Can Virtual Noticing Enhance L2 Students' Lexical Complexity? A Study of the Effects of Online Discussions on L2 Learners' Lexical Complexity

Arab Journal of Applied Linguistics
e-ISSN 2490-4198
Vol. 5, No. 2, December 2020, 32-54

http://www.arjals.com

Diana Al Jahromi

University of Bahrain, Bahrain

Abstract

The primary aim of this study was to investigate the impact of using online discussions on L2 learners' lexical complexity (LC) using a blend of qualitative and quantitative data collection methods to measure how L2 learners' lexical variation, lexical density, and lexical richness can be influenced by online interactions facilitated in virtual discussions. In a quasi-experimental study, 50 3rd –year University of Bahrain L2 students were divided into an experimental group, which was involved in both in-class discussions and online discussion, and a control group, which was involved in in-class discussions only. These students' lexical variation, lexical density, and lexical richness were analysed and compared using three measures: *type/token ratio* (TTR), *the total number of lexical words divided by total no. of words (L/W)* and *P_Lex lambda* using measures of central tendency and independent sample *t*-tests. Overall results suggest that L2 learners' LC can be significantly enhanced through the utilization of online discussions in L2 learning settings due to a number of interrelated cognitive factors. Accordingly, a number of significant implications and recommendations have been delineated.

Keywords*:* *Lexical complexity, Lexical variation, Lexical density, Online discussions, Noticing*

Introduction

In formal EFL tertiary education, it is often stressed that language exposure and comprehensible linguistic data are significant conditions of adequate learning. Learners are exposed to such input through proper L2 instruction, authentic material, and communication. Once properly exposed, a number of reliable measures of language development are employed to gauge the degree of possible development in the language skills (Ellis, 2009). One of these measures is the complexity of the learners' output, whether grammatical or lexical. Complexity refers to the "extent to which learners produce elaborated language" (Ellis & Barkhuizen, 2005, p.139). According to Skehan (1996), complexity reveals how prepared L2 learners are to take risks and restructure their interlanguages. More specifically, lexical complexity entails that "a wide variety of basic and sophisticated words are available and can be accessed quickly" (Wolfe-Quintero, Inagaki & Kim, 1998, p.101). It marks the variety and sophistication of the words used and is reflected in L2 writing in many dimensions such as lexical variation/richness, and lexical density. While *lexical variation (LV)* reflects the number of different words in any spoken or written text , *lexical density (LD)*, as defined by Halliday (1985), is "a measure of the density of information in any passage of text, according to how tightly the lexical items (content words) have been packed into the grammatical structure" (p.10). The current research study defines LD as a concept that measures the complexity of using functional and content words in any given discourse. Development in these dimensions and others related to lexical complexity is a key measure of language development and a clear indicator of a writer's adoption of discourse conventions (Ishikawa, 2015; Nation, 2011). For instance, a positive and interconnected correlation between lexical variation and writing quality has been shown in a number of studies and lexical density has been found higher in the written texts with more unpredictable lexical words whereas speech has more predictable grammatical words (Engber, 1995; Halliday, 1985; Laufer, 1994; Read, 2000; Zhai, 2016).

Review of the Literature

Development of learners' lexical knowledge has attracted a number of researchers' attention (Ai & Lu, 2010; AlQahtani, 2015; Bulté & Housen, 2014; Lu, 2012; Nation, 2011; Zhou & Dai, 2016). While previous research studies were more concerned with the estimation of vocabulary size, current studies are more interested in measuring the lexical complexity using frameworks of different traits and measurable dimensions such as lexical variation, density and richness. The complexity of lexis has also been widely researched by Halliday (1985) and his Neo-Firthian followers. Halliday's Systemic-Functional Linguistics (SFL) stresses the consideration of function and semantics in understanding human language and the importance of acknowledging the social context obtained "through a systematic relationship between the social environment on the one hand, and the functional organization of language on the other" (Halliday, 1985, p.11). SFL-oriented approach considers three aspects of language: a) *textual*, measured by type/token ratio and lexical density; b) *interpersonal*, measured by the use of speech-functions, personal reference, discourse markers, exchange structure, involvement and detachment, and c) *ideational*, measured by the use of modality to refer to propositional content (Yates, 1996).

Type-token ratio (TTR), one of the best measures of *lexical variation* in any writer's discourse (Wolfe-Quintero, Inagaki & Kim, 1998), is often used to analyse each learner's overall linguistic behaviour and mark their 'voiceprint' or discourse signature (Davis & Brewer, 1997). TTR measures *the number of different words in a text as a percentage of the total number of words* within that text. If the TTR is high, this means that learners employ a more diverse linguistic form (Baker, 2006) and a clear shift in the individual's writing style or register (Davis & Brewer, 1997). If no significant changes are found, the discourse is possibly less lexically diverse and more repetitive. Many studies using TTR to evaluate the lexical complexity of online discussions have found different results. Yates (2001) found that the type/token ratio of the online discourse found in *CoSy* discussions (TTR= 0.590) was more akin to that found in the written corpus *LOB* (TTR=0.624) than the spoken corpus *London-*

