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Exposure Density in Relation to Learning and Retention in EFL

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Abstract

The present study investigates the effect of different exposure densities on third grade Iranian junior high school (IJHS) students' EFL development and retention. It also attempts to explore whether there is any differential performance due to type of post-exposure assessment tasks (recognition vs. written production). Performances of five groups of learners receiving equal amount of exposure to EFL knowledge with different densities over different time spans were compared on both recognition and written production tasks. The results of the repeated measures analysis of variance and paired sample tests reveal that there seems to be a threshold exposure density for development of structure production, as well as for the retention of total EFL and vocabulary production. Analyses of variance for the five groups were performed on the raw scores obtained for a pre-test and two post-tests. The results further reveal significant differences for acquisition and retention of the target EFL knowledge among different groups. The results also suggest different optimal exposure densities for the target EFL knowledge development and retention.

Keywords: Exposure Density, High Exposure Density (HED), Low Exposure Density (LED), Mid Exposure Density (MED), Mid-High Exposure Density (MHED), Mid-Low Exposure Density (MLED), Optimal Exposure Density (OED), Target EFL knowledge score, Threshold Exposure Density (TED)

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Introduction

In recent years, research on second and foreign language instruction has received noticeable attention, due to the ever increasing significance of international communication.

Such research has further highlighted the role of various influential features including age, instruction and time for language learning. Whether or not significant rates of attainment and retention for some language learners are due to their as lower ages, greater amount of exposure or longer instruction period have been controversial issues in the literature. These issues may remain debatable as long as the effects of different features are confounded.

The present study is an attempt to explore the combined effects of exposure and time. The term density is borrowed here to refer the amount of exposure per unit of time. While one may use intensity and density interchangeably, the term density is used in this study to emphasize the fact that amount of exposure for different densities is the same but the time of delivery is not. However, in the literature of content based approaches and immersion programs, higher intensity usually implies greater amount of exposure.

The present study investigates the effect of different exposure densities on EFL learning and retention and further addresses threshold and optimal exposure densities for learning and retention of target EFL knowledge components in two types of recognition and production post-exposure assessment tasks.

In other words, this study is an attempt to explore an optimal EFL exposure density for maximum EFL achievementand retention rates . It is also an attempt to find out a threshold exposure density, which a foreign language program should deliver as a requirement of language learning and retention.

Literature Review

Many parents and educators believe that younger children learn languages more easily and more rapidly than adults and consequently they plan for early exposure of theis children to foreign language instruction at school. Therefore, by lowering the age of instructional exposure to EFL, the number of years of academic study is increased.

However, evidences from other studies such as Barcelona Age Factor (BAF) project reveal that in a foreign language context, late starters with limited exposure surpass early starters with the same amount of instructional exposure (Muñoz, 1999, Celaya, Torras, & Pérez-Vidal, 2001). Singleton (1995) argues that the limited exposure of the foreign language classrooms and the insufficient time are the reasons for such findings, where younger starters may not be able to show their long-term advantage.

In support of the above viewpoint that older children are more efficient learners, some

researchers refer to a growing body of evidence from a variety of language learning contexts. Krashen, Scarcella and Long (1982) have similarly reported that in a second language context older learners show a faster learning rate. According to Turnbull, Lapkin, Hart and Swain (1998), late-starting students with comparable amounts of instructional exposure in the Canadian-French immersion programs have outperformed their earlier-starting counterparts on some measures of both production and comprehension.

Highlighting the possible confounding effects of age and instructional time state that secondary school graduates who had started the early French total immersion program at the age of five Turnbull et.al (1998) had shown a superior oral proficiency over older starting counterparts.

Evidences from other studies (Patkowski, 1980; Johnson & Newport, 1989; Flege, 1999; DeKeyser, 2000) also suggest that the likelihood of reaching native-like levels of proficiency is greater for the younger language learners. These results however, seem to be the most robust for learning a second language or for the students who have had many years of rich exposure to the language. In a foreign language context, for learnes whose primary and only contact with the target language is the language in the classroom, the evidence for an early start advantage seems to be less conclusive.

Myriam (2004) believes the influential features of the research should be incorporated in school programs that offer foreign languages. The most self-evident feature, Myriam believes, is the adequate time. To compensate the effect of insufficient contact hours for foreign language learning, Myriam (2004) highlights the role of content-based language learning. In this approach, classroom instruction of the subject matter is through the medium of the foreign language. In an immersion program thus, half or more of the school uses the target language as the medium of instruction. Likewise, in a content-based approach, classroom teachers use the foreign language instead of students' native language to teach a number of subjects. Students in a total immersion program learn to read the target language even before they learn to read in their own language (Myriam, 2004).

Another challenge of foreign language learning is when students find themselves repeatedly learning the same beginning-level content. Such repetition is often the result of insufficient time allocation during a single school year. Students cannot learn or remember enough to make noticeable progress within a school year, so teachers feel compelled to start from scratch every year. In some schools, in addition to inadequate contact time during instruction, there is a long interruption between class sessions or cycles (Myriam, 2004).

Referring to the difference between second and foreign language learning, DeKeyser (2000)

and Scovel (2000) claim that the critical period hypothesis may therefore apply only to second language acquisition contexts. Harley (1986) also underlines the importance of this distinction in the contexts where the follow-up programs are inadequate and the target language is not readily available outside the classroom.

Other studies, which address the issue of language competence and the amount of exposure to the language either in classroom or length of residence report consistent results with Krashen's input hypothesis: the more comprehensible input one receives in low-stress situations, the more language competence that one will have (Kennedy, 2003).

Addressing the intensity of instruction, Spada and Lightbown (1989) report superior outcomes for the learners in the intensive context, compare to the outcomes of learners with comparable amounts of instruction distributed over several years. The research findings of Collins, Halter, Lightbown and Spada (1999), also suggest that intensity, rather than simply age of exposure, plays a key role in foreign language learning. They state that students with instructional time that was concentrated over a few months rather than distributed throughout the school year outperformed other students. The intensity factor thus may contribute to the differences in language outcomes between the older and younger starters.

