is observed. Chapelle believes that the conditions in which language learning take place are changing constantly (Chapelle, 2003). It is undeniable that nowadays language learners have access to vast amount of language materials through the Internet and computers and many of them are using these materials, even when they are not put and predicted in their syllabus. Prensky (2003) believes that today's world would seem meaningless to students without access to the Internet, computers and digital media.

In a reciprocal approach, Chapelle (2003) points out that TBLT can guide instructors in selection of technology-enhanced language learning sources and materials. This view suggests that technology and TBLT can move together to reach an optimal point where language learners be able to achieve the optimum performance in language learning process. Doughty and Long (2003) also emphasize the reciprocal relationship and interdependence between technology and TBLT. At the same time, they state, TBLT provides a foundation and outline to select proper technological tools and facilities. They, then, point out that the selection among technological options for language learning and teaching purpose must be theoretically and empirically inspired rather than being market-driven.

The aim of all teachers is to make the best environment for their students so that they could learn a new language in the best possible way. To reach this goal, many factors are involved and teachers must be aware of them. These factors correspondingly do exist in technology-mediated language teaching contexts. It doesn't seem reasonable to conclude that the sole use of technology would bring positive attitudes and better language learning for all the learners with different characteristics, even in a single classroom.

Oxford (2006, p. 9) proposes five dimensions for the task framework: "task type (for example, information-gap), importance of task (low- or high-stake requirement), task complexity (at linguistic or cognitive levels), and teacher factor (task roles for teachers as well as the support teachers give to learners), and learner factor (different task roles for learners as well as individual learning styles)." Among these dimensions, learner factor is the focus of this study. Teachers must know about their students' characteristics and the best way they can learn a new subject. A single subject might be interpreted and grasped in different ways by different students in a certain language classroom and result in complete chaos.

In the literature, various roles have been assigned to learners such as group participant, monitor, risk taker/innovator, strategy-user, goal-setter, self-evaluator, task-analyzer, and more (for example, Honeyfield, 1993; Oxford, 1990; Richards & Rodgers, 2001). The other learner factor is learner's individual learning style.

Learning styles are "the attitudes and behaviors which determine an individual's preferred way of learning" (Honey et al., 1992, p. 1). Keefe (1982, p. 4) defines learning styles as "cognitive, affective, and psychological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment". Fenrich (2006) states that instructional designers must consider learners' learning styles when they are designing certain syllabus and materials in order to achieve the maximum learning state of the students. Research in this area has shown that a match between leaning style and instructional materials can lead to learners' success in learning and performing tasks in order to achieve a particular outcome (Ayersman, 1993; Ghaoui & Janvier, 2004; Price, 2004; Yung-Bin, 1992).

Robin states that "in the immediate future – the next five to ten years – the frontier in language learning and technology will not be found in what program does what better, but rather which students use off-the-shelf technology to best facilitate their own learning in their own learning style" (2007, p. 109). Empirical research suggests that it may be the best to adapt instructional delivery and content to accommodate differences in the ways students learn (Hansen & Stansfield, 1981; Hansen, 1980).

Raschio (1990) examined the role of cognitive style in improving Computer-assisted Language Learning (CALL). In his study he concludes that "for CALL to be effective, we must not only give our students access to computers for reasonable amounts of time; we must also understand their learning strategies and provide exercises that are conducive to their particular cognitive [learning] style" (Raschio, 1990, p. 540).

Canavan (2004) investigated how personalized courses can be delivered to the learner in an adaptive environment. More specifically, he examined how learning style information can be integrated into an Adaptive Hypermedia System to offer increased personalization which will result in better learning. In another study, Shaw (2012) investigated the relationship between learning styles, participation types, and performance in programming language learning supported by online forums. He uses Kolb's (1999) learning style inventory in his study. He concluded that different learning styles were associated with significantly different learning scores.

Purpose of the study and research questions

The aim of this study was to investigate the language produced by learners in a synchronous environment in terms of lexical density and diversity, and syntactic complexity and accuracy in relation to learners' individual learning styles.

To fulfill the objectives of this study the following questions were raised to be answered:

- Is there any relationship between learning style of the learners and their performance in tasks carried out in the Synchronous Computer-mediated Communication (SCMC) in terms of lexical density and diversity, and syntactic complexity and accuracy?
- Which learning style(s) contribute to better task performance in SCMC?