Lund (TTR=0.395). However, although TTR is a straightforward measure of lexical complexity, it is sometimes considered flawed because its results can vary depending on text length (Ellis, 2009). When words are added to the sample, the number of tokens differs, not the number of types, if these are not new words. That said, standardisation of sample size is used to solve this problem and counting the number of types produced over a particular span of time is another way, although the latter method overlaps with of fluency measures. Also, the standardisation of the tokens' size is not feasible with a small-sized data and can lead to wasting any remaining data. The second weakness of TTR lies in its limited scope to distinguish word classes or types. Lexical items (content words: e.g., *language, beauty, study, etc.*) and grammatical items (e.g. *I, of, and, etc.*) are not differentiated and hence, do not truly reveal whether the discourse in hand is more speech-like for having increased grammatical items or more written-like for having increased lexical items. Yates (1993) suggests limiting the comparison of type/token ratio to lexical/content items only. Lexical variation measured by type/token ratio (TTR) also depends on a number of sociolinguistic aspects and hence, does not fully measure the textuality of a given discourse. However, TTR remains a practical measure that shows lexical variation in L2 writing, once it is standardised. Davis and Brewer (1997) used chunks of 50 words to calculate TTR for each student to evaluate the influence of online discussions on their lexical complexity and found significant results. Also, using a reliable complementary measure, such as calculating the lexical density of the discourse to determine how dense a text is with information (Yates, 1993) in addition to other measures alongside TTR, helps ensure sound provision results (Davis & Brewer, 1997; Wolfe-Quintero, Inagaki & Kim, 1998).

Measuring *lexical density* is expedient in identifying the lexical properties of writers as a high lexical density score often signifies greater language development of lexicon (Wolfe-Quintero, Inagaki & Kim, 1998). In addition, Halliday (1985) claims that as per lexical density, written language's lexical density is double that of speech (between 1.5 and 2 in speech versus between 3 and 6 in writing), and that there could be a higher proportion of

lexical items per clause in written language than speech. He computes lexical density by dividing the *total number of lexical items by the total number of lexical and grammatical items*. Yates (2001) also argues that this measure quantitatively captures the difference between written and spoken productions of language. He found that the mean lexical density of his online corpus (=0.492) was closer to the written corpus *LOB* (=0.503) than the lexical density found in the spoken corpus *London-Lund* (=0.422). Nevertheless, Yates argues that lexical density varies according to the types of online interactions involved, the user's experience with these types and the social context.

Table 1

Measures of Lexical Complexity

1. Lexical Variation:
   a. Type/Token Ratio (TTR): (Fitze, 2006; Ortega, 1999; Scott & Tribble, 1996; Warschauer, 1996; Yates, 1993, 1996; Yuan & Ellis, 2003)
   b. Ratio of different verb types to the total no. of verbs (VT/V)
2. Lexical Density or Token/Token Ratio: Total no. of lexical words divided by total no. of words (LW/W) (Engber, 1995; Halliday, 1985; Yates, 1996)
3. Lexical Richness: Lexical Frequency Profile (Laufer & Nation, 1995), P_Lex (Meara & Bell, 2001), and others (e.g. *Text_L*, *Textalyser*, etc.)

A number of other measures have been proposed to particularly evaluate learners' lexical richness, which Engber (1995) argues to affect the overall writing quality. Laufer and Nation (1995) propose using *Lexical Frequency Profile* (LFP) as a reliable measure as it reflects the proportion of words from varied levels of frequency and correlates with students' vocabulary size once placed in a situation that requires them to utilize their knowledge. Another more recent measure, however, is *P_Lex* (Meara & Bell, 2001). It is claimed to be more effective than LFP in assessing L2 learners' short texts (Espinosa, 2005) as it divides the written text into sections of 10 words each then counts the frequency of 'difficult' words

in each section. *P_Lex* considers 'difficult words' "any word that is not found in a short list of high frequency words" (Meara, 2001, p.1). In addition to the aforementioned measures, a number of other measures have been used by different researchers. Table 1 below summarises the measures used for each dimension and provides a list of the studies that have used these measures.

In investigating the effect of online discussion and communication facets on the enhancement of L2 skills, Warschauer (1996) compared the aspects of syntactic complexity and lexical range of online discourse compared to the ones in face-to-face discussions and concluded that there were greater significant relationships between both aspects and online discussions and more particularly with reference to the syntactic complexity. Yates (1996) carried out a quantitative discourse analysis study comparing asynchronous discussions on *CoSy*, the Open University's portal discussion, to existing corpora of speech and writing in terms of interaction, modality and textuality of CMC. His study is noteworthy in particular for the analysis of *lexical variation* through Type/Token ratios (TTR) and *lexical density*. Although the findings of his study have been used in a significant number of studies and although our study greatly benefited from its methods of analysis, its use in our study was limited because the three corpora were L1-based while our study is more concerned with the analysis of the discourse in asynchronous L2 discussions. Sotillo's (2000) found higher complexity in asynchronous rather than synchronous discussions because of the flexibility of time in the earlier. Many studies have shown that learners are more attentive to lexical items than grammatical structures when engaged in interactive negotiations of meaning (Al-Qahtani, 2015; Larsen-Freeman, 2011; Lu, 2012; Zheng, 2012). This could be considered a disadvantage of these interactions if a teacher's main aim is to increase students' accuracy. Abrams (2006) empirically compared the effect of synchronous, asynchronous and face-to-face (f2f) discussion on enhancing the lexical and syntactic quality of German students' oral language but found no significant differences between the three types of discussion, although synchronous discussion was found to be more effective than asynchronous discussion in encouraging whole-class interaction. Similarly, Lamy and Goodfellow (1999)