In fact, in addition to the age factor research needs to explore the optimal instructional time distribution or the degree of exposure intensity in language learning contexts. The effect of an increase in the intensity of exposure on EFL learning is also a critical issue to be studied for the classroom instruction. In other words, research needs to address the optimal amount of exposure per time within each educational context. It also needs to investigate the gains for learners receiving different degrees of exposure intensity. Therefore, the ways in which the instructional time is distributed should be studied in addition to the optimal age for the introduction of foreign language instruction.

This is while other researchers (Dempster, 1988; Melton, 1970; Underwood, 1970) report that there is not necessarily a linear relationship between amount of exposure and amount of learning. This means that the distribution of instructional time or exposure as opposed to simply the total amount of exposure could also be a key factor in learning EFL.

Under a cognitive attentional framework, Leow (1998) addresses the effects of amount and type of exposure on adult learners' L2 development. His study shows significant effects for both multiple and learner-centered exposures to morphological forms. It also indicates significant differences in the results of the recognition and written production post-exposure assessment tasks.

Therefore, influential features of age, exposure and time and their combined effects still need noticeable attention in EFL research. Among all these, a critical issue researchers need to attend to is the minimum amount of exposure per time or exposure density, which specifies a threshold level as a requirement for language learning and retention. This can help reduce the effects of insufficient time for cases like Iran where a content-based approach may hardly have any implications. At the same time, the effect of different exposure densities should be examined to identify an optimal amount of exposure per time, the language learners should receive.

Considering the significance of adequate time and amount of exposure, this study investigates the effect of different exposure densities (HED, MHED, MED, MLED and LED) on Iranian junior high school (IJHS) student's EFL development and retention in order to test the following hypotheses:

1. EFL development and retention are significantly enhanced as a result of all different exposure densities.

2. EFL development and retention resulting from different exposure densities are not significantly different.

Method

Participants

The sample of participants comprised 258 Iranian male students who had completed the second year of junior high school. They were all native speakers of Farsi in the age group of 12 to 13 years.

To ensure the homogeneity of the participants in terms of the EFL knowledge, they had gained through previous years of JH school, a teacher-made test including 20 items from the English books of the first and second grades of JH school was administered one week before the experiment. The results are displayed in Table 1.

One hundred eighty eight participants whose scores had fallen between +1 and -1 standard deviation from the mean were selected from the total of 258 participants.

Table 1 Test Results of First and Second Grade JH School EFL Knowledge

X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
F	0	0	6	7	14	10	17	21	23	24	22	25	24	17	15	13	6	5	4	1	4
N	258																				
Mean	9.87																				
SD	3.98																				

* The marked scores (188) are between +1 and -1 standard deviation (SD)

In order to control the variable of motivation, a motivation questionnaire (Appendix 1) was administrated to the selected participants. Participants with too high and too low motivation (26 participants) were eliminated from the list, and the remaining 162 participants were randomly assigned to the five groups of High Exposure Density (HED), Mid-High Exposure Density (MHED), Mid Exposure Density (MED), Mid-Low Exposure Density (MLED) and Low Exposure Density (LED). Except for the last group (LED), which received 34 participants due to anticipation of a probable higher attrition rate during its longer exposure period, the other groups received 32 participants. After random assignment of the participants, a few (four) students had to shift from one group to other to be able to comply with the exposure schedule. All participants received the same amount of exposure but with different densities. The number of participants who received exposure outside this study (nine), those who were absent for more than one session (eight) and those who did not take the post-tests (ten) were subtracted later from the remaining 162 participants. Therefore, the number of participants whose data was analyzed in the present study is 135. Table 2 displays a breakdown of groups by exposure density and the attrition effect on the number of participants in each group.

Table 2 Breakdown of Groups by Exposure Density and Attrition Effect

Group	Randomly assigned numbers	Participants with exposure from outside	Participants who were absent for more than one session	Participants who did not take the post tests	The remaining numbers for analysis
HED	32	1	3	1	27
MHED	32	0	1	3	28
MED	32	2	1	2	27
MLED	32	2	1	2	27
LED	34	4	2	2	26
Total	162	9	8	10	135

Target EFL Knowledge

The focus of this study was on the knowledge of vocabulary, structure and reading comprehension based on the instructional materials in English text books of the third grade JH school. The target items for the participants of the study were selected for two reasons. First, the second grade JH students are

not exposed to these forms before the third year of the JH school. Second, these forms are the first to which, the JH students are exposed after completing the second grade. In a pilot study with 11 second grade JH students, the time allocation requirement for the experiment was assessed. For practicality issues and due to the time restrictions, 24 vocabulary items and 6 structure lessons were chosen as the target EFL knowledge (Appendix 2).

Exposure task for the HED, MHED, MED, MLED and LED groups

The lesson plans designed to present the target EFL forms for the groups were identical. To ensure that participants receive the same amount of exposure with the same teaching style, one instructor was assigned for teaching all groups. He was also responsible to control the amount of exposure in each session. A set of general principles (Appendix 3) formulated by Ellis (2005) led the classroom instruction.

The textbook of the third grade JH school was used to present the target forms. In each session, one new structure lesson and four new vocabulary items were presented to the students as the exposure materials. Every target form was introduced by the instructor on the blackboard.

Multiple examples were provided by the teacher and the students. Group work and exercises were encouraged during the exposure period for all groups. Each target item was referred to several times and during the next sessions in the review exercises to ensure multiple exposures to the target EFL materials. Each session lasted approximately 90 minutes. Students were allowed to ask questions in their mother tongue but the teacher would often use English as the main medium of communication. At the end of each session, students would also go through a reading passage and answer its questions. Repetition, unscrambling, fill in the blank and short answer exercises were the main activities for practicing the new forms.

The HED group received twosessions per day and the exposure period lasted for three days. It was followed by the first post test, on day fourth. The MHED group received one session per day. The exposure period lasted for six successive days. The MED group participants were exposed to the same materials on every other day. Their exposure period lasted for 12 days. The MLED group received two sessions per week and their exposure period lasted for about three weeks (18 days). The LED group received one exposure session per week. Their exposure period lasted for about six weeks (36 days).

