



**Title**

**Vocabulary comprehension and learning in an ESP context:  
Strategy use and knowledge sources**

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**Abstract**

Investigating the cognitive processes used by EFL learners is a revealing enterprise in the domain of L2 vocabulary acquisition. A fundamental question that has remained unanswered in the literature on vocabulary acquisition concerns the relationship between the range of strategies and knowledge sources EFL learners use. In this study, a qualitative approach was designed and carried out in which 103 participants were selected randomly from among medical and paramedical students who enrolled in ESP I at Isfahan University of Medical Sciences. Data on VLSs in an ESP context were elicited by observation, interview and questionnaire. This study has implications for EFL learners, instructors, curriculum developers and materials writers.

**Keywords:** knowledge sources; strategy use; vocabulary comprehension strategies;  
English for specific purposes; specialized and non-specialized vocabulary

**1. Introduction**

The notion of learning strategies was motivated by two fields, namely cognitive psychology and second language acquisition. In the 1980s, researchers shifted focus from what the good learner does to learn a language to the classification systems of strategies (Griffiths and Parr, 2001). Although taxonomies of a broad range of vocabulary learning strategies (VLSs) do exist, they tend to be incomplete in terms of strategies or factors arguably important for vocabulary learning (Riazi and Alavi, 2004; Riazi et al., 2005). Despite the interesting patterns seen in quantitative studies

(Gu & Johnson, 1996; Kojic-Sabo & Lightbown, 1999; Schmitt, 1997), these studies do not show how a particular type of strategy is used in the development of vocabulary. Thus, we adopted a qualitative approach in this study in order to have a clearer picture of the process of vocabulary acquisition with a focus on intentional learning of vocabulary especially in ESP contexts.

Research suggests that readers use a variety of strategies when they encounter new words, including ignoring unknown words, consulting a dictionary for their meaning, writing them down for further consultation with a teacher or attempting to infer their meaning from context (Harley & Hart, 2000). Fraser (1999) and Paribakht and Wesche (1999) found that lexical inferencing was the most frequent and preferred strategy used by adult L2 learners to learn the meanings of new words. Conversely, the most frequently used strategy for understanding and learning the meaning of the new words in Kudo's study (1999) was using bilingual dictionaries.

The theoretical foundation of this study is based on Schmitt's study (1997) since in the area of VLS taxonomy development, the most notable effort in terms of range of strategies considered has been that of Schmitt's. However, some critical features make the context of this study significantly different from that in Schmitt's study and these features may influence the kind of strategies and knowledge sources used by ESP students for comprehending and learning specialized and non-specialized vocabulary.

First, in an ESP context, words (mainly specialized vocabulary) are expected to be used both productively (i.e., interactional communication of ESP students with their content teachers, doctors and peers in clinical and academic settings) and receptively (i.e., ESP students' comprehension and/or translation of two main English sources: their English references (printed sources) and information sources from the Internet (online sources)). But "use" was mainly defined by Schmitt (1997) as vocabulary practice rather than interactional communication.

Second, it seems that in Schmitt's taxonomy, what is dealt with are strategies for remembering form-meaning pairs and what is missing are skill-oriented strategies which are characteristic of learning specialized words in an ESP context.

Third, Despite Schmitt's study which was conducted for different age groups at different educational levels and with different purposes, this study was carried out

with the a relatively homogeneous group of learners, in terms of their age, language proficiency and their field of study and who are supposed to learn English (i.e. acquire mainly their required vocabulary items) through reading academic texts in ESP courses. ESP students learn English as a means to achieve their subject-specific and ultimately their occupational goals.

Knowledge sources range from knowledge of grammar, morphology, phonology and knowledge of the world to knowledge of punctuation, word association, cognates, L1 knowledge and discourse knowledge (Nassaji, 2003). Paribakht and Wesche (1999) found that their university ESL readers appealed to a variety of linguistic and nonlinguistic knowledge sources when attempting to derive the meaning of new words from context. Specialized words are made up of words that occurred frequently in a specialized text or subject area but did not occur or were of very low frequency in other fields (Nation, 2001; Nation & Chung 2004; Oh et al., 2000) and non-specialized vocabulary are terms that have a specific meaning in a scientific context (Childs & O' Farrell, 2003; Strevens et al., 2000). Taking into account the specific features of ESP contexts in the domain of VLSs and in the light of Schmitt's taxonomy (1997), the following questions are raised:

1. What strategies are used for vocabulary learning and vocabulary comprehension in an ESP context?
2. What knowledge sources are used for vocabulary learning and vocabulary comprehension?