examined the asynchronous postings of L2 French learners on *Lexica*, and found that asynchronous discussion promoted learning through three levels of interaction *(a)* monologic *(i.e., "contain[ing] no invitation to interaction," p. 48), (b)* conversational/dialogic *(i.e., social in nature),* and *(c)* reflective *(i.e., allowing participants to negotiate meaning through personal exchanges, focus on formal features of language and strategies, and produce modified output within a structured setting).*

In addition to the aforementioned qualities of the utilization of online discussions in L2 classrooms, it seems that students get engaged in some novel cognitive processes that involve learning strategies that employ *noticing* and *intentional learning* strategy and *incidental learning* strategies (i.e., learning from context) (Hulstijn, 2001; Rieder, 2002). Nation (2011) maintains that incidental learning is considered the most crucial source of lexical learning in addition to the deliberate attention to decontexualised learning. It is then possible that incidental learning of lexis takes place in online discussions when students read their peers' virtually posted discussions. In addition to the fact that they learn new words, they also develop their functional and grammatical competence, and reading skills. Learners' attention might be incidentally drawn towards the unfamiliar lexical items they encounter while reading followed by the process of memory retrieval of these items while writing. *Noticing* is a cognitive process of conscious intake of the linguistic input the language learner receives. *Noticing*, which has lately received SLA theorists' and researchers' great attention, seems to have positive effects on the enhancement of L2 learning. Schmidt's (1990) *Noticing Theory* postulates that noticing is exclusive from attention, short-term memory, processing, and understanding and that it is a key ingredient for successful language learning as learners cannot improve their language skills and abilities if they are unable to process in a conscious manner the input which, once noticed, becomes an intake. This intake can help learners identify possible gaps between their own idiolects and those of others. Schmidt later modified his theory and stated that noticing is not a requirement of learning although noticing is an important process and the more learners notice, the more learning takes place.

Skehan's (1998) *Information Processing Model* lists a number of factors that influence noticing such as individual differences, classroom teaching, demands on talk, learners' readiness, and most importantly the "frequency and salience of the input" (Kuiken & Vedder, 2002, p.147). It is also proposed that the level of frequency of a particular form makes it more noticeable and hence, learners alternate or adapt their linguistic output (Long, Lee & VanPattern, 1996). Consequently, this modified output turns into modified input, which in return affects noticing. Figure 1 below demonstrates Skehan's model of the different types of noticing.

Figure 1

Skehan's (1998) Model on Types of Noticing

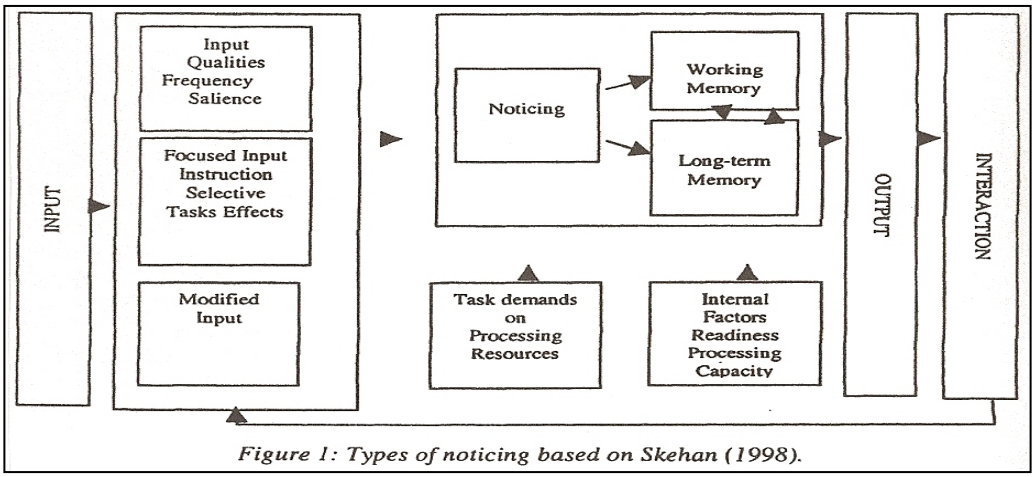


Figure 1: Types of noticing based on Skehan (1998).