Assessment Tasks and Tools

The pre- exposure assessment tasks included an assessment of participants' homogeneity in terms of their previous knowledge. This assessment was carried out through the teacher-

made test (KR-21 r=0.72), which included recognition and written production items based on the first and second grade JH text book materials. Results are displayed in Table 1. An assessment of the participants' motivation was done by administering a motivation questionnaire (4 intrinsic motivation items and 4 extrinsic motivation items, Appendix 1). This questionnaire was adapted from Schmidt et al. (1996) and Takahashi S. (2005). To avoid extraneous variable of prior knowledge of targeted forms, a pre-test (Test A, Appendix 5) with 50 items was administrated to all groups.

The post-exposure assessment tasks included an assessment of the learned and the retained target EFL knowledge for each group. For assessment of the learned target EFL knowledge, test B (Appendix 6), which was parallel with test A and is referred to as the first post-test in this study was administered to each group, immediately after the exposure period ended for that group. The retention of the acquired knowledge after one month with no exposure was assessed by the second post-test which was identical to the pre-test (Test A). Thus, test A was administered once as the pre-test before the exposure period and once as the second post-test after no exposure period. Test B was administered only once as the first post-test, immediately after the exposure period.

Finally, to control the effect of exposure from outside, a debriefing questionnaire (Appendix 4) was administered. This was to ensure that participants were representative of the learners who lacked exposure to target forms from outside during the study.

Diagram 1 shows the design of the study and the administration of the assessment tasks.

Diagram 1 Design of the study

Pre-exposure assessment tasks ►►►►			**Exposure period** ►►►►	**Post- exposure assessment tasks** ►►►►		
258 participants took the EFL homogeneity test based on the 1st and 2nd grades of JHS text books (188 participants were selected)	188 participants completed the motivation homogeneity questionnaire (162 participants were selected and randomly assigned to five groups of HED, MHED, MED, MLED and LED)	Pre-test (Test A) was administered to avoid the extraneous variable of prior knowledge of targeted forms	3-36 days exposure; HED group received six instruction sessions per three days. MHED, MED, MLED, and LED groups respectively received six instruction sessions per 6, 12, 18 and 36 days.	One day after completion of exposure period, the immediate post-test (Test B) was administered to assess target EFL knowledge development	One month (no exposure period)	Delayed Post-test (Test A) and debriefing questionnaire were administered to assess retention of the target EFL knowledge

All of the assessment tools had been piloted before being used. The poor items in terms of item difficulty and/or item facility were either modified or replaced. A native speaker of English read the items and commented on the natural use of the language. Tests A and B were piloted with 24 third grade JH school students. To control the potential practice effects due to the order of tests administrations, 12 students took test A first followed by test B. Twelve other students took test B prior to taking test A. The results were submitted to a Pearson Product correlation analysis. A high correlation of 0.909 indicates that these tests could be used as two parallel forms.

The handbook of the new Cambridge Young Learners Test (third edition 2005, starters, movers and flyers) was used as a reference during the test construction procedure. The target forms were mainly at the starter and mover levels of the University of Cambridge Local Examinations Syndicate (UCLES).

Testing Procedure

The present study used a pre-test- exposure-immediate post-test- delayed post-test design to address the immediate and delayed effects of different exposure densities.

The pre-test was designed to measure participants' prior knowledge of the target forms. To assess the learned target EFL knowledge, the first post-test was administered one day after exposure was completed by each group. Finally, the delayed or the second post-test was administered one month after the administration of the first post-test. This period is also referred to as no exposure period in this study. Test instructions were also provided in Persian to ensure that participants would clearly know how to respond the items.

Both tests A and B included three sections of vocabulary (20 items), structure (20 items) and reading comprehension (10 items). The assessment of the vocabulary and the structure knowledge of the target forms were undertaken by two types of items. To measure participants' intake, they were required to select the appropriate vocabulary or structure from among a list of items provided. To measure the participants' ability to produce the target EFL forms, written production items were devised, which required the participants to fill in the blanks with their own words. Finally, in the reading comprehension section the participants needed to read the passage and answer the True/ False and short answer questions (Appendices 5 and 6). The time allocated for each test (50 items) was 45 minutes. None of the tests had been announced in advance.

Scoring Procedure

In scoring each item of the recognition and the written production tasks, one point was assigned for a correct answer. The total score would be 50 for a participant who could answer

all the questions correctly. In addition to the total EFL score calculated for each participant, scores on the vocabulary, structure and reading comprehension were computed. The total vocabulary score and total structure score would be 20 for a participant who could answer all the vocabulary or structure questions correctly. The total score for reading comprehension was 10.

Each total vocabulary score comprised of, a vocabulary recognition and a vocabulary production score. Each total structure score also comprised of, a structure recognition and a structure production score. The total for each of these scores was 10.

Total recognition and total production scores were also computed by adding up the vocabulary and structure recognition scores and vocabulary and structure production scores. The total recognition and the total production scores were 20.

Therefore each participant received 10 scores in each test (the pre-test, the first post-test and the second post-test). These score were Total EFL knowledge, Total Vocabulary, Total Structure, Reading Comprehension, Vocabulary Recognition, Vocabulary Production, Structure Recognition, Structure Production, Total Recognition and Total Production scores.

In total, 4,050 scores were computed in this study.

Table 3 displays the total EFL mean scores and the SDs for each group on the pre-test and the post-tests.

Table 3 Descriptive statistics of exposure density groups for the pre-test and two post tests

Dependent Variable	Groups	Number of Participants	Mean	Standard Deviation
Prior EFL Knowledge Total (Pre-test)	Low Exposure Density (LED)	26	4.8077	2.31550
	Mid-Low Exposure Density (MLED)	27	4.2222	3.15416
	Mid Exposure Density (MED)	27	5.2593	3.75799
	Mid-High Exposure Density (MHED)	28	4.4286	3.02372
	High Exposure Density (HED)	27	4.0000	1.88108
	Total	135	4.5407	2.89818
Learned EFL Knowledge Total (First Post-test)	Low Exposure Density (LED)	26	22.1154	7.71143
	Mid-Low Exposure Density (MLED)	27	26.0741	9.87197
	Mid Exposure Density (MED)	27	32.0370	10.75776
	Mid-High Exposure Density (MHED)	28	34.6071	7.73802
	High Exposure Density (HED)	27	27.9630	7.33528
	Total	135	28.6519	9.71636
Retained EFL Knowledge Total (Second Post-test)	Low Exposure Density (LED)	26	18.2692	6.51495
	Mid-Low Exposure Density (MLED)	27	16.5185	9.74431
	Mid Exposure Density (MED)	27	25.9630	11.20261
	Mid-High Exposure Density (MHED)	28	22.5714	5.97171
	High Exposure Density (HED)	27	16.3333	6.80498
	Total	135	19.9630	9.00780

Analysis

The Intra group comparisons focused on the performance of each group on the pre-test and the two post tests. The results of these assessment tasks were compared for each group separately. In other words the performance of each group was analyzed over time, before exposure, immediately after exposure and after one month gap with no exposure.