## **2. The Present Study**

### **2.1. Participants**

137 medical and paramedical students, taking ESP I course at Isfahan University of Medical Sciences. (i.e., medicine, pharmacy, dentistry, midwifery, nursing, physiotherapy, management of healthcare services and medical records) were selected to take part in this study. A standardized language proficiency test (Intermediate TOEFL Test Practices by Folse, 1997) was administered to the participants. Although it was a standard test, it was piloted in conditions similar to our main study to ensure its reliability for the context of our study, its calculated test- retest reliability turned

out to be 0.75. Three areas of language proficiency were tested: grammar (20 items), vocabulary (20 items), and reading comprehension (10 items)

Then, 103 learners with mean  $\pm$  1SD were identified. 14% of the participants were male and 86% were female. The participants' mean age was  $20 \pm 1.12$ .

Table 1. The distribution of the participants by sex, degree, field of study, and language proficiency

Field	Total N	Ph.	BS	Asso	mean	SD	Selec	Mal	Fema
Medicine	17	*			28.82	6.47	14	5	9
Dentistry	17	*			28.18	5.07	13	0	13
Pharmacy	21	*			25.43	4.63	16	0	16
Midwifery	14		*		20.07	6.07	11	0	11
Nursing	17		*		21.24	4.20	13	3	10
Physiothera	15		*		23.47	6.09	9	2	7
Manageme nt of	15		*		20.33	5.91	11	2	9
Medical	21			*	18.24	4.61	16	0	16
Total	137						103	12	91

\* =have Ph.D., BSs or Associate degrees

Since the study was qualitative, random sampling was not practically possible in its real sense. On the other hand, it was not feasible to study all of the students in different classes and in all fields of study. For instance, some classes were held simultaneously by different teachers and it was not possible for the researcher to observe them at the same time. Or in some classes, the teacher did not allow the researcher to carry out her research. So, from among the existing ESP I classes for each of the above-mentioned fields, one was selected randomly in order to attempt stratification of the participants. A normality test was performed using EViews software\* which ensured the normality of the population in each field (i.e., Jarque\_???Bera statistics for all fields was less than 5.99 with confidence interval 95% and degrees of freedom equal to two). Since the status quo was examined (i.e., the existing ESP classes) in this study, it was clear that we did not have any other choice than to accept limitations such as lack of gender distribution or equal number of participants in each group.

## 2.2. Methodology

In order to elicit data on VLSs and knowledge sources used, three methods were used: a) interviewing the students individually about their vocabulary comprehension and vocabulary learning activities and knowledge sources used while studying their academic texts, b) observing the students in person in the classroom and outside the classroom while studying their academic texts, and c) using a questionnaire based on theoretical considerations of some previous attempts to study VLSs, including that of Schmitt (e.g., Kudo, 1999; Segler et al., 2002; Winke, 2002), to identify VLSs types and based on data collected from interviews and observations. All 103 participants were subject to all three phases of data collection.

First, a semi-structured interview (Mackey & Gass, 2005) was used in the pilot study based on which the final fixed set of questions was developed to be asked in the main study through structured interviews (Cohen, 1998). The purpose of the interviews was to elicit task-specific VLSs, to uncover general vocabulary comprehension strategies and knowledge sources used in this regard. The interviews were conducted in the participants' first language and the students were asked to bring their books to illustrate what they do when they face a new word.

In the main study, the researcher was motivated to find out what VLSs and vocabulary comprehension strategies were used and elicit what knowledge sources were being used to facilitate vocabulary comprehension and learning. Thus, it was decided to observe the students' performance in and outside the classroom before carrying out the questionnaire. The researcher observed the students' VLSs which were used in each classroom while they were asking their ESP teacher questions about vocabulary items, answering their ESP teacher's questions about vocabulary items, reading their ESP texts aloud and translating the translation section of each lesson in their books. The researcher also observed the students' books to check their notes about vocabulary items.

The questionnaire was constructed for the collection of data on what the participants actually do while comprehending and learning the vocabulary items in their ESP texts. The questionnaire, written in learner L1, consisted of two parts: questions to gain demographic information about the participants and questions related to the vocabulary comprehension and learning strategies the participants might

have used. Nonparametric statistics were used to analyze the frequency of ordinal variables in Likert-scale data. Frequency of use was measured as a five-point Likert scale: 1: *never*, 2: *seldom*, 3: *sometimes*, 4: *often* and 5: *always* on a 62-item questionnaire.