Turning to the local context in Bahrain, a close analysis of the current L2 classroom practices reveals a number of setbacks that could be addressed to ensure the enhancement of students' lexical complexity. First, the majority of L2 Arab learners' written products can be characterised with the overuse of grammatical words and an underuse of lexical words, and hence, with low lexical complexity (Al Jahromi, 2012). In addition, it seems that, pertaining to instruction and curriculum design, L2 learning suffers from the lack of exposure to comprehensible and authentic input and other possibly related cognitive processes. Classroom tasks often lack interaction and authenticity, are more teacher-

centered, and the use of media and technology in class in many settings is still at its infancy. With the advancements in virtual instructional technologies, however, it is possible that different facets of these technologies be used to augment local and regional EFL settings with opportunities for increased input through the facilitation of asynchronous student-operated discussions, which can, if properly implemented, compensate for the insufficient exposure these learners need to enhance the lexical complexity of their written products and expedite higher-order thinking skills. Thus and while acknowledging Hinkel's (2003) argument that "research has not established with certainty what specific syntactic and lexical features, when taken together, can create an impression of a seemingly simplistic or reasonably sophisticated text in written L2 discourse" (p.275), this study investigated the effects of using online discussions in EFL writing classes on the development of university students' lexical complexity. It answered the following questions:

a) *Does the use of the online discussions improve L2 students' written lexical complexity?*
b) *What are students' perceptions of the effect of using online discussions on their lexical complexity?*
c) *What are the most significant variables that could enhance students' lexical complexity in virtual settings?*

Data Collection and Analysis

The subjects, who were 50 full-time 3rd-year L2 students from both genders enrolled at a language and literature undergraduate program at the University of Bahrain, were randomly divided into a control group which received normal instruction, and an experimental group which was engaged in online asynchronous discussions, served on the University portal, in addition to receiving normal instruction from the same teacher of the control group.

In order to measure students' lexical complexity, the design used was quasi-experimental as both groups were given a writing task as a pre- and post-test in weeks 1 and 12 respectively. During the period between weeks 2 and 11, the control group received normal instruction and was engaged in classroom discussions only, while the experimental group received normal instruction, was engaged in classroom discussions, and discussed with their peers course-related topics posted by the teacher on a university discussion board every weekend. The latter group had to post their opinions on 10 topics and reply to at least three peer responses. The aim behind that was to enhance interactivity and to encourage students to read their peers' posts. At the end of the experiment, semi-structured interviews were conducted with 10 randomly selected students in the experimental group to measure their viewpoints on the possible gains of the experiment.

Quantitative and qualitative data collection was employed. In addition to the pre- and post-study writing tests, transcripts of experimental students' threaded discussions were collected. Data were analysed using several methods. First, the pre- and post-study writing tests were marked using the same rubric and the results were compared. In addition, all the retrieved online discussion transcripts were analysed in a corpus using Wordsmiths Tools. Entries were cleansed and coded accordingly.

Table 2

Lexical Complexity Measures of Dimensions Used

1. Lexical Variation: Type/Token Ratio (TTR)
2. Lexical Density: Total no. of lexical words divided by total no. of words (L/W)
3. Lexical Richness: P_Lex

Students' lexical complexity was examined using multiple measures, as shown in Table 2 below: *lexical variation (LV)* was measured through the calculation of type/token ratio (TTR), and *lexical density (LD)* was measured through the calculation of the total number of lexical

words divided by the total number of words (L/W). To measure *lexical richness*, *P_Lex* was used to measure possible significant changes in students' lexical richness.

It is important to mention that lexical words identified were *nouns, verbs, adjectives*, and *adverbs* (i.e. non-grammatical words such as *articles, pronouns, prepositions, conjunctions, auxiliary verbs, interjections, particles, expletives and pro-sentences*). Also, derivatives were not considered different words during data analysis (e.g. "*pointy*," "*pointed*," as derivatives of "*point*"). A word family was considered a single word so that students who used derivatives are distinguished from those who used different families of words (Laufer & Nation, 1995).

In order to decide whether there were significant differences between the control group and the experimental group before the experiment, this study compared mean and standard deviation (SD), and performed independent sample *t*-tests on all the measures, which were calculated on the data obtained from the pre-test using SPSS with an alpha level of *0.05* as the significance level.

Results and Discussion

Results of the pre-test (*see* Table 3) indicated that there were no significant differences between both groups although the scores were widely distributed, which indicated the variability between members of both groups.

Table 3

Difference in Lexical Complexity between Control Groupand Experimental Group in the Pre-Test

Lexical Complexity	Measure	Group	$\bar{x}$	SD	*t*-test	*p*<.05
Lexical Variation	TTR	*Experimental*	53.9	5.65	.256	.799
		Control	53.4	6.01		
Lexical Density	L/W	*Experimental*	75.6	5.87	-.962	.342
		Control	77.3	4.83		

*$\bar{x}$ =mean, SD=standard deviation, t-test=values from t-test, p<.05=probability level, *=values are significant at the level of 0.05*

However, the independent sample *t*-tests, which aimed at measuring possible differences in the post-test between the control group and the experimental group after the use of online discussions, revealed that there were significant differences between both groups in the post-test in students' lexical variation and lexical density, in favor of the experimental group.