To measure the effect of time (prior knowledge, learned knowledge and retained knowledge) on learning and retention of the target EFL knowledge (Total EFL knowledge, Vocabulary Recognition, Vocabulary Production, Total vocabulary, Structure Recognition, Structure Production, Total Structure, Total Recognition, Total Production and Reading Comprehension) the raw scores which were obtained on the pre-test and two post-tests were submitted to a 3 x 10 repeated measures analysis of variance. The within subject factor was time and the measures were target EFL knowledge scores.

All the scores were also submitted to 150 paired-samples t-tests to compute the differences for participants' 10 scores on three assessment tasks (the pre-test and post-tests) in the five exposure density groups.

To compare the group performances on the assessment tasks, the total EFL knowledge scores were further submitted to a simple analysis of variance (ANOVA) and to a post-hoc test to carry out the multiple comparisons.

Results

Repeated measures analysis of variance, performed on the raw scores obtained for a pre-test and two post-tests revealed significant main effects for time on all the EFL measures across the five groups except for the structure production in the LED group (F= 1.391, Sig.=0.253, Appendix 7 Repeated Measures and Pair wise Comparisons). The results of pair wise comparison tests however revealed that there is no significant difference between the means of prior vocabulary production and retained vocabulary production (Sig. = 0.310, Appendix 7 Repeated Measures and Pair wise Comparisons) in the LED group. As expected based on the results of the repeated measures analysis, the results of the pair wise comparison tests also indicated that there is no significant difference between the means of the prior and learned structure production (Sig. = 0.549, Appendix 7 Repeated Measures and Pair wise Comparisons) and therefore no significant difference between the means of the prior structure production and the retained structure production (Sig. = 1.000, Appendix 7 Repeated Measures and Pair wise Comparisons) or between the means of the learned structure production and the retained structure production (Sig. = 0.249, Appendix 7 Repeated Measures and Pair wise Comparisons). Finally these results revealed that there is no significant difference between the prior and retained total production mean scores (Sig. = 0.344, Appendix 7 Repeated Measures and Pair wise Comparisons).

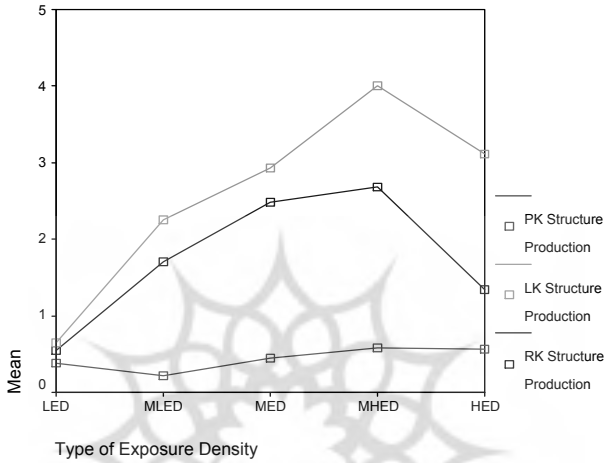
Analyses of variance also suggest different optimal exposure densities for the target EFL knowledge development and retention. The results suggest that MHED is an optimal exposure density for EFL development whereas MED is an optimal

exposure density for EFL retention (Appendices- 8 and 9, ANOVAs and Post-hoc tests for the learned and retained EFL knowledge).

Therefore, the first hypothesis is rejected on the basis of the following results:

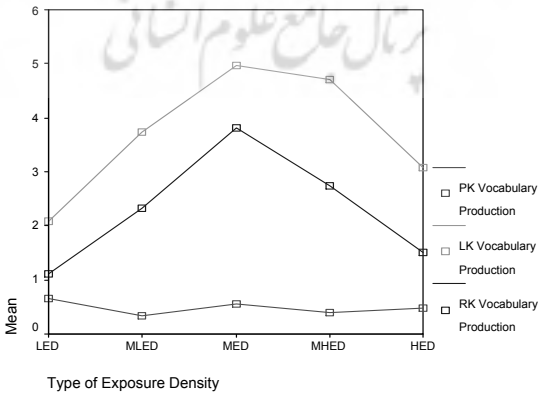
There was no significant difference between the LED's prior and learned structure written production knowledge (Appendix- 7, LED Paired Sample Test, Sig. 0.183).

In other words, one session exposure per week was not enough for development of structure production knowledge.



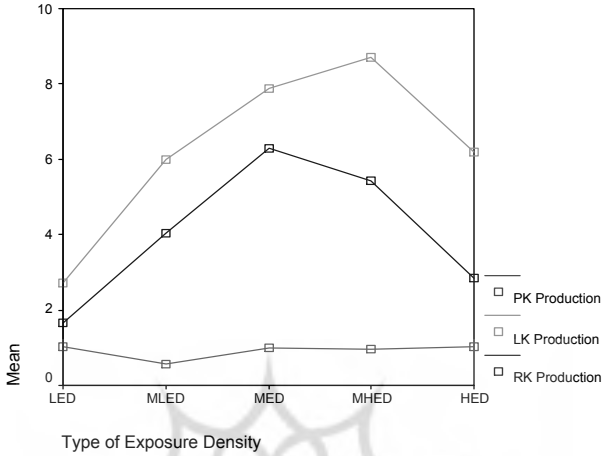
Graph 1 Comparing groups' structure production knowledge on assessment tasks (Prior Knowledge= PK, Learned Knowledge= LK and Retained Knowledge= RK).