The questionnaire consisted of strategies for both comprehension and learning of the new words. The final version of the questionnaire was used in a pilot group. Before administering it to all of the participants, the validity and reliability of the test was examined. , the reliability of the test turned out to be satisfying (Cronbach alpha= 0.82).

To determine the validity of the questionnaire, it was read critically by experts in applied linguistics to clarify its possible problems. Furthermore, in order to measure the degree to which the questionnaire accurately reflects or assesses vocabulary comprehension and vocabulary learning strategies, factor analysis with varimax rotation was also run. The results of the rotated solution revealed the presence of two components showing certain items loading substantially on one component and certain other items loading on another component. Factor analysis showed that the 62 strategies fit into the two main tentative factors as originally hypothesized (i.e., discovery and consolidation strategies). The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was 0.607 which was satisfactory where the KMO measures “the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed” (University of New Castle upon Tyne, 2002).

### **3. Results**

To answer research question one: "What strategies are used for vocabulary learning and vocabulary comprehension in an ESP context?", the analysis of the questionnaire revealed that using bilingual dictionary for determining the meaning of unknown words whether specialized or non-specialized was the most frequently used comprehension strategy.

Table 2. The most frequent comprehension strategies for specialized and non-specialized vocabulary

Field	Med	Mean	SD	Dent	Mean	SD	Pharm	Mean	SD	Mid	Mean	SD
non-sp	A15	3.21	0.802	A13	3.58	0.793	A13	3.42	0.793	A24	3.55	0.522
	A13	3.14	0.846	A44	3.25	0.965	A15	3.33	0.492	A15	3.18	1.250
	A24	3.00	1.038	A15	2.83	0.937	A19	2.83	0.937	A13	3.00	0.894
Sp	Q15	3.21	0.802	Q61	3.25	1.055	Q13	3.50	0.905	Q24	3.64	0.505
	Q13	3.14	0.864	Q13	2.92	1.379	Q15	3.33	0.651	Q15	3.18	0.982
	Q24	3.00	1.038	Q44	2.92	1.084	Q28	3.17	0.718	Q13	3.09	0.831

Field	Nurse	Mean	SD	Physio	Mean	SD	Manag	Mean	SD	Med	Mean	ds
non-sp	A24	3.08	0.954	A13	3.60	0.516	A13	3.73	0.647	A13	3.40	0.910
	A13	3.08	0.760	A15	3.30	0.675	A15	3.00	0.775	A44	2.93	1.335
	A15	3.00	1.155	A24	2.70	1.252	A4	2.91	1.044	A24	2.55	0.743
Sp	Q13	3.00	0.577	Q13	3.40	0.699	Q13	3.73	0.647	Q13	3.60	0.737
	Q28	2.92	0.954	Q15	3.30	0.675	Q15	3.09	0.701	Q44	2.93	1.335
	Q24	2.92	0.862	Q24	2.70	1.252	Q4	2.91	0.944	Q24	2.55	0.915

The strategies for non-specialized vocabulary were shown with letter A and strategies for specialized vocabulary were shown with letter Q. The first three most frequent vocabulary comprehension strategies were shown in table 2. Comparing the first three strategies reveals that strategy 13, using bilingual dictionary for determining the meaning of unknown words, was the most frequent one.

Table 3. The most frequent learning strategies for specialized and non-specialized vocabulary

Field	Med	Mean	SD	Dent	Mean	SD	Pharm	Mean	SD	Mid	Mean	SD
Lrn	A39	2.79	1.122	A43	2.50	1.000	A39	2.83	1.267	A54	2.82	1.250
non-sp	A53	2.54	0.967	A33	2.25	1.055	A29	2.67	0.985	A39	2.80	0.919
	A59	2.29	1.069	A39	2.25	1.658	A33	2.50	0.905	A17	2.64	1.433
Lrn sp	Q39	2.79	1.122	Q43	2.67	0.651	Q47	3.17	0.835	Q39	2.73	1.272
	Q53	2.50	0.941	Q54	2.42	1.443	Q41	3.00	0.853	Q54	2.73	1.272
	Q59	2.29	1.069	Q39	2.42	0.996	Q39	2.92	0.996	Q46	2.73	0.905