And the following null hypotheses were formulated for answering the research questions:

H_o1: There is no significant relationship between learners' learning style and their performance in tasks carried out in SCMC in terms of lexical density and diversity, and syntactic complexity and accuracy.

H_o2: No specific learning style contributes to better task performance in SCMC.

Material and methods

Participants

In this study participants, initially, consisted of 60 advanced-level Iranian EFL learners. Levy and Stockwell (2006) suggest that learners need to achieve a certain level of language proficiency to deal with synchronous communication; and that is why the advanced-level learners were selected for this study. After employing the learning style inventory, 40 of them with different learning styles were selected and categorized into eight groups with different learning styles defined in Felder-Silverman Learning Style Model. This selection was done in order to have almost equal number of participants for each learning style dimension. Another point was that, the participants with higher tendency toward any learning style dimension were selected.

The participants' age range was between 20 to 32 and they had at least three years of English learning experience at the time of task performance. They consisted of both females (N = 23) and males (N = 17) and their education level varied from Bachelor's to PhD degree. They were selected from EFL learners enrolled at a language institute in Tehran, Iran, which is affiliated to University of Tehran, Faculty of Foreign Languages and Literatures. The participants' level of proficiency was assumed to be the same as they were in the same level studying Summit 1a (Saslow & Ascher, 2006) and they were classmates for more than four semesters. To be more accurate and definite about participants' level of proficiency, the researcher had interviews with all of them in separate sessions. This examination had a qualitative nature and no scores were given to participants' performance.

Instruments

The instruments used in this study consisted of one learning style questionnaire and one online chat tool. Felder-Soloman's (1991) Index of Learning Style (ILS) was chosen to be used among different learning style models. The online chat tool was located in a website (www.mohsenhedayati.ir) designed and developed by the researcher for the purpose of the present study.

Felder-Soloman Index of Learning Style

There are different learning style inventories in the literature: Kolb (1984), Honey and Mumford (1992) and others. In this study, Felder-Soloman (1991) Index of Learning Style (ILS) was used, which is based on Felder-Silverman (1988) Learning Style Model (FSLSM). The reason for choosing ILS for this study was that "most other learning style models classify learners into a few groups, whereas Felder and Soloman describe the learning style of a learner in more detail, distinguishing between preferences on four dimensions. Another main difference is that ILS is based on tendencies; indicating that learners with a high preference for certain behavior can also act sometimes differently" (Graf et al., 2007, p.3). Carver et al. (1999, p. 34) believe "the Felder Model is most appropriate for hypermedia courseware." This comment suggests the appropriateness of the ILS for studies in which technology is integrated using different tools in multimedia.

Kuljis and Liu (2005) did a comparison among learning style models and introduced Felder Model as the most appropriate one. In this inventory four dimensions are identified: Active versus reflective learners, sensing versus intuitive learners, visual versus verbal learners, and sequential versus global learners. The inventory consists of 44 items and each learner has a personal preference for each dimension. These preferences are expressed with values between +11 to -11 per dimension, with steps +/-2 (Graf et al., 2007).

Concerning the reliability and the validity of this inventory, a number of studies have reported high reliability and validity for it. Seery et al. (2003), for example, examined the test-retest reliability of this test and reported a high correlation in all the four dimensions (0.804 for Active/reflective dimension, 0.787 for sensing/intuitive dimension, .870 for visual/verbal dimension, and .725 for global/sequential dimension; all coefficients are significant at the 0.05 level or better). The internal consistency reliability of ILS which investigates the homogeneity of the items within a test is measured in Zywno's (2003) study. He uses Cronbach's coefficient alpha metric and reports almost high homogeneity among the items in all the four dimensions (.60, .70, .63, and .53; all greater than the criterion value of 0.5). In terms of construct validity, which signifies how successfully a certain instrument really measures the theoretical construct, Felder and Spurlin (2005) conducted a study and based on the results confirmed ILS's construct validity.

Online chat tool

In the present study, participants were asked to take part in online chat sessions. Through these chat sessions they were involved in an opinion-gap task performed in the style of free discussion. This online chat accessibility was supplied in a website designed and developed by the researcher for the purpose of the present study. In this web site (www.mohsenhedayati.ir), there is a section for synchronous chat which is designed highly sensitive to the goals of the study.

Method and procedure

The procedure of this study consisted of three phases: implementing Learning Style Questionnaire, collecting data from synchronous chat sessions, and data analysis. This study benefited from a descriptive design with a deductive objective.