Table 4

Language Development Differences between Control Group and Experimental Group in the Post-test

Lexical Complexity	Measure	Group	$\bar{x}$	SD	*t*-test	*p*<.05
Lexical Variation	TTR	*Experimental*	57.9	7.04	2.028	0.049*
		Control	53.9	5.85		
Lexical Density	L/W	*Experimental*	83.5	3.53	3.812	.001*
		Control	77.7	5.60		

*$\bar{x}$ =mean, SD=standard deviation, t-test=values from t-test, p<.05=probability level, *=values are significant at the level of 0.05*

As illustrated in Table 4, results of the independent sample *t*-tests revealed that there was a significant difference between the experimental and control group's lexical complexity. Findings of standardised TTR showed a relatively significant difference between the control group and the experimental group's lexical complexity (*t*=2.028, *P*= 0.049*). It seems clear that students' written post-tests in the experimental group had higher lexical variation due to being involved in the online discussions for 10 weeks while no significant development was witnessed among students in the control group. In addition, highly significant differences were found between both groups in relation to the development of their lexical density measured by calculating the *ratio of lexical words to the total number of words* (*t*=3.81, *P*=0.001* for L/W), as also shown in Figure 2 and Figure 3 below. Lexical density was thus found to be higher in the experimental group as it seems

that students used more lexical words than grammatical words in their post-tests, and hence their written texts were denser than their counterparts in the control group.

Figure 2

Development of Students' Lexical Variation: Standardised Type/Token Ratio (TTR)

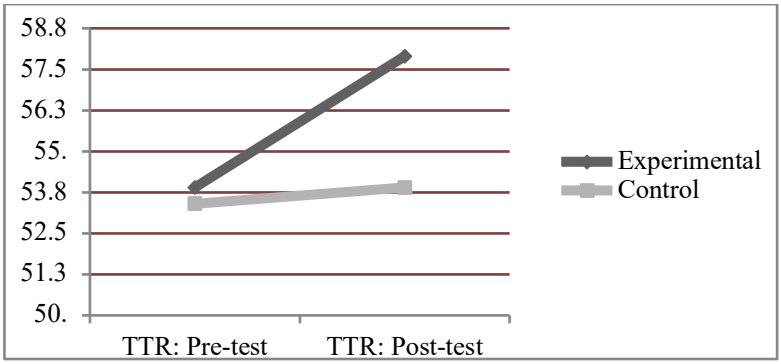
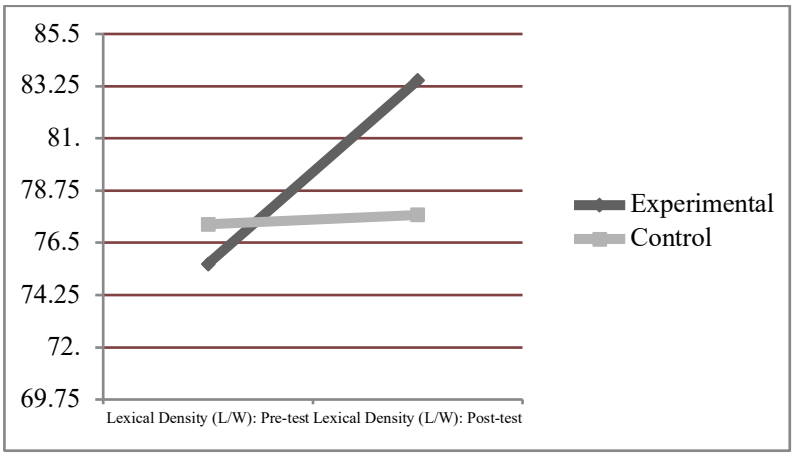


Figure 3

Development of Students' Lexical Density (L/W)



It seems that while students in the experimental group were discussing topics that they found interesting and relevant to their preferences and voicing their viewpoints over 10 weeks in a written mode, students were also consciously involved in reading their peers' posts. The fact that they were instructed to reply to their peers' initial posts necessitated that they carefully read these posts and develop replies that were reflective and critical. Such an employment of higher-order thinking skills must have entailed the employment of other cognitive skills such as noticing and memory retrieval which enabled them to produce virtual texts with lexical items used by their peers at an earlier stage. Hence, these findings

also underline the significance of scaffolding that online discussions expedite through active and collaborative student-student interactions (Cho & Cho, 2016).

To give further validity to the results on students' lexical complexity development, their lexical richness was assessed using *P_Lex*. Text length of students' pre-and post-study writings was standardised by dividing the data into chunks of 100 tokens (Espinosa, 2005; Read, 2000). The mean lambda value for both groups was found to be significantly different between both groups in the post-test while it was the same in the pre-test, as shown in Table 5 below.

Table 5

Mean Lambda Scores of Pre- and Post-Tests for Both Groups

	Lambda Experimental Group	*Lambda* Control Group
Pre-Test	0.99	0.99
Post-Test	1.69	1.16

These findings illustrated that the mean lambda value of the experimental group's writing has significantly increased in the post-test unlike the control group, whose lambda slightly increased in the post-test. These results positively correlate with those found using measures of lexical variation (TTR) and lexical density (L/W). Hence, we could conclude that the online discussions significantly helped improve students' lexical complexity at different levels. Many researchers have found similar results in relation to the effect of online communication, whether synchronous or asynchronous, on the lexical complexity of the participants. Similar findings were found by Abrams (2006), Cho and Kim (2013), Fitze (2006), Warschauer (1996), and Yates (1996). Fitze (2006), for instance, found that students' online conferences were significantly lexically denser than face-to-face conferences.