There was no significant difference between the LED's prior and retained vocabulary written production knowledge (Appendix- 7, LED Paired Sample Test, Sig. 0.103). This means that participants who received one session exposure per week did not retain the knowledge of vocabulary production.



Graph 2 Comparing groups' vocabulary production knowledge on assessment tasks (Prior Knowledge= PK, Learned Knowledge= LK and Retained Knowledge= RK).

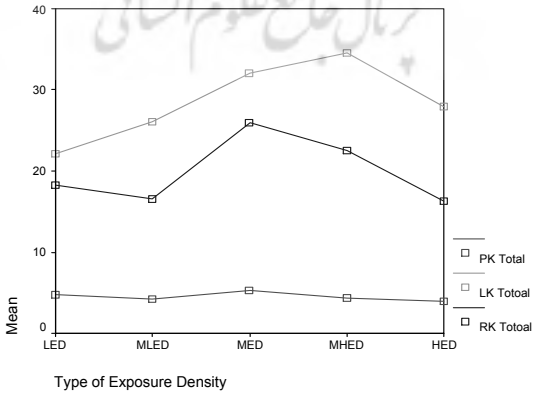
There was no significant difference between the LED's prior and retained total EFL written production knowledge (Appendix- 7, LED Paired Sample Test, Sig. 0.115). In other words, participants with one session exposure per week did not retain the EFL production knowledge.



Graph 3 Comparing groups' total production knowledge on assessment tasks (Prior Knowledge= PK, Learned Knowledge= LK and Retained Knowledge= RK).

The second hypothesis is also rejected on the basis of the following results: Learned EFL knowledge mean differences of groups with different exposure densities were highly significant (Appendices- 8 and 9, ANOVA and Post-hoc test for the learned EFL knowledge, Sig. 0.000). This means that groups with different exposure densities performed differently on EFL development.

Retained EFL knowledge mean differences of groups with different exposure densities were highly significant (Appendices- 8 and 9, ANOVA and Post-hoc test for the retained EFL knowledge, Sig. 0.000). In other words, groups with different exposure densities performed differently on retention of EFL knowledge.



Graph 4 Comparing group performance on assessment tasks (Prior Knowledge= PK, Learned Knowledge= LK and Retained Knowledge= RK).

Conclusion

The present study focused on the combined effects of the amount of EFL exposure and time i.e., EFL exposure density. The study tried to slightly touch upon the significant role of exposure density for learning and retention of EFL knowledge. As a result of different exposure densities, the groups whose performances on the pre-test were not significantly different, showed significant differences in learning and retention of EFL knowledge. This is while compared to other exposure densities, the low exposure density, with only one exposure session per week proved to be insufficient for EFL learning and retention. Therefore, the EFL programs, which deliver insufficient exposure during a certain period of time may not help learners to develop or retain EFL knowledge. These results led to identification of threshold and optimal exposure densities for EFL development and retention.

As results in indicate, not all different exposure densities lead to significant development or retention of EFL knowledge.

The lowest exposure density, which resulted in significant development of structure production was MLED. Therefore, MLED is considered to be a threshold exposure density because LED participants' structure written production was not significantly enhanced after the exposure. In other words, the results from participants in the low exposure density group who received one session of exposure per week indicated that these participants were not able to develop an ability to produce structure. It seems that one session exposure per week or the LED does not provide enough exposure to develop such ability. However, participants with two exposure sessions per week (MLED) proved to have significantly developed a structure written production ability.

The MLED is also considered to be the threshold density for retention of vocabulary and total EFL written production, since the LED's prior and retention of vocabulary and total EFL written production were not significantly different. The participants in the MLED group therefore significantly retained their total EFL written production and vocabulary production abilities.

These results are in line with the reports submitted by Collins, Halter, Lightbown and Spada (1999) who assign a key role to intensity in foreign language learning. An explanation for such findings can be the

insufficient time allocation referred to by Myriam (2004) as a challenge of foreign language learning or long interruption between class sessions.

The significant differences between target EFL knowledge development and retention means of different groups further suggested that MHED is an optimal exposure density for EFL development and MED is an optimal exposure density for EFL retention. This means participants who received six exposure sessions per week outperformed other groups in developing the total EFL knowledge. However, after no exposure period there were the MED group participants who exhibited significant higher retention rate. In other words, participants who received three exposure sessions per week showed to have acquired a more long lasting EFL knowledge compared to other groups. These results are also in line with Dempster (1988), Melton (1970) Underwood (1970) who reported that there is not necessarily a linear relationship between intensity and amount of learning.

As a final remark, the results of this study underline the significance of exposure density in addition to the amount and type of exposure highlighted by Leow (1998) in a cognitive attentional framework.

Operational Definitions

Exposure Density: Amount of EFL instruction per unit of time. High Exposure Density (HED) group received six instruction sessions per three days. Mid-High Exposure Density (MHED), Mid Exposure Density (MED), Mid-Low Exposure Density (MLED) and Low Exposure Density (LED) groups respectively received six instruction sessions per 6, 12, 18 and 36 days.

Optimal Exposure Density (OED): The lowest exposure density which leads to highest target EFL knowledge attainment.

Target EFL knowledge score: Participants scores on the assessment tasks comprising 10 vocabulary recognition, 10 vocabulary production, 10 structure recognition, 10 structure production and 10 reading comprehension items.

Threshold Exposure Density (TED): The lowest exposure density which leads to significant learning and/ or retention of target EFL knowledge.

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Appendices

Appendix – 1 Motivation Questionnaire adapted from Schmidt et al. 1996 and Takahashi S. 2005 for Iranian Junior High school students.

Please specify your agreement by circling one of the choices a, b, c or d Thank you for your cooperation.