Field	Nurs	Mean	SD	Physio	Mean	SD	Manag	Mean	SD	Med	Mean	SD
Lrn	A39	3.17	0.937	A39	2.89	1.167	A39	3.27	0.647	A39	2.93	1.163
Non-sp	A59	2.69	0.630	A46	2.60	1.174	A45	3.18	0.982	A54	2.67	0.976
	A29	2.62	1.044	A54	2.56	1.130	A29	2.64	1.27	A43	2.40	0.828
Lrn sp	Q43	3.23	0.927	Q46	3.00	0.943	Q45	3.18	0.982	Q39	3.07	1.033
	Q39	3.15	0.987	Q39	2.70	1.418	Q39	3.18	0.751	Q54	2.73	0.884
	Q11	3.00	0.816	Q54	2.50	1.179	Q29	2.73	1.104	Q11	2.60	1.056

Among the first three most frequent strategies used for learning specialized and non-specialized vocabulary items, the highest mean is repeating the word silently together with its meaning as it is placed in text (A39). The next most frequent strategy is repeating the word together with its meaning aloud (Q54). Choosing between strategies 39 and 54 depended on the students' learning environment (i.e., whether they are at home, in the library or in the dormitory) on the one hand and their learning style (i.e., the role of hearing the pronunciation in learning) on the other.

To answer research question two "What knowledge sources are used for vocabulary learning and vocabulary comprehension?", the integrative summaries of all three data sources revealed that a great majority of the participants in different

fields of study did not demonstrate satisfactory levels of EFL vocabulary knowledge. Since comprehension is one of the basic requirements for learning a word, usually made explicit reference to the following knowledge sources in their comprehension and learning strategies depending on their degree of awareness of the existing knowledge sources and their usefulness in vocabulary comprehension.

	medicine	pharmacy	dentistry	midwifery	nursing	physiotherapy	management of healthcare services	medical records
L1 knowledge	64%	62%	44%	73%	62%	78%	73%	69%
Grammatical knowledge	50%	46%	38%	64%	54%	56%	56%	50%
Morphological knowledge	43%	38%	31%	55%	46%	44%	36%	44%
Academic knowledge	36%	31%	25%	45%	38%	33%	27%	25%
Knowledge of contextual clues	24%	23%	19%	36%	23%	22%	18%	18%

Knowledge of pronunciation and spelling	21%	15%	13%	18%	15%	11%	9%	6%
Knowledge of Collocational phrases	14%	8%	6%	9%	8%	0%	0%	0%

Table 4. The frequency of knowledge sources used in each field of study

#### 4. Discussion and Conclusion

As far as vocabulary learning and vocabulary comprehension strategies are concerned, the results are in line with those of Kudo (1999) and Schmitt (1997). With regard to comprehension strategies, the results of this study were rather predictable since the use of bilingual dictionary is a common practice among Iranian EFL learners due to the widespread practice of the Grammar-Translation Method and the lack of necessary study skills (such as how to use different pieces of information in monolingual dictionaries, word analysis and guessing the meaning from context).

According to the participants, the easiest and quickest way to find the meaning of the new words and comprehend the passage is to consult a dictionary. In addition, without a certain amount of vocabulary, it is hard to understand the definition of new words when using a monolingual dictionary. Students would find themselves looking up word after word as unknown words in one definition lead to other definitions. In sum, dictionary use aids second language learners' vocabulary development because it is the initial step in learning a new word. It provides fast and reliable support for learners who have vocabulary and language limitations.

In fact, the results of the questionnaire were verified by those elicited from interviews and observations of English classes and students' English textbooks. The participants in different groups explained that because of their limited knowledge of vocabulary, they could neither rely on their guesses nor use the monolingual

dictionary; so it was better to save time and energy by immediately referring to the dictionary. They did not have the essential comprehension skills including deriving the meaning of new words from the contextual clues and they got used to translating the text word for word.

The role of synonym learning revealed some interesting trends like some students wrote the Persian translation above each of the new words. However, there were students in different groups who, based on their reports in the interviews, attended English classes in private institutes where they had learned how to use monolingual dictionaries. These students had already written the English synonyms of the new words in their English textbooks before they were given the synonyms in the classroom. Many learners fixed on the meaning they had already learned for a given word and found it very difficult to use another one even if the one they knew had no sense in the new context. For instance, it was observed when the teacher asked the synonym of the word “*effectiveness*” in the sentence: “*The nurse evaluates the effectiveness of health care interventions*”, the nursing participants’ answer was “*influence*”. They had, in fact, written the Persian meaning “*tasir*” above it in their textbooks for which they already had the English word “*influence*” in their background knowledge and said it out loud in answer to their teacher.