With reference to students' perceptions of the possible gains using online discussions had on their lexical complexity, all student interviewees (n=10) revealed that they considered these discussions a valuable milieu through which they improved their lexical

complexity. They attributed such an improvement to a number of factors such as the authenticity of the tasks and the topics discussed and the enhanced peer-to-peer interactions. However, what all the students considered the key factor behind their heightened lexical complexity was the effect of noticing and retention on their vocabulary learning:

- *Student 1: We communicated and we realised our language learning problems better in the discussion board. I realised that I have problems with vocabulary that I didn't use to care about. I started giving more attention to this problem during the discussions by looking for better and different words with the help of online dictionaries.*
- *Student 3: I believe I have learnt many new words from the discussions. I used to notice new words other students used, find out their meanings and then use them in my own writing.*

The significant development of students' lexical complexity could be attributed to a number of factors. One noteworthy factor that could have positively affected students' lexical complexity is their realization and appreciation for the existence of a real audience, which many consider a conducive condition for L2 writing development (Hamdaoui, 2006; Jarvis, 2013; Weissberg, 2006). It seems that students considered the online discussions a social milieu in which their written participation was recognised as an act of maintaining social bonds with real interlocutors. Yates (1996) argues that such significant enhancement of students' lexical complexity "should not be seen simply as an existent property of writing. Rather it is tied to the social practices which surround the act of writing. Specifically, it is tied to the process of drafting and redrafting which written texts undergo, as well as to the other types of production activity" (p.89).

Another intertwined factor could be related to the delayed nature of the linguistic output in these discussions. Students, influenced by audience expectations (*i.e.* peers and teacher), had enough time to use external sources to support their arguments, plan and organise their responses, and read their peers' writings and copy their peers' writing styles and lexical items before finally submitting their posts.

It is also possible that the extensive amount of exposure to language that they had access to while reading and commenting on their peers' written arguments has influenced their lexical knowledge, while the control group had limited linguistic input and no exposure to peers' writing and hence, to their lexical words and expressions, a common feature of traditional L2 learning settings. Correspondingly, Nation (2011) argues that the cumulative process of lexical proficiency can change because of the continuous contact with the target language. Wolfe-Quintero, Inagaki and Kim (1998) take the point of exposure to linguistic output further and state that the availability of productive lexical items provides learners with a variety of word choice that they can use freely. It seems that students discussed over a great period (n=10 weeks) different topics with their peers, which could have led to greater input and output exchange. It is noteworthy to understand and acknowledge the amount of linguistic production and receiving of written virtual texts that students were not accustomed to and that was responsible for the gradual enhancement of students' lexical knowledge in a scaffolding manner (Cho & Cho, 2016).

In sum, it seems that all these findings and factors could be unswervingly associated with the notion of *noticing* discussed earlier in the Literature Review section as the key factor behind students' enhanced lexical complexity, as also reported by the students during their interviews. The influence of interactive peer feedback that provided students with greater language exposure seems to have predominantly led to noticing peers' use of lexical items and to intentional lexical borrowings. It appears that students' involvement in interactive discussions probably fostered the co-construction of lexical knowledge through the process

of negotiation of meaning among peers using each other's words. Peers' use of sophisticated lexical words and expressions led to identifiable advancement in students' overall lexical complexity. According to VanPatten (2004), the juxtaposition of a student's output with a peer's input can prompt them to address their own interlocutor's language and realise novel knowledge that gets assimilated as new data into their interlanguage system. Hence, students' lexical complexity was significantly advanced due to noticing each other's output while and re-using their peers' lexical items while negotiating meaning and reply to their peers' original debates. Similar findings were reported by Abrams (2006), Johansson (2008) and Kalantari and Gholami (2017).

While the findings are intriguing, they could be limited in several ways. The duration of the online discussions (n=10 weeks) may not have been long enough to detect the possible effects of these discussions on the lexical complexity. In addition, the tangible effects of noticing cannot be effectively measured unless rigorous psychological tools are used in addition to the ones used in this study. Hence, factors other than noticing could have contributed to the significant improvement of students' lexical complexity as stated before.

Implications and Recommendations

Based on the aforementioned findings and discussion, a number of pedagogical implications could be drawn. L2 practitioners and policy makers are first urged to make ultimate use of online discussions to enhance students' lexical complexity and help them think critically when preparing responses. In addition, effective technical capacity building workshops should be provided to both teachers and students to reduce computer anxiety (Boyd, 2008). Students' performance or participation in the online discussions should also be monitored to ensure that accurate and comprehensible input is received, and hence appropriate noticing is employed. It should also be made clear to the students whether their online discussions are to be assessed. If so, students need to be informed of the type of assessment (whether self-assessment, peer assessment, teacher assessment, portfolio

assessment) and the type of scoring (whether analytical or holistic) (Abrams, 2006). Assessment sheets should be provided so that students understand their teacher's expectations of their participatory roles and whether their contributions are to be assessed on their communicative skills or grammatical and lexical accuracy. Also, up-to-date assessment models such as Abrams' (2006) model (2006) can be used to assess tasks on discussion boards. Another important implication is the importance of changing teachers' and educationists' traditional viewpoints pertaining to the negligence of utilising interactive instructional technologies such as discussion boards and social media in their pedagogical practices.