1- I enjoy Learning English.

a. Disagree b. slightly agree c. agree d. strongly agree

2- Learning English is a hobby for me.

a. Disagree b. slightly agree c. agree d. strongly agree

3- I believe that learning English is important for me.

a. Disagree b. slightly agree c. agree d. strongly agree

4- I wish I could learn English in an easier way, without going to class.

a. Disagree b. slightly agree c. agree d. strongly agree

5- The main reason I am studying English is that my parents (my family or someone close to me) want me to improve my English.

a. Disagree b. slightly agree c. agree d. strongly agree

6- I want to learn English because it is useful when traveling in many countries.

a. Disagree b. slightly agree c. agree d. strongly agree

7- The main reason I need to learn English is to pass examinations.

a. Disagree b. slightly agree c. agree d. strongly agree

8- If I learn English I will be able to get a better job.

a. Disagree b. slightly agree c. agree d. strongly agree

Appendix – 2 Target EFL Materials

Vocabulary

1- Airplane
2- Answer
3- Ask
4- Broke
5- Dictionary
6- Enjoy
7- Famous
8- Ground
9- Guests
10- Kitchen
11- Lion
12- Like
13- Library
14- Look
15- Neighbors
16- Parents
17- Program
18- Ride
19- Say
20- Thin
21- Tiger
22- Wait
23- Wheels
24- Zoo

Structure

1- Possessive forms ('s and of)
2- Adjectives (Noun + Adjective)
3- Object Pronouns (her, him, us, them)
4- Adverbs of Frequency (Sometimes/ Never)
5- Quantity Expressions (Countable/ Uncountable)
6- Simple Past Tense (Regular/ Irregular)

Appendix – 3 Principles of instructed language learning (Ellis, R. 2005)

Principle 1:	Instruction needs to ensure that learners develop both a rich repertoire of formulaic expressions and a rule-based competence.
Principle 2:	Instruction needs to ensure that learners focus predominantly on meaning
Principle 3:	Instruction needs to ensure that learners also focus on form
Principle 4:	Instruction needs to be predominantly directed at developing implicit knowledge of the L2 while not neglecting explicit knowledge.
Principle 5:	Instruction needs to take into account the learner's 'built-in syllabus'.
Principle 6:	Successful instructed language learning requires extensive L2 input.
Principle 7:	Successful instructed language learning also requires opportunities for output.
Principle 8:	The opportunity to interact in the L2 is central to developing L2 proficiency.
Principle 9:	Instruction needs to take account of individual differences in learners.
Principle 10:	In assessing learners' L2 proficiency, it is important to examine free as well as controlled production

Appendix – 4 Debriefing Questionnaire to control the effect of outside exposure

Please circle one of the choices a or b. Thank you for your cooperation.

1- Have you been attending other English classes after the start of these classes?

a- Yes (please write how many classes? ……..)

b- No

2- What have you been doing for learning English in addition to attending these classes?

a- I have always been studying, watching movies or listening to English programs.

b- I have not done any thing else

Appendix- 5 Sample items of the pre test/ second post test.

I. Vocabulary (A. Recognition and B. Written Production)

A. Fill in the blanks with the 10 appropriate words from the box below.

famous, neighbors, enjoy, ask, parents, waited, library, ride, dictionary, go guests, look, answer

2. A: Do Peter and his friends go to school by bicycle?
   B: Yes, they ……. their bicycles to school.

B. Look at the picture(s) read the sentences and then fill in the blanks.

2. A: Peter has a big bicycle.
   B: It has two big ……..too.

II. Structure (A. Recognition and B. Written Production)

A. Fill in the blanks with the 10 appropriate words from the box below.

always, many, never, did, a few, Zahra's, he, how much, a little, how many, him, sometimes, them

6. A: …… books are there on the table?
   B: There are a lot of books on the table.

B. **Look at the picture(s) read the sentences and then fill in the blanks**.

1. A. What are those?
   B. Those are the …… the table.

III. Reading Comprehension (First Paragraph)

Read the following passage carefully.

Maryam and her family live in Tehran. They went to Mashhad six months ago. They stayed there for two weeks. They visited many places and had a very good time there. They went to the Holy Shrine several times. A lot of people go to Mashhad each year. They go from different parts of the country.

A. Choose true or false in front of each sentence.

2. Maryam went to the Holy Shrine many times. True False

B. Answer these questions.

2. How many weeks did Maryam stay in Mashhad?

……

Appendix- 6 Sample items of the first post test.

I. Vocabulary (A. Recognition and B. Written Production)

A. Fill in the blanks with the 10 appropriate words from the box below.

famous, go guests, neighbors, enjoyed, ask, library, ride, dictionary like, answer parents, waited

2. A: How do your friends go to school?
   B: They ……. their bicycles to school.

B. Look at the picture(s) read the sentences and then fill in the blanks.

2. A: Do you have a small bicycle?
   B: Yes, it has two small ……..too.

II. Structure (A. Recognition and B. Written Production)

A. Fill in the blanks with the 10 appropriate words from the box below.

always, many, never, did, a few, Zahra's, he, how much, a little, how many, him, sometimes, them

6. A: …… students are there in the classroom?
   B: There are a lot of students in the classroom.

B. **Look at the picture(s) read the sentences and then fill in the blanks**.

A: What are those?

B: Those are the …… the chair

III. Reading Comprehension (First Paragraph)

Read the following passage carefully.

Ali and his family live in Shiraz. They went to Esfahan last year and stayed there for four days. They visited many places and enjoyed their time. They liked old mosques very much and went there several times. They saw a lot of people there. A lot of people go to Esfahan from different cities each year.

