Collegiate Aviation Review International

Volume 37 | Issue 2 Peer-Reviewed Article #6

8-5-2019

Explicit, Implicit, and Blended Vocabulary Instruction: Efficiency in an Aviation English Course

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This paper reports on the results of vocabulary teaching sessions in an Aviation English Course conducted with three different groups of 12 fourth-year undergraduate students at the Flight Academy of the National Aviation University in Ukraine. The research objective was to identify how the explicit, the implicit, and the blended instruction influenced the students' progress in Aviation English vocabulary acquisition. Experimental data was analyzed following the grounded theory approach. Each group took a pretest, a post-test, and a delayed test. The results showed that all three types of vocabulary instruction had a positive effect on the learning and recall of aviation vocabulary. The students who received the explicit treatment statistically outperformed the other two treatment groups in the posttest, based on immediate word acquisition. The results of the delayed test demonstrated that blended instruction was the most efficient approach in terms of delayed vocabulary retention as compared to a solely implicit or explicit teaching method. Therefore, we conclude that Aviation English classroom practices should incorporate a balanced approach employing both implicit and explicit vocabulary instruction.

Recommended Citation:

Fainman, I. & Tokar, Y. (2019). Explicit, Implicit, and Blended Vocabulary Instruction: Efficiency in an Aviation English Course. *Collegiate Aviation Review International*, 37(2), 110-132. Retrieved from http://ojs.library.okstate.edu/osu/index.php/CARI/article/view/7911/7306

Lexical competence is crucial to foreign language proficiency. The vocabulary of a language is just like the bricks used to construct a building. McCarthy (1990) stated "it is the experience of most language teachers that the single biggest component of any language course is vocabulary" (p. viii). Vocabulary is a key to effective communication, i.e. it is needed to convey the meaning and comprehend the idea when listening and reading.

Furthermore, McCarthy (1990) argued that "no matter how well the student learns grammar, no matter how successfully the sounds of a foreign language (L2) are mastered, without words to express a wide range of meanings, communication in an L2 just cannot happen in any meaningful way" (p. viii). Therefore, it is clear why linguistic and methodological issues of vocabulary teaching have become of particular value.

Aviation English is used in professional communication where a lack of the necessary lexical skills can lead to miscommunication, or cause fatal accidents. Searching for the most efficient ways of teaching Aviation English vocabulary is of paramount importance.

Nonetheless, there is no consensus among the researchers concerning greater productivity and efficacy of some instructional practices over the others. Beck, McKeown and Omanson (1987) emphasized, that "research has provided much useful information about vocabulary learning and instruction. What it has not provided is a simple formula for optimal instruction, because no such formula can exist" (p. 150). However, researchers still strongly argue on which instructional method—implicit or explicit—yields more effective lexis acquisition. A number of linguists (Cunningham, 2005; Stahl, 2005) support the use of deliberate regular instruction alongside with multiple exposures, thus aiming at effective vocabulary development. On the other hand, Newton (1995) and Nation (2001) opt for implicit instruction, which requires rich contexts to expand the vocabulary. Both approaches definitely have certain advantages as well as some shortcomings, while there is a suggestion that "vocabulary is neither the exclusive domain of implicit nor that of explicit learning but it is rather associated with both and the two modalities interact with and influence each other" (Souleyman, 2009, p. 48). As Schmitt (2000) stated, the best vocabulary acquisition method is "a proper mix of explicit teaching and activities from which accidental learning can occur" (p.145).

This paper brings together suggestions from a varied body of research on L2 and English for Specific Purposes (ESP) vocabulary learning and discusses the peculiarities of explicit, implicit and blended vocabulary instruction. It provides insight into teaching vocabulary in the Aviation English Course and finally presents the study, comparing the learning outcomes of explicit, implicit and blended aviation vocabulary instruction to three groups of learners.

Literature Review

Specialized Vocabulary: Why it is Important in an Aviation English Course

The Aviation English Courses taught at colleges and universities can generally be regarded as English for Specific Purposes. ESP is a blanket term used for a variety of spheres. According to Strevens (1988),

> ESP is designed to meet specific needs of the learner. (…) The language taught to the ESP learners is related in content (themes and topics) to the professional context it is going to be used in. (…) Moreover, the language needed in these activities is in the center of the course, and it covers all the language needed by the learner in order to function in a given work environment (p.4).

Consequently, specialized vocabulary composes an essential part of an ESP course to serve the needs of students since second and foreign language learners feel the necessity for a large lexical corpus to cope with their studies and further work in academic or professional environments.

Aviation vocabulary is crucial in an Aviation English Course for a number of reasons. Some of them are common to all the ESP areas whereas others deal with the specific peculiarities of this certain sphere.

First, aviation vocabulary is highly important for future aviators because knowledge of the specialized vocabulary of any field is tightly related to content knowledge of the discipline. In a longitudinal study of undergraduate students' academic writing Woodward-Kron (2008) wrote,

> The specialist language of a discipline is intrinsic to students' learning of disciplinary knowledge; students need to show their understanding of concepts, phenomena, relations between phenomena etc. by incorporating the specialist language and terminology of their discipline into their writing accurately. They also need to adopt the specialist language in order to make meaning and engage with disciplinary knowledge (p.246).

Secer and Sahin (2014), focusing on challenges of teaching aviation vocabulary and radio phraseology at the high school level, stated that "teaching the meaning and the usage of the technical vocabulary contributes a lot to the learning of the content area" (p.111).

Secondly, this engagement with disciplinary knowledge and vocabulary is significant because it signals the belonging to a community which shares the same concepts and understandings of a field (Wray, 2002). "Specific purpose language is precise, has distinctive features (lexical, semantic, syntactic or even phonological) which make it peculiar and understandable only in the environment of its users" (Douglas, 2000