Since the main part of this study was conducted in a technology-mediated environment using the Internet, the implementation of Learning Style Questionnaire was also done online. When the participants were chosen for the first time, their email addresses were asked and recorded, and afterwards, all the procedure was followed by using the Internet. The ILS questionnaire was emailed to participants in pdf format and they were asked to answer and email it back within one week. Based on the results, the participants were categorized into 8 groups in four dimensions: Active vs. Reflective, Sensing vs. Intuitive, Visual vs. Verbal, and Sequential vs. Global learners. The next step was to hold the synchronous chat sessions for performing the opinion-gap task.

As the main part of the study, the participants were asked to take part in synchronous chat sessions to perform free discussion task. The discussion topics were chosen from the topics in the students' course book (Summit, 1A), for example: new perspectives into life, musical moods, money matters and etc. This link between the discussion topics

and students course book let them have access to related vocabularies and grammar. There were six online free discussion sessions, each one lasting for 50 to 70 minutes. These sessions were held twice a week on Mondays and Thursdays for three consecutive weeks. The researcher took part in the discussions as the facilitator and tried to prepare the equal opportunities for all the participants to get involved in the discussion. This control let all the participants share their ideas with others. The researcher introduced the topic of discussion at the beginning of every chat session and then asked the participants to share their ideas one by one. When one of the students completed his/her writing, others were invited to comment on his/her ideas.

After the six discussions were conducted, all the texts were recorded and every participant's produced language was saved individually to his/her own profile on Microsoft Word software. Every utterance produced by the students in the chat session was counted as data for analysis. In other words, no random selection was used for data selection. After six sessions, every student's profile included around 446-482 words, and 51-62 sentences. The next step began by analyzing these data based on Lexical density and diversity, and syntactic complexity and accuracy.

The main purpose of this study was to analyze the language produced by language learners in synchronous computer-mediated communication and examine whether there exist any relationship between their produced language and their individual learning style. In this regard, students' produced language was analyzed in terms of lexical density and diversity at vocabulary level, and syntactic complexity and accuracy at grammar level. For comparing these measures among groups in the four aforementioned dimensions the descriptive measures of mean (M) and standard deviation (SD) were used. Then, independent samples *t*-test was conducted to check if the differences between the groups were significant.

Lexical density was measured by calculating the proportion of lexical (content) items to the total number of words in the text (Ure, 1971). Lexical items involved nouns, verbs, adjectives, and most of the adverbs. In terms of lexical diversity, texts were analyzed to find out how many different words are used by a single student in their produced language. To calculate this measure, the WordSmith Tools (Scott, 2012) software was employed.

At grammar level, two measures of syntactic complexity and error-free C-units were used. Regarding syntactic complexity, the Average Sentence Length (ASL) index was utilized. To determine the average sentence length, the average number of words used in every sentence was calculated. This measurement was also done using WordSmith Tools (Scott, 2012) software. For the second measure, the percentage of error-free C-units in learners' produced language was calculated. The rationale behind choosing C-units is that they include partial sentences as well as complete sentences. In contrast, T-units only include sentences that can stand alone. Since many utterances in online communication include partial sentences, using c-units, all the utterances could be analyzed. It's worth mentioning that, 50 percent of the analyses (i.e., lexical density and error-free c-units) which were done by the researcher were reanalyzed by an experienced Ph.D. student in TEFL.

Results

Learners' learning style frequency

In the first phase of this study, the researcher identified language learners' individual learning style using ILS and categorized them into eight groups in four dimensions (see Tables 1, 2, 3, and 4).

Table 1. Frequency of participants, first dimension (active/reflective)

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Active	21	52.5	52.5	52.5
	Reflective	19	47.5	47.5	100
	Total	40	100	100	

Table 2. Frequency of participants, second dimension (sensing/intuitive)

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Sensing	18	45	45	45
	Intuitive	22	55	55	100
	Total	40	100	100	

Table 3. Frequency of participants, third dimension (verbal/visual)

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Verbal	13	32.5	35	35
	Visual	27	67.5	65	100
	Total	40	100	100	

Table 4. Frequency of participants, fourth dimension (sequential/global)

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Sequential	17	42.5	37.5	37.5
	Global	23	57.5	62.5	100
	Total	40	100	100	

Lexical density and diversity analysis

At vocabulary level, the participants' produced language was analyzed using two measures of Lexical Density and Lexical Diversity (see Table 5). Lexical Density was calculated by the formula developed by Ure (1971):

$$\text{LD} = \frac{\text{Lexical items}}{\text{Total number of words}} \text{ x } 100$$

As the purpose of this study, the mean lexical density of the language produced by participants in every group was compared with the other group's mean in every one of the dimensions using independent samples *t*-test and the following results were gained. The same process was performed for lexical diversity, but this measure was calculated by Wordsmith software (2012).

In the first dimension, it was revealed that the reflective learners outperformed the active ones in terms of lexical density (by the overall mean of 45.83 in comparison to the overall mean of 41.69). An independent samples *t*-test was conducted to compare the lexical density scores for active and reflective learners. As shown in Tables 5 and 6, there was a significant difference in the mean lexical density of active learners (M = 41.69, SD = 4.39, N = 21) and reflective learners, M = 45.83, SD = 5.73, N = 19; $t(38) = 1.71$, P = .050 (two-tailed). These results showed that reflective learners produced lexically denser sentences in comparison to active learners.

Table 5. Descriptive statistics for students' performance at vocabulary level

		Lexical density				Lexical diversity			
		N	Mean	*SD*	Sig.	*N*	Mean	*SD*	Sig.
Dimension 1	Active	21	41.6962	4.39676	.050	21	56.6576	8.87385	.050
	Reflective	19	45.8395	5.73873		19	60.5979	7.31177	
Dimension 2	Sensing	18	40.0522	3.53534	.011	18	54.1411	6.57722	.034
	intuitive	22	44.0286	5.44868		22	59.5286	8.51685	
Dimension 3	Verbal	13	38.3862	2.57768	.000	13	52.6469	8.70487	.013
	Visual	27	44.0944	4.90996		27	59.2504	6.94513	
Dimension 4	Sequential	17	43.9918	5.14807	.050	17	59.1735	8.66963	.050
	Global	23	40.9439	4.65938		23	56.3139	7.71550	

The mean lexical density was also different in the other three dimensions, and these differences were all significant (see, Tables 5 and Figure 1). In the second dimension, intuitive learners (M = 44.02, SD = 5.44, N = 22) outperformed the sensing learners (M = 40.05, SD = 3.53, N = 18) and this difference was significant; $t(38) = 2.66$, P = .011 (two-tailed). In the third dimension, the results also indicated that visual learners (M = 44.09, SD = 4.90, N = 27) produced lexically denser sentences in comparison to verbal learners (M = 38.38, SD = 2.57, N = 13). In the last dimension, sequential learners (M = 43.99, SD = 5.14, N = 17) outperformed the global learners (M = 40.94, SD = 4.65, N = 23). The significance levels of these differences were calculated using independent-samples *t*-test and results are reported in Table 6.