Future studies can also further examine peers' effects on students' lexical development. Conducting more in-depth and longitudinal studies on the cognitive processes employed in online settings and their effect on the lexical complexity using other measures such as thin-aloud protocols may facilitate more significant findings. We need to have a full understanding of how discourse in L2 settings unfolds effectively in discussion boards through the examination of the sophistication of the discourse's linguistic features using multiple models.

Conclusion

Using a quasi-experimental design and multiple measures, this study examined the effects of using online discussions on the enhancement of L2 university students' lexical complexity and the possible factors involved. Findings of the study revealed that engaging L2 students in online discussions can significantly enhance their lexical variation, richness and density, and accordingly their lexical complexity, and can warrant students' perceived satisfaction once successfully employed. Such an enhancement could be reliably related to a number of social, but more importantly, cognitive factors, the most significant of which is intentional noticing.

References

Abrams, Z. I. (2006). From theory to practice: Intracultural CMC in the L2 classroom. *In* L. Ducate *&* N. Arnold (Eds.), *Calling to CALL: From theory and research to new directions in foreign language teaching* (pp. *181–209*). San Marcos, TX: Computer Assisted Language Instruction Consortium. Available online: http://www.personal.psu.edu/slt13/589_s2007/Abrams_CMCIntraclass06.pdf

Ai, H. & Lu, X. (2010). *A Web-based System for Automatic Measurement of Lexical Complexity*. *Paper presented at 27th Annual Symposium of the Computer Assisted Language Consortium (CALICO-10)*. Available online: (http://www.personal.psu.edu/hua126/papers/calico10_ai_lu.pdf

Al Jahromi, D. (2012). *A study of the use of discussion boards in L2 writing instruction at the University of Bahrain*. (Unpublished doctoral thesis). Sheffield, UK: University of Sheffield.

AlQahtani, M. (2015). The importance of vocabulary in language learning and how to be taught. *International Journal of Teaching and Education*, 3*(3)*, 21-34. doi: 10.20472/TE.2015.3.3.002

Baker, P. (2006). *Using corpora in discourse analysis*. London: Continuum.

Bulté, B. & Housen, A. (2014). Conceptualizing and measuring short-term changes in L2 writing complexity. *Journal of Second Language Writing*, 26*(4)*, 42-65.

Cho, M.-H., & Cho, Y. (2016). Online instructors' use of scaffolding strategies to promote interactions: A scale development study. *International Review of Research in Open and Distributed Learning*, 17*(6)*. doi: 10.19173/irrodl.v17i6.2816

Cho, M.-H., & Kim, B. J. (2013). Students' self-regulation for interaction with others in online learning environments. *Internet and Higher Education,* 17, 69-75.

Davis, B. H. & Brewer, J. P. (1997). *Electronic discourse: Linguistic individuals in virtual space*. Albany, NY: State University of New York Press.

Ellis, R. & Barkhuizen, G. (2005). *Analysing learner language*. Oxford: Oxford University Press.

Ellis, R. (2009). The differential effects of three types of task planning on the fluency, complexity, and accuracy in l2 oral production. *Applied Linguistics*, 30*(4)*, 474-509. doi: 10.1093/applin/amp042

Engber, C. A. (1995). The relationship of lexical proficiency to the quality of ESL compositions. *Journal of Second Language Writing*, 4*(2)*, 139-55.

Espinosa, S. M. (2005). Can P_Lex accurately measure lexical richness in the written production of young learners of EFL? *Porta Linguarum*, 4, 7-22.

Fitze, M. (2006). Discourse and participation in ESL face-to-face and written electronic discussions. *Language Learning and Technology*, *10(1)*, 67-87.

Halliday, M. A. K. (1985). *An introduction to functional grammar*. London: Edward Arnold.

Hamdaoui, R. E. (2006). *Writing in cognate vs. non-cognate languages: A comparative study of two groups of American students writing in Arabic and French as L2*. (Unpublished doctoral thesis). Indiana: Purdue University.

Hinkel, W. (2003). Simplicity without elegance: Features of sentences in L1 and L2 academic texts. *TESOL Quarterly*, *37(2)*, 275-301.

Hulstijn, J. H. (2001). Intentional and incidental second language vocabulary learning: a reappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.). *Cognition and second language instruction* (pp. 258-287). Cambridge: Cambridge University Press.

Ishikawa, S. (2015). Lexical development in L2 English learners' speeches and writings. *Procedia-Social and Behavioral Sciences*, 198, 202-210. doi: 10.1016/j.sbspro.2015.07.437

Jarvis, S. (2013). Capturing the diversity in lexical diversity. *Language Learning*, 63, 87-106.

Johansson, V. (2008). Lexical diversity and lexical density in speech and writing: a developmental perspective. *Lund University, Dept. of Linguistics and Phonetics Working Papers*, 53, 61-79.

Kalantari, R., & Gholami, J. (2017). Lexical complexity development from dynamic systems theory perspective: Lexical density, diversity, and sophistication. *International Journal of Instruction*, 10*(4)*, 1-18. doi: 10.12973/iji.2017.1041a

Kuiken, F. & Vedder, I. (2002). Collaborative writing in L2: The effect of group interaction on text quality. New directions for research in L2 writing. *Studies in Writing*, 11, 169-188.