The results of vocabulary learning strategies were also verified by those elicited from the other two sources. Students in different groups reported that memorization is the easiest and quickest way to learn the meaning of the new words. They agreed that although this strategy leads to short-time retention of the new words, it can allow them to satisfy their immediate need, i.e., passing the exam.

During the term, they underlined the new words in context or highlighted them so as to distinguish them from familiar words. They wrote their meanings (Persian or English if they have any synonyms for them in their mind) above them in the passage and after comprehending the meaning of the text (to make themselves ready to attend each ESP session), at the end of term, they tried to learn the words by repeating them silently as they looked at the word in the text while hiding its meaning. (Because of time constraints, large numbers of new words and high load of course work in each term; students often prepared a bilingual word list at the end of the term for their final exam and tried to learn the new words through repetition. In other words, students focused primarily on short-term comprehension strategies and not on long-term

language-learning strategies, and the reason for this is that students were not externally motivated (by, say, a mid-term exam) to learn words before they had to for the final exam.

In interviews, when they were asked: “How do you learn a new word?” they replied: “we memorize it”. For them, learning was synonymous to memorization as they were not aware of other more effective learning strategies. This fact was also revealed when they were asked to answer the questionnaire. The students in different groups said that they did not know that there could be other strategies for learning a new word. However, their reports of the process of memorization in interviews revealed that they did not use pure memorization and it was associated with a kind of land marking or assigning some kind of code to the words to facilitate memorization (i.e., their learning) and to increase their retention period. They mostly related the sounds in the pronunciation of the English word whether specialized or non-specialized to the sounds in the meaning of the same word in Persian. For example, “*chill*” means “*larz*” in Persian; both of them have the sound /l/. Or for learning the word “*pituitary*” which means “*hypofiz*” in Persian, one of the medical students said that he made a code in this way: since “*pituitary gland*” is said to be as small as a “*pea*” and both “*pea*” and “*pituitary*” begin with the sound “p”; learning the meaning of *pituitary* becomes easy. Or in learning the meaning of the word “*ill*”, one of medical records students reported that the word “*ill*” reminded him of the Persian word “*i:l*” (i.e., tribe) who do not have the necessary facilities to observe hygienic rules and ,therefore; they may frequently become “*ill*” (i.e., sick). For learning the word “*discard*” one of the nursing students said that this word consists of the part “*card*” which in Persian means “*knife*”; so the word acts as a knife that cuts something and the unusable part is “*thrown away*”. Or the word “*universal*” is like “*university*” which includes all of the fields of study so it reminds her the words “*jame’ v kamel*” in Persian (i.e., comprehensive, including everything).

Since comprehension is one of the basic requirements for learning a word, they usually made explicit reference to the following knowledge sources in their comprehension and learning strategies depending on their degree of awareness of the existing knowledge sources and their usefulness in vocabulary comprehension. The findings in this part of the study are in agreement with Nassaji’s (2003) study of the relationship between strategies and knowledge sources. The knowledge sources are

arranged from the most- to the least-frequently used by the participants in different groups.

**L1 knowledge.** Using L1 knowledge, the learner attempts to figure out the meaning of the new word by translating or finding an equivalent for it in their L1, i.e., word for word translation strategy. From classroom observations, this over-reliance word-for-word translation is illustrated nicely in the following exchange in midwifery classroom. When asked for a synonym of the word "enable" in this sentence: "Enzymes enable microorganisms to make proper use of food." Students answered: "able", "power", "ability", "can", or "capable". Their answers were mainly based on the meaning they derived from the new word itself without paying any attention to its part of speech or its grammatical function in the sentence.

The findings about dictionary use revealed that the first piece of information all participants looked for in a dictionary was the meaning of the word. As far as part of speech of the word was concerned, they also tried to take it into account to some extent since this feature could also help them in the translation/comprehension of the words in a sentence. They usually inferred this feature based on the meaning of the word and/or the suffixes attached to the word and they did not usually pay any attention to the abbreviations used for the parts of speech in each entry in the dictionary. They also used the grammatical function of the words in the sentence to infer its part of speech. It was usually the case when they were good at recognizing grammatical relations between the words.