A. Choose true or false in front of each sentence.

2. Ali did not see the old mosques last year. True False

B. Answer these questions.

2. What did Ali's family like in Esfahan?

……

Appendix- 7 Repeated Measures and Pairwise Comparisons for the Five Exposure Density Groups (LED, MLED, MED, MHED, HED)

EXPOSURE DENSITY GROUP	Source	Measure	Epsilon Corrections	Type III Sum of Squares	df	Mean Square	F	Sig.
LOW EXPOSURE DENSITY	TIME	TOTAL	Sphericity Assumed	4,294.872	2	2,147.436	104.740	0.000
			Greenhouse-Geisser	4,294.872	1.408	3,049.826	104.740	0.000
			Huynh-Feldt	4,294.872	1.467	2,927.234	104.740	0.000
			Lower-bound	4,294.872	1.000	4,294.872	104.740	0.000
		Vocabulary Recognition	Sphericity Assumed	627.769	2	313.885	269.518	0.000
			Greenhouse-Geisser	627.769	1.452	432.444	269.518	0.000
			Huynh-Feldt	627.769	1.518	413.582	269.518	0.000
			Lower-bound	627.769	1.000	627.769	269.518	0.000
		Vocabulary Production	Sphericity Assumed	27.410	2	13.705	9.026	0.000
			Greenhouse-Geisser	27.410	1.742	15.738	9.026	0.001
			Huynh-Feldt	27.410	1.861	14.729	9.026	0.001
			Lower-bound	27.410	1.000	27.410	9.026	0.006
		Vocabulary Total	Sphericity Assumed	864.641	2	432.321	115.784	0.000
			Greenhouse-Geisser	864.641	1.784	484.530	115.784	0.000
			Huynh-Feldt	864.641	1.912	452.129	115.784	0.000
			Lower-bound	864.641	1.000	864.641	115.784	0.000
		Structure Recognition	Sphericity Assumed	315.795	2	157.897	51.644	0.000
			Greenhouse-Geisser	315.795	1.553	203.310	51.644	0.000
			Huynh-Feldt	315.795	1.637	192.897	51.644	0.000
			Lower-bound	315.795	1.000	315.795	51.644	0.000
		Structure Production	Sphericity Assumed	0.949	2	0.474	1.391	0.258
			Greenhouse-Geisser	0.949	1.165	0.814	1.391	0.253
			Huynh-Feldt	0.949	1.187	0.799	1.391	0.254
			Lower-bound	0.949	1.000	0.949	1.391	0.249
		Structure Total	Sphericity Assumed	350.846	2	175.423	45.410	0.000
			Greenhouse-Geisser	350.846	1.419	247.302	45.410	0.000
			Huynh-Feldt	350.846	1.479	237.155	45.410	0.000
			Lower-bound	350.846	1.000	350.846	45.410	0.000

Pairwise Comparisons

EXPOSUREDENSITY GROUP	Measure	(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
							Lower Bound	Upper Bound
LOW EXPOSUREDENSITY	TOTAL	1.00	2.00	-17.31	1.53	0.000	-21.23	-13.38
			3.00	-13.46	1.34	0.000	-16.89	-10.03
		2.00	1.00	17.31	1.53	0.000	13.38	21.23
			3.00	3.85	0.78	0.000	1.85	5.84
		3.00	1.00	13.46	1.34	0.000	10.03	16.89
			2.00	-3.85	0.78	0.000	-5.84	-1.85
	Vocabulary Production	1.00	2.00	-1.42	0.39	0.004	-2.42	-0.42
			3.00	-0.46	0.27	0.310	-1.16	0.24
		2.00	1.00	1.42	0.39	0.004	0.42	2.42
			3.00	0.96	0.35	0.035	0.06	1.87
		3.00	1.00	0.46	0.27	0.310	-0.24	1.16
			2.00	-0.96	0.35	0.035	-1.87	-0.06
	Vocabulary Total	1.00	2.00	-7.69	0.62	0.000	-9.29	-6.10
			3.00	-6.19	0.49	0.000	-7.45	-4.94
		2.00	1.00	7.69	0.62	0.000	6.10	9.29
			3.00	1.50	0.48	0.014	0.26	2.74
		3.00	1.00	6.19	0.49	0.000	4.94	7.45
			2.00	-1.50	0.48	0.014	-2.74	-0.26
	Structure Production	1.00	2.00	-0.27	0.20	0.549	-0.77	0.24
			3.00	-0.15	0.19	1.000	-0.64	0.33
		2.00	1.00	0.27	0.20	0.549	-0.24	0.77
			3.00	0.12	0.06	0.249	-0.05	0.28
		3.00	1.00	0.15	0.19	1.000	-0.33	0.64
			2.00	-0.12	0.06	0.249	-0.28	0.05
	Structure Total	1.00	2.00	-5.04	0.64	0.000	-6.68	-3.39
			3.00	-3.62	0.61	0.000	-5.18	-2.05
		2.00	1.00	5.04	0.64	0.000	3.39	6.68
			3.00	1.42	0.33	0.001	0.58	2.27
		3.00	1.00	3.62	0.61	0.000	2.05	5.18

EXPOSUREDENSITY GROUP	Measure	(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
							Lower Bound	Upper Bound
			2.00	-1.42	0.33	0.001	-2.27	-0.58
	Production Total	1.00	2.00	-1.69	0.55	0.014	-3.09	-0.29
			3.00	-0.62	0.38	0.344	-1.58	0.35
		2.00	1.00	1.69	0.55	0.014	0.29	3.09
			3.00	1.08	0.35	0.014	0.19	1.96
		3.00	1.00	0.62	0.38	0.344	-0.35	1.58
			2.00	-1.08	0.35	0.014	-1.96	-0.19

Appendix- 8 Analysis of Variance for group performance on assessment tasks (Prior Knowledge= PK, Learned Knowledge= LK and Retained Knowledge= RK)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PK Totoal	Between Groups	26.778	4	6.695	.792	.532
	Within Groups	1098.747	130	8.452		
	Total	1125.526	134			
LK Totoal	Between Groups	2605.527	4	651.382	8.430	.000
	Within Groups	10045.110	130	77.270		
	Total	12650.637	134			
RK Totoal	Between Groups	1913.139	4	478.285	6.940	.000
	Within Groups	8959.676	130	68.921		
	Total	10872.815	134			

Appendix- 9_Multiple Comparisons for group performance on assessment tasks (Prior Knowledge= PK, Learned Knowledge= LK and Retained Knowledge= RK)

Multiple Comparisons

Games-Howell

Dependent Variable	(I) Type of Exposure Density	(J) Type of Exposure Density	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PK Totoal	LED	MLED	.5855	.75808	.937	-1.5636	2.7345
		MED	-.4516	.85397	.984	-2.8815	1.9784
		MHED	.3791	.72989	.985	-1.6860	2.4442
		HED	.8077	.58075	.636	-.8380	2.4534
	MLED	LED	-.5855	.75808	.937	-2.7345	1.5636
		MED	-1.0370	.94421	.807	-3.7080	1.6339
		MHED	-.2063	.83367	.999	-2.5611	2.1484
		HED	.2222	.70677	.998	-1.7911	2.2355
	MED	LED	.4516	.85397	.984	-1.9784	2.8815
		MLED	1.0370	.94421	.807	-1.6339	3.7080
		MHED	.8307	.92173	.895	-1.7779	3.4392
		HED	1.2593	.80877	.533	-1.0555	3.5741
	MHED	LED	-.3791	.72989	.985	-2.4442	1.6860
		MLED	.2063	.83367	.999	-2.1484	2.5611
		MED	-.8307	.92173	.895	-3.4392	1.7779
		HED	.4286	.67645	.969	-1.4928	2.3499
	HED	LED	-.8077	.58075	.636	-2.4534	.8380
		MLED	-.2222	.70677	.998	-2.2355	1.7911
		MED	-1.2593	.80877	.533	-3.5741	1.0555
		MHED	-.4286	.67645	.969	-2.3499	1.4928
LK Totoal	LED	MLED	-3.9587	2.428	.486	-10.8358	2.9184
		MED	-9.9217*	2.564	.003	-17.1930	-2.6504
		MHED	-12.4918*	2.104	.000	-18.4375	-6.5460
		HED	-5.8476	2.069	.050	-11.6993	.0042
	MLED	LED	3.9587	2.428	.486	-2.9184	10.8358
		MED	-5.9630	2.810	.227	-13.9053	1.9794
		MHED	-8.5331*	2.397	.007	-15.3212	-1.7450
		HED	-1.8889	2.367	.930	-8.5971	4.8193
	MED	LED	9.9217*	2.564	.003	2.6504	17.1930
		MLED	5.9630	2.810	.227	-1.9794	13.9053
		MHED	-2.5701	2.535	.848	-9.7590	4.6188
		HED	4.0741	2.506	.489	-3.0405	11.1886
	MHED	LED	12.4918*	2.104	.000	6.5460	18.4375
		MLED	8.5331*	2.397	.007	1.7450	15.3212
		MED	2.5701	2.535	.848	-4.6188	9.7590
		HED	6.6442*	2.033	.016	.9044	12.3840
	HED	LED	5.8476	2.069	.050	-.0042	11.6993
		MLED	1.8889	2.367	.930	-4.8193	8.5971
		MED	-4.0741	2.506	.489	-11.1886	3.0405
		MHED	-6.6442*	2.033	.016	-12.3840	-.9044
RK Totoal	LED	MLED	1.7507	2.269	.937	-4.6939	8.1954
		MED	-7.6937*	2.506	.029	-14.8351	-.5524
		MHED	-4.3022	1.705	.101	-9.1239	.5195
		HED	1.9359	1.830	.827	-3.2379	7.1097
	MLED	LED	-1.7507	2.269	.937	-8.1954	4.6939
		MED	-9.4444*	2.857	.014	-17.5244	-1.3645
		MHED	-6.0529	2.189	.061	-12.2849	.1791
		HED	.1852	2.287	1.000	-6.3056	6.6759
	MED	LED	7.6937*	2.506	.029	.5524	14.8351
		MLED	9.4444*	2.857	.014	1.3645	17.5244
		MHED	3.3915	2.433	.635	-3.5639	10.3470
		HED	9.6296*	2.523	.004	2.4474	16.8118
	MHED	LED	4.3022	1.705	.101	-.5195	9.1239
		MLED	6.0529	2.189	.061	-.1791	12.2849
		MED	-3.3915	2.433	.635	-10.3470	3.5639
		HED	6.2381*	1.729	.006	1.3514	11.1248
	HED	LED	-1.9359	1.830	.827	-7.1097	3.2379
		MLED	-.1852	2.287	1.000	-6.6759	6.3056
		MED	-9.6296*	2.523	.004	-16.8118	-2.4474
		MHED	-6.2381*	1.729	.006	-11.1248	-1.3514

*. The mean difference is significant at the .05 level.

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چگالی عرضه در رابطه با یادگیری و ماندگاری زبان انگلیسی به عنوان زبان خارجی

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تحقیق حاضر به بررسی تاثیر چگالی‌های مختلف عرضه بر یادگیری و ماندگاری دانش زبان انگلیسی (به عنوان یک زبان خارجی) دانش آموزان دوره سوم راهنمایی در ایران می پردازد. همچنین به بررسی این موضوع می پردازد که آیا نحوه ارزشیابی پس-از-عرضه از دو طریق تشخیص یا تولید پاسخ صحیح بر نتایج مطالعه تاثیر می گذارد یا خیر.

عملکرد پنج گروه از شرکت کنندگان که در دوره های مختلف از نظر طول دوره در معرض میزان برابری از آموزش زبان انگلیسی (به عنوان یک زبان خارجی) قرار گرفتند از دو طریق تشخیص یا تولید پاسخ صحیح با یکدیگر مقایسه شد. با توجه به نتایج تحلیل واریانس با اندازه های تکراری و آزمونهای t با دو نمونه وابسته به نظر می رسد برای آموختن تولید ساختار، ماندگاری دانش کلی زبان انگلیسی (به عنوان یک زبان خارجی) و ماندگاری توانایی تولید واژگان، نوعی آستانه چگالی عرضه وجود دارد. تحلیل واریانس نمرات پیش آزمون و دو پس آزمون پنج گروه نشان داد گروهها از نظر یادگیری و ماندگاری دانش زبان انگلیسی (به عنوان یک زبان خارجی) با یکدیگر تفاوت معنا داری دارند. این نتایج همچنین حاکی از چگالی های عرضه بهینه مختلفی برای یادگیری و ماندگاری زبان انگلیسی (به عنوان یک زبان خارجی) است.

واژگان کلیدی: چگالی عرضه، چگالی عرضه بالا، چگالی عرضه پایین، چگالی عرضه متوسط، چگالی عرضه متوسط بالا، چگالی عرضه متوسط پایین، چگالی عرضه بهینه، نمره دانش زبان انگلیسی هدف به عنوان زبان خارجی، چگالی عرضه آستانه

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