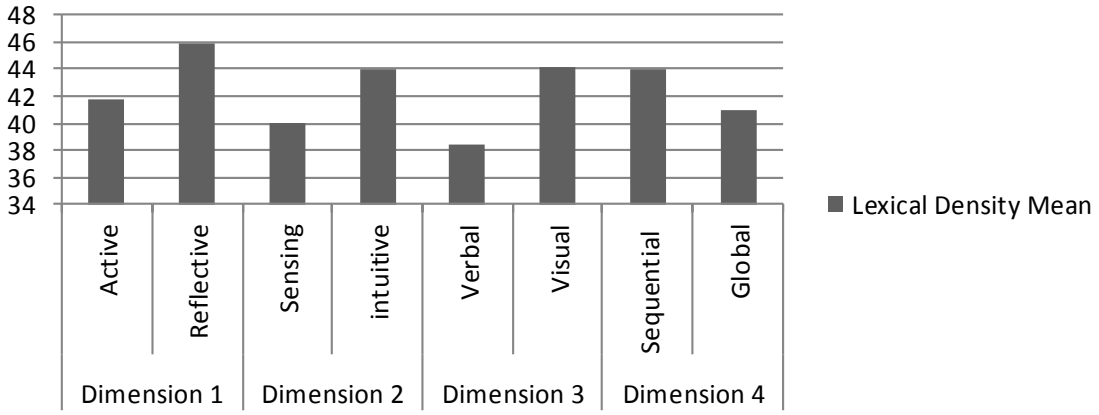

Figure 1. Lexical density mean

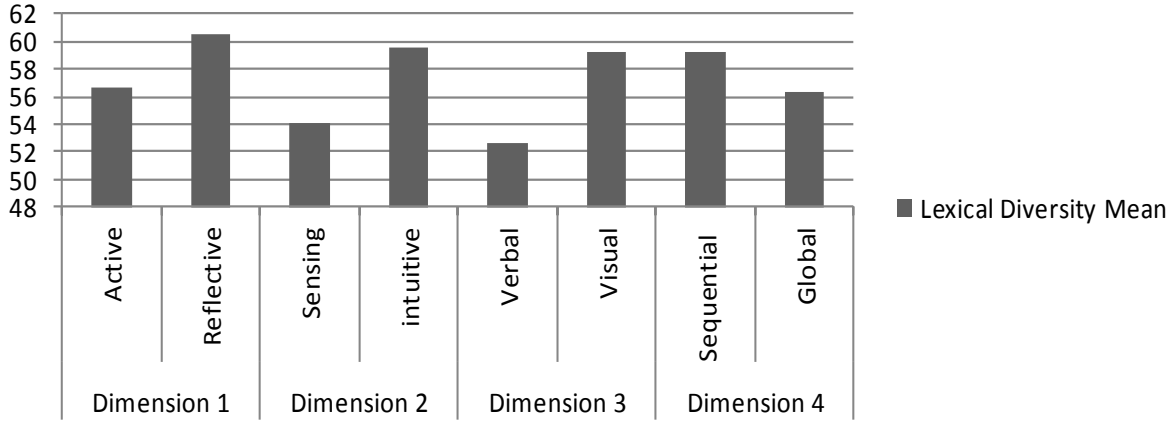

Figure 2. Lexical Diversity Mean

Table 6. Independent Samples *t*-test for Lexical density means

		t-test for equality of means (Lexical Density)				
		t	*df*	Sig. (2-tailed)	Mean difference	Std. error difference
Dimension 1	Active Reflective	-1.711	38	.050	-4.14328	1.60745
Dimension 2	Sensing Intuitive	-2.668	38	.011	-3.97641	1.49065
Dimension 3	Verbal Visual	-3.922	38	.000	-5.70829	1.45563
Dimension 4	Sequential Global	1.956	38	.050	3.04785	1.55801

The results for the lexical diversity analysis also indicated significant difference between groups in the four dimensions (see Table 7 and Figure 2). The independent samples *t*-test was also conducted at this level. The results showed that reflective learners (M = 60.59, SD = 7.31, N = 19) used more variant words in their sentences, in comparison to active learners (M = 56.65, SD = 8.87, N = 21); $t(38) = 1.36$, P = .050 (two-tailed). In the second dimension, the results indicated that intuitive learners (M = 59.52, SD = 8.51, N = 22) used greater variety of words in their produced language comparing to sensing learners (M = 54.14, SD = 6.57, N = 18); $t(38) = 2.19$, P = .034 (two-tailed). In the third dimensions, visual learners (M = 59.25, SD = 6.94, N = 27) had higher lexical diversity rate than verbal learners (M = 52.64, SD = 8.70, N = 13); $t(38) = 2.59$, P = .013 (two-tailed). In the fourth dimension, Sequential learners (M = 59.17, SD = 8.66, N = 17) used more different lexical words in the language they produced comparing to global learners (M = 56.31, SD = 7.71, N = 23); $t(38) = 1.71$, P = .050 (two-tailed).

Table 7. Independent samples *t*-test for Lexical diversity means

		t-test for equality of means (Lexical Diversity)				
		t	*df*	Sig. (2-tailed)	Mean difference	Std. error difference
Dimension 1	Active Reflective	-1.363	38	.050	-4.94028	2.58721
Dimension 2	Sensing Intuitive	-2.199	38	.034	-5.38753	2.45030
Dimension 3	Verbal Visual	-2.592	38	.013	-6.60345	2.54714
Dimension 4	Sequential Global	1.715	38	.050	2.85962	2.60064

Syntactic complexity and accuracy analysis

Data was first analyzed at vocabulary level, in the first phase of the study, and then the same data was investigated at grammar level. To analyze the learners' produced language at grammar level, two measures of Average Sentence Length (ASL) and percentage of error-free c-units (EFU) were used (see Table 8). The ASL was calculated using Wordsmith tool (2012), and the calculation of mean percentage of error-free c-units was accomplished by the researcher. The results showed that, in general, learners in some of the groups of learning style model performed differently at grammar level in comparison to vocabulary level.

At grammar level reflective learners showed better performance in terms of both mean average sentence length (see Table 9 and Figure 3) and mean percentage of error-free c-units (see Table 10 and Figure 4). The results of independent samples *t*-test showed that reflective learners (M = 9.12, SD = 2.89, N = 19) produced longer sentences in comparison to active learners (M = 7.40, SD = 2.38, N = 21); $t(38) = 2.06$, P = .046 (two-tailed). In the second dimension, the results of independent samples *t*-test indicated that sensing learners (M = 9.50, SD = 3.09, N = 18) produced longer sentences in comparison to intuitive learners (M = 7.98, SD = 2.47, N = 22); and this difference between means was significant; $t(38) = 1.58$, P = .050. These results showed that sensing and intuitive learners had different performance at vocabulary and grammar level. At vocabulary level, intuitive learners outperformed the sensing learners, but at grammar level, the opposite was true.

In the third dimension, visual learners outperformed verbal learners; the same was witnessed at vocabulary level. The results of the independent samples *t*-test revealed a significant difference between the mean of average sentence length of visual learners (M = 10.22, SD = 2.64, N = 27) and the verbal learners (M = 8.20, SD = 3.07, N = 13); $t(38)$ = 1.02, P = .040 (two-tailed). In the last dimension, results were not the same as at vocabulary level; global learners had better performance than sequential learners at grammar level. Global learners (M = 9.10, SD = 2.67, N = 23) produced longer sentences than sequential learners (M = 7.01, SD = 2.42, N 17), and this difference between means was shown to be significant; $t(38) = 2.53$, P = .015.

Table 8. Descriptive statistics for students' performance at grammar level

		Average Sentence Length				Error-free C-units			
		N	Mean	*SD*	Sig.	*N*	Mean	*SD*	Sig.
Dimension 1	Active	21	7.4014	2.38714	.046	21	43.952	6.0578	.030
	Reflective	19	9.1258	2.89645		19	47.953	5.9645	
Dimension 2	Sensing	18	9.5033	3.09680	.050	18	46.211	6.9377	.040
	Intuitive	22	7.9891	2.47835		22	44.695	5.4471	
Dimension 3	Verbal	13	8.2038	3.07325	.040	13	44.923	6.8975	.030
	Visual	27	10.2285	2.64062		27	46.596	5.8480	
Dimension 4	Sequential	17	7.0188	2.42346	.015	17	42.876	4.9150	.024
	Global	23	9.1087	2.67968		23	47.226	6.3698	

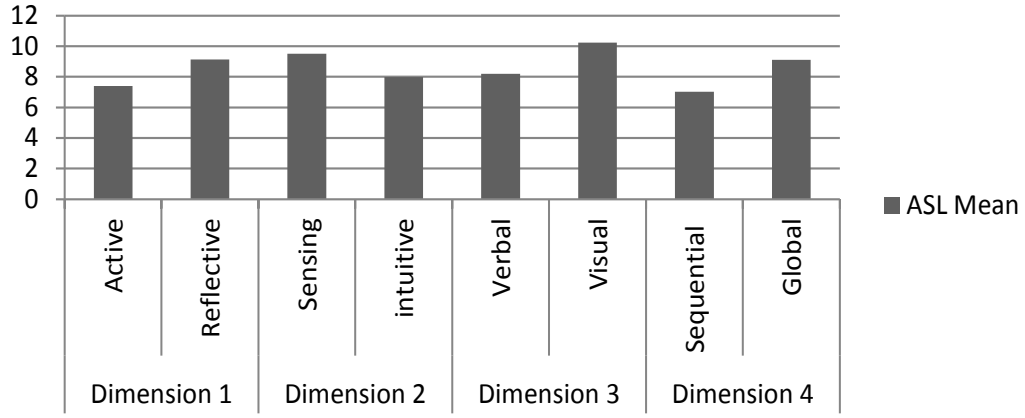

Figure 3. Average Sentence Length (ASL) Mean

Table 9. Independent Samples *t*-test for ASL

		t-test for equality of means (Average Sentence Length)				
		t	*df*	Sig. (2-tailed)	Mean difference	Std. error difference
Dimension 1	Active Reflective	-2.062	38	.046	-1.72436	.83610
Dimension 2	Sensing Intuitive	1.584	38	.050	2.51424	.88104
Dimension 3	Visual Verbal	-1.026	38	.040	-2.02467	.93999
Dimension 4	Sequential Global	-2.538	38	.015	-2.08987	.82357

At accuracy level, the data was analyzed by percentage of error-free c-units measure to investigate the accuracy level of the produced language by the learners. Independent samples *t*-test was used to compare the means between the groups in the four dimensions. The results of the analysis revealed a significant difference between the means of the error-free c-units' percentage between the groups. In the first dimension, the results showed that reflective learners (M = 47.95, SD = 5.96, N = 19) were more accurate than active learner (M = 43.95, SD = 6.05, N = 21) and this difference was significant; $t(38) = 1.57$, P = .030. In the second dimension, sensing learners (M = 46.21, SD = 6.93, N = 18) were more accurate than intuitive learners (M = 44.69, SD = 5.44, N = 22); $t(38) = 1.77$, P = .040. In the third dimension, Visual learners (M = 46.59, SD = 5.84, N = 27) outperformed the verbal learners (M = 44.92, SD = 6.89, N = 13) in terms of accuracy; $t(38) = 1.32$, P = .030. In the fourth dimension, global learners (M = 47.22, SD = 6.36, N = 23) were more accurate than sequential learners (M = 42.87, SD = 4.91, N= 17); $t(38) = 2.34$, P = .024 (two-tailed).

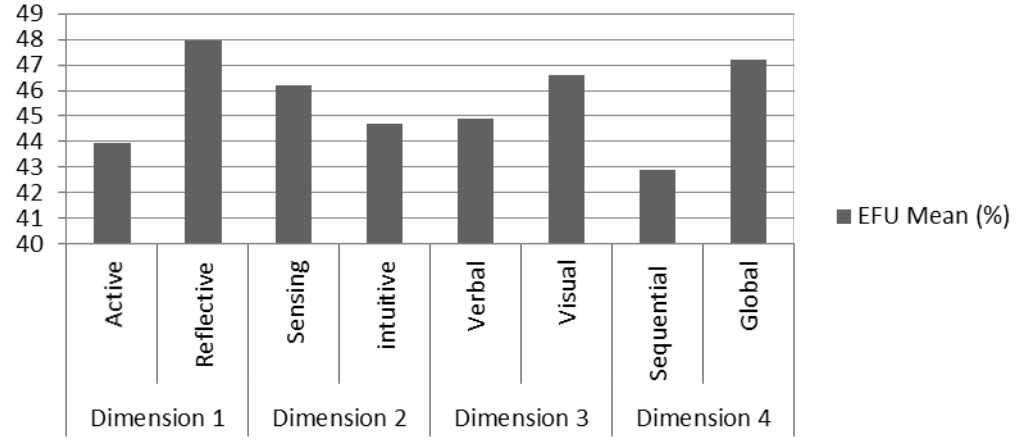

Figure 4. Percentage of Error-free C-units (EFU) Mean

Table 10. Independent samples *t*-test for error-free

		t-test for equality of means (Error-free c-units)				
		t	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Dimension 1	Active Reflective	-1.576	38	.030	-4.0003	1.9041
Dimension 2	Sensing Intuitive	1.774	38	.040	1.5157	1.9574
Dimension 3	Visual Verbal	-1.322	38	.030	-2.6732	2.0925
Dimension 4	Sequential Global	-2.344	38	.024	-4.3496	1.8557

Discussion

Felder and Soloman (1991) described the characteristics of the learners with any of the learning styles in FSLSM. They suggested that, in the first dimension, active learners learn best by doing something physically and prefer group working, while reflective learners prefer to think about something comprehensively and they tend to work alone. The results of this study showed that reflective learners produced lexically denser sentences in comparison to active learners; this was also witnessed in terms of lexical diversity. This difference was more obvious at grammar level where reflective learners produced longer sentences with higher percentage of error-free c-units. The longer sentences with higher percentage of error-free c-units can denote a relationship between reflective learners' thoughtfulness and their better performance at grammar level in SCMC. In other words, it can be discussed that reflective learners sustained their thoughtfulness even in the fast nature of synchronous online chat rooms and tried to be more accurate rather than proficient. Reflective learners showed that they are not affected negatively with the time-pressure existed in the online chat. The other point is that, online discussions are assumed to be group works done by all the students and in this regard, students who prefer group work (Active learners) should have better performance. But the results of this study showed that reflective learners, who prefer working alone, had better performance.

Regarding the second dimension, Felder and Soloman (1991) stated that sensors have tendency toward being more practical and careful in comparison to intuitors who deemed to be more innovative. In this study, sensors produced longer sentences with higher percentage of error-free c-units, while intuitors outperformed sensors at vocabulary level by producing lexically denser and more variant sentences. These results suggest that, learners with sensing learning style attempted to follow well-established rules of syntax to produce accurate utterances. Sensors also used fewer abbreviations in comparison to intuitors. Intuitive learners benefited from their innovation ability and produced more abbreviated utterances among which some were coined by themselves at the moment of conversation. The following example shows the use of abbreviations coined by an intuitive learner (S1):

S1: *Even most lenient prnts are extremely strict in some mttrs.*

This example shows that intuitive learners are more successful in delivering their intended meaning in the shortest possible way. On the other hand, they might neglect spelling or grammatical rules and produce erroneous sentences.

Visual learners had lexically better performance than verbals and this was also witnessed at grammar level. Since visual learners prefer learning by pictures and analogous stuffs (Felder & Soloman, 1991), they benefited significantly from emoticons in the chat sessions. This opportunity let them convey their emotions and feelings using the small emoticons rather than verbal options. In some cases the number of emoticons denotes the degree of their specific feeling; as in the following example produced by a visual leaner (S1):

S1: *we can observe indirectly & slap directly :-D :-D :-D*

The online chat environment was not highly welcomed by verbal learners who prefer to be engaged in defined and rule-governed discussions. They mostly commented on the sentences written by the teacher rather than other students.

In the last dimension sequential learners had better performance at vocabulary level comparing to global learners. In contrast, at grammar level, global learners outperformed sequential learners. Felder and Soloman (1991) claimed that sequential learners follow linear steps for gaining new information and are able to make logical relationship among pieces of information. In other words, they have an analytic approach toward finding solutions for the existing problems, however, global learners, as the term "global" denotes, have synthetic approach toward solving problems and they need to get a whole picture of the new information to be able to deal with. These features, in my opinion, may not justify the existence of the relationship between sequential learners' outperformance at vocabulary level, and respectively global learners' outperformance at grammar level.

Based on the findings of this study, the first null hypothesis which assumed that "there is no significant relationship between learners' learning style and their performance in tasks carried out in SCMC in terms of lexical density and diversity, and syntactic complexity and accuracy," is rejected. The second research question asked whether any learning style(s) contribute to better task performance in synchronous computer-mediated communication (SCMC). The findings of the present study revealed that two groups of learning styles, reflective learners and visual learners, outperformed other groups at both vocabulary and grammar levels. In other words, reflective learners, as well as visual learners produced lexically denser sentences with higher variation of words. At the same time, they produced longer sentences with higher percentage of error-free c-units. Based on these findings the second null hypothesis was also rejected, where reflective learners as well as visual learners outperformed others lexically and syntactically. This difference in performance suggests that students with varying learning styles go through various learning experiences while using computer tools for communication.

Conclusions

Language learners' individual learning styles determine the pattern through which they deal with language input, as well as output. This research showed that when language learners find consistency between their preferred way of learning and the form of presented materials, they show higher access to their language abilities and display improved performance. In other words, individual differences can be the sources of performance variations in a language class. The results suggest that we should not expect the same performance from all the students in a technology-mediated language learning course until we have comprehensive information about their preferred way of learning by knowing their individual learning styles which determines looked-for ways of learning. This information will let both students and teachers to be more accurate in addressing the right area of discrepancy and divergence. This study confirms the idea that mere use of technology in language education is not a panacea which would results in increased language learning for all students.

Based on these findings, it is worth studying the feasibility of designing a technology-enhanced syllabus which corresponds to language learners' individual learning style, while sustaining the ultimate goals of the course.

At the time of the performance of this research there were some limitations which did not let the researcher include more variables to investigate the issue more comprehensively. For instance, language learners' setting at the time of online chat were not specified or homogenized. On the other hand, the setting heterogeneity of participants in an online chat room is inevitable in real-life situation. The other limitation was the varying number of participants in each group. While the number of participants could not be increased due to group management parameters, some learning styles are observed less than others in real-life situation and it was not possible to find equal number of participants for every group at the moment of study. In addition, task type was not included and investigated in this study, which could probably affect the results. The only task type used in this study was opinion-gap task; while other tasks like jigsaw and information-gap can be included. This study also can be performed in an asynchronous mode to see if the same results will be achieved; this study was conducted in a synchronous mode.

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