As one of the most important functions of dictionaries is to provide word meanings, it is understandable that L2 learners consult dictionaries most frequently to check the meaning of new words. Learners value dictionaries because they can improve the reading comprehension of lower proficiency L2 learners and they assist vocabulary learning at all levels of proficiency (Hulstijn et al., 1996; Knight, 1994). Also, their definitions are short and relatively easy to understand. However, they can contribute to over-reliance on one-to-one word translation (Baxter, 1980; Tang, 1997).

**Grammatical knowledge.** Based on the results elicited from calculating the frequency of items mentioned in question (one of the interview in part one and the

questions in part two of the interview and from observation of students' notes), since the participants in different groups highly relied on the translation of the English passages into their L1 as a main device for exact comprehension of the texts, one of the frequently used knowledge sources was their limited grammatical knowledge of L2 words. It is in line with Paribakht (2004) who found that such knowledge can make significant contribution to understanding the meaning of unfamiliar words while reading.

Grammatical knowledge is using knowledge of grammatical functions or syntactic categories such as verbs, adjectives or adverbs. For example, in observing the nursing class, this sentence: "*Surface temperature fluctuates depending on blood flow to the skin and ...*" was translated as "*taghirat-e damay-e sathi bastegi darad be...*" by one of the students who indicated that "*depend*" was considered as the main verb of the sentence and "*fluctuates*" was considered as a plural noun and as the subject of the sentence. In this regard, when the teacher asked the students in the same class to make a question about this sentence, some students (6 students) answered: "*What do surface temperature fluctuates depend on?*"

**Morphological knowledge.** Due to our participants' limited morphological knowledge in different groups (based on observations and interviews), they usually considered compound words as single units with one meaning for the whole word unless they became familiar with their constituent parts in their Medical Terminology course. The participants also seemed to use their knowledge of the most frequent affixes to make some overgeneralizations. For example, it was observed that the participants in management of healthcare services took the word "*disappointed*" as the opposite of "*appointed*" or "*discover*" as the opposite of "*cover*". In another example in the nursing group, in the sentence: "*It may be misleading for the nurse to diagnose a problem on the basis of one assessment finding.*", the word "*misleading*" was translated as "*monjar nashodan*" which indicates that "*mislead*" was considered as the opposite of "*lead to*".

When the participants in medicine, dentistry and pharmacy groups became familiar with the medical terminology or the meaning of the constituent parts of the

specialized vocabulary, they (based on observations and interviews) mainly relied on word analysis for both comprehension and learning of such words.

Studies show that introducing the morphological method into language teaching helps students to learn quickly, easily and accurately with a minimum time and effort and maximum growth and retention of vocabulary (Xiao and Lu, 2005). Kieffer & Lesaux (in press) found that those students who take unfamiliar words and break them down into smaller parts, or morphemes, have increased success in deciphering and learning unfamiliar vocabulary.

**Academic knowledge.** Based on the results elicited from observations and interviews, in reading ESP books, the participants used their knowledge of academic (specialized) courses to a great extent to understand ESP words. For instance, it was observed that in a passage about techniques of assessment such as palpation, percussion, auscultation and inspection, since the nursing participants obtained enough knowledge about these techniques in their theoretical specialized courses as well as in their practical training courses, although they had difficulties in understanding some of the sentences word for word, they could understand the essence of the sentences.

Similarly, it was observed in the medical group that almost all participants did not have any problems in understanding this sentence: "common regional anesthesia techniques include spinal (subarachnoid block), epidurals, caudals and major peripheral nerve blocks."; since they had already learned (internalized) the concepts for the specialized terms in their anatomy course so that they did not need to have any translation for the words "caudal" and "epidural" and automatically pronounced them in Persian pronunciation system (i.e., /kodal/ and /epidural/). In fact, translation of many such specialized words was difficult for the participants in all groups and they preferred to use the word as pronounced in English in Persian system when they learned the concept.

**Knowledge of contextual clues.** Another related source of knowledge was knowledge of contextual clues. Inferring the meaning of unknown words from the context in which it is used is one of the comprehension strategies used by the learners. Based on observations and interviews, the participants in all groups did not ordinarily

pay attention to the contextual clues in the text and they insisted on deriving the meaning from their bilingual dictionaries. For example, it was observed when the teacher asked for the synonym of the word "*deliberate*" as in the following sentence: "*Unlike the immune system, which is slow and deliberate, the effects of inflammation are immediate*", the nursing students gave its literal meaning based on what they found in bilingual dictionaries (i.e., "*agahane*") instead of giving its contextual meaning (i.e., the synonym of the word "*slow*" or the opposite of "*immediate*" in this sentence). This implies that students need consciousness-raising to improve their comprehension of new words based on the contextual clues that are used.

In line with Laufer (2003), it was observed that when a word is noticed as unfamiliar, the reader may try to infer its meaning from context. Yet, not all contexts provide clues for unknown words. Sometimes, clues are ignored when the reader thinks s/he understands the message or when the correct meaning is not compatible with the learner's knowledge of the world. There are also cases when knowledge of the world overrides the use of a linguistic clue. More importantly, clues may appear in words which themselves are unknown to the learner and are therefore unusable.

**Knowledge of pronunciation and spelling.** Pronunciation was also important for learning the meaning of the new words especially for auditory learners. However, there were some variations in the way the participants used it. It was observed when the teacher asked the participants in different groups randomly to read part of the text; they usually pronounced the new word as it was written/spelt. For example, the nursing students usually pronounced the word "*heart*" as the word "*hurt*" or pronounced the letter "*p*" in "*pneumonia*" or the word "*patient*" as "*patiyent*". There were few participants (one or two students) in each group especially those attending private English institutes who preferred to refer to monolingual dictionaries as they were taught how to find the meaning together with the pronunciation of the new word there. Based on observations and interviews, the participants in different groups mainly relied on pronunciation of the new words when they had to distinguish words with similar or identical pronunciations (homophones) but with different meanings and they mainly relied on spelling when they had to distinguish words with similar or identical spellings (homonyms) but different meanings.

In fact, knowledge of pronunciation is related not only to the use of L2 words but also to their acquisition. Research findings have shown that when students know how to say a word, it is easier for them to commit the word to memory (Chi et al., 1994; Fan, 1998; Fan et al., 1996). However, it is a fact that most students have difficulty with phonetic scripts (Taylor, 1988; p. 89) and this will continue unremedied until they get help from the teacher.

Correct pronunciation provides the basis for accurate spelling. With correct pronunciation and fair knowledge of spelling rules, correct spelling can be achieved. Clearly, correct pronunciation and proper knowledge of spelling are a great help to memorize words. As a result, spelling rules as well as the relationship between pronunciation and spelling should be expounded thoroughly to the EFL learners.

**Knowledge of collocation.** In fact, it was observed that the students in different groups were not usually able to recognize most phrases due to their unfamiliarity and the infrequent use of monolingual dictionaries. Therefore, participants translated them literally and tried to stick to the most frequent meaning which they first learned for the same word or the first meaning mentioned in the bilingual dictionary entry. It was observed that since the participants in different groups got used to translating each word in the order in which it occurred in the sentence, they could not recognize the components of a phrase especially when they were separated from each other. For example, in the sentence: "*Despite extremes in environmental conditions and physical activity, temperature-control mechanisms of human beings keep the body's core temperature or temperature of deep tissues relatively constant.*", midwifery students had difficulty to recognize the verb of the sentence as "*keep constant*". Or in the sentence: "*Precise determinations of the client's health problems can be made*", all midwifery students considered "*can be made*" as the main verb rather than "*make determinations*".

However, there were cases where students in all groups mentioned that learning the words together facilitated their learning. They reported that it is true only when they knew that the words are related in a phrasal group. For instance, midwifery students mentioned that learning "amniotic sac" is much easier for them than learning each of the words by itself. It is also the case for learning the words in the phrase "viral invasion".

McCarthy claims that “in vocabulary teaching there is a high importance of collocation”, and describes that ‘the relationship of collocation is fundamental in the study of vocabulary, and collocation is an important organising principle in the vocabulary of any language’ (1990:12), focusing on collocation acquisition as an appropriate perspective to enrich vocabulary. Students should be encouraged to adopt a more context-based approach by going beyond the word and paying attention to the phrase, clause, sentence and even the paragraph in which the word is located.

### **5. Implications of the study**

The results of this research offer some insights for ESP learners, instructors, curriculum developers and materials writers. One of the crucial characteristics of ESP students that make them fundamentally different from other English as foreign language (EFL) students is that they do not usually need concept-formation, without which the simple retention of word-meaning pairs is meaningless, since they have already acquired the necessary concepts in their L1. In addition, they are expected to learn (i.e., use receptively and productively) both non-specialized and specialized vocabulary in their field of study.

Most of the students, while answering the questionnaire, reported that they did not know that there were so many different strategies to learn vocabulary. If students can find strategies suitable for them and actually use them, this might increase their vocabulary size. ESP learners should learn to recognize different VLSs and be advised to select the appropriate ones depending on the nature of the words they are learning, their purpose of learning and the conditions in which the words are learned. Use of appropriate VLSs enables students to take responsibility for their own learning by enhancing learner autonomy, independence and self-direction (Lee 2003). These factors are important because learners need to keep on learning when they are no longer in formal classroom setting.

In this study, it was revealed that in fields in which the content of the material in the students' specialized field was presented mainly by using English terminology, the references were mainly in English, the content teachers' lectures were full of English terminology and students also practically experienced the necessity, critical role and usefulness of specialized vocabulary in their training clinical courses, ESP students resorted to more elaborative strategies to learn the new vocabulary for long

term purposes while in fields in which the students did not feel the practical usefulness of the vocabulary items in simulated occupational settings, most of their references were translated into Persian and their content teachers used mostly pure Persian, ESP students resorted to repetition and memorization for short term purposes.

Since referring to bilingual dictionaries is the most frequently used comprehension and to some extent learning strategy, dictionary work, including practicing good dictionary skills, is useful as an independent vocabulary acquisition strategy. Students usually come to the language classroom without these study skills, so it is helpful to expose them to a variety of ways to practice words and their definitions and let them choose the manner which is comfortable for them.

The primary lexical objectives are increasing vocabulary breadth, elaborating vocabulary knowledge, developing fluency with known vocabulary and coordinating the use of strategies with various knowledge sources. The means for achieving these objectives are skill-based and include training learners to effectively learn decontextualized lexis, consolidate and elaborate previously met lexis, consult dictionaries, infer from context and engage in reading for meaning.

It is equally important to foster a type of word learning environment that helps students actively use enriched knowledge of words through developing different knowledge sources as students are exposed to words in different contexts.

Teachers should become aware of learners' strategies and learning styles so that they can develop teaching strategies that are compatible with their students' ways of learning. In addition, diversified vocabulary learning activities should be incorporated in both the classroom and ESP books to accommodate various styles of learning and various types of vocabulary items.

Content-based ESP teaching presents a challenge to ESP instructors (Bell 1996). The problems faced by ESP teachers and the students can be placed at the opposing ends of a bipolar scale; the students struggle with the language of the content and the teachers struggle with the content of the language (Liyanage & Birch 2001). As a result, solving this problem requires collaboration between content teachers and language teachers.

In this regard, the curriculum of presenting courses must also be revised in a way that the necessary specialized courses were held first to familiarize the students

with basic specialized concepts and then the ESP courses together with Medical Terminology course would be presented. In this way the schematic knowledge is formed to anchor the new labels to it. On the other hand, the ESP books must be revised in a way that short interesting specialized topics together with attractive pictures are presented to the students to motivate them to read ESP texts as extensively as possible.

In this study it is observed that there is time interval between general English course and ESP courses. During this time interval, students did not have the necessary exposure to English texts (except in few cases in the form of optional translation work). So they mainly forgot the English words they had already learned for two reasons: the main strategy of learning new vocabulary is memorization, the conditions for their recurrent use or frequent reference to them are not provided.

To mitigate this problem, one of the alternatives is to present two-credit English courses in each term to provide enough time for teachers to develop the basic study and reading skills together with different kinds of VLSs to develop the students' reading comprehension and expose students to as many ESP texts as possible to provide conditions to practice and reinforce those skills and strategies. This might remove one of the main hindrances of learning which according to students' reports is learning a large number of new vocabulary in a very short time under the pressure of passing the final exam rather than willingly and with high motivation.

Finally, material designers should first conduct a needs analysis and define objectives of the learners in relation to their field of study before writing materials. This can lead to providing interesting, informative, short, pictorial passages with few new vocabulary items which are repeated in subsequent passages with enough exercises to practice and reinforce the essential learning strategies.

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**\*Note: (EViews 6 Student Version** allows students to analyze datasets whose size is limited only by available computer memory. Among the features students may use via EViews' easy-to-use context sensitive menus and dialogs are: basic descriptive statistics and ANOVA, tabulation, cross-tabulation, covariance and correlation analysis, principal components, **factor analysis**, empirical distribution function tests), time series plots, distribution graphs (histograms, distribution plots, kernel density plots. Instead of this software, we can also use SPSS.