Lamy, M. & Goodfellow, R. (1999). Supporting language students' interactions in web-based conferencing. *Computer Assisted Language Learning*, 12*(5)*, 457-477. doi: 10.1076/call.12.5.457.5696

Larsen-Freeman, D. (2011). A complexity theory approach to second language development/acquisition. In D. Atkinson (Ed), *Alternative approaches to second language acquisition* (pp. 48–72). New York: Routledge.

Laufer, B. & Nation, P. (1995). Vocabulary size: lexical richness in L2 written production. *Applied Linguistics*, 16, 307-22.

Laufer, B. (1994). The lexical profile of second language writing: Does it change over time? *RELC Journal*, 25*(2)*, 21-33.

Long, D., Lee, J., & VanPatten, B. (1996). Making communicative language teaching happen. *The Modern Language Journal*, 80*(2)*, 236. doi: 10.2307/328644

Lu, X. (2012). The relationship of lexical richness to the quality of ESL learners' oral narratives. *The Modern Language Journal*, *96(2)*, 190-208.

Lu, X. & Ai, H. (2011). *Synlex: Lexical complexity analyzer complexity analyzer. L2 syntactical complexity analyzer. (Computer software)*. Available online: http://aihaiyang.com/software/

Meara, P. & Bell, H. (2001). P_Lex: A simple and effective way of describing the lexical characteristics of short L2 texts. *Prospect: An Australian Journal of TESOL*, 16*(3)*, 5-19.

Meara, P. (2001). *P_Lex (Version 1.1)*. Swansea.

Nation, I. (2011). Research into practice: Vocabulary. *Language Teaching*, 44*(4)*, 529-539. doi:10.1017/S0261444811000267

Ortega, L. (1999). Planning and focus on form in L2 oral performance. *Studies in Second Language Acquisition*, 21, 109–148.

Ortega, L. (2009). *Understanding second language acquisition*. USA: Hodder Education.

Read, J. (2000). *Assessing vocabulary*. Cambridge: Cambridge University Press.

Rieder, A. (2002). A cognitive view of incidental vocabulary acquisition: from text meaning to word meaning. *VIEWS*, 11*(1&2)*, 53-71.

Schmidt, R. (1990). The role of consciousness in second language learning. Applied Linguistics, *11*(2), 129-158. doi:10.1093/applin/11.2.129. S2CID 16247450.

Skehan, P. (1996). A framework for the implementation of task-based instruction. *Applied Linguistics*, 17, 38-62.

Skehan, P. (1998). *A cognitive approach to language learning*. Oxford: Oxford University Press.

Sotillo, S. (2000). Discourse functions and syntactic complexity in synchronous and asynchronous communication. *Language Learning and Technology Journal,* 4*(1)*, 82-119.

VanPatten, B. (Ed.). (2004). *Second language acquisition research. Processing instruction: Theory, research, and commentary.* New York: Lawrence Erlbaum Associates Publishers.

Ure, J. (1971). Lexical density and register differentiation. In G.E. Perren, & J.L.M. Trim, (Eds.), *Applications of Linguistics: Selected Papers of the Second International Congress of Applied Linguistics, Cambridge 1969* (pp. 443-452). Cambridge: Cambridge University Press.

Warschauer, M. (1996). Comparing face-to-face and electronic discussion in the second language classroom. *CALICO Journal*, 13*(2)*, 7-26.

Weissberg, R. (2006). *Connecting speaking & writing in second language writing instruction*. Ann Arbor, MI: The University of Michigan Press.

Wolf-Quintero, K., Inagaki, S., & Kim, H. Y. (1998). *Second language development in writing: Measures of fluency, accuracy, and complexity*. Honolulu: National Foreign Language Resource Center.

Yates, S. J. (2001). Gender, language and CMC for education. *Learning and Instruction, 11*, 21-34.

Yates, S. J. (1996). Oral and written linguistic aspects of computer conferencing. In S. Herring (Ed.), *Computer-mediated communication: Linguistic, social and cross- cultural perspectives* (pp.9-46). Amsterdam: John Benjamins.

Yates, S. J. (1993). *The textuality of computer-mediated communication: speech, writing and genre in CMC discourse*. (Published doctoral thesis). UK: Open University.

Yuan, F. & Ellis, R. (2003). The effects of pre-task planning and on-line planning on fluency, complexity, and accuracy in L2 monologic oral production. *Applied Linguistics*, 24, 1-27.

Zhai, L. (2016). A study on Chinese EFL learners' vocabulary usage in writing. *Journal of Language Teaching and Research*, *7(4)*, 752-759. doi: http://dx.doi.org/10.17507/jltr.0704.16

Zheng, Y. (2016). The complex, dynamic development of L2 lexical use: A longitudinal study on Chinese learners of English. *System*, 56, 40-53.

Zhou, U. & Dai, Z. (2016). Empirical studies on correlations between lexical knowledge and English proficiency of Chinese EFL learners in Mainland China over the past two decades. *Journal of Education and Practice*, *7(26)*, 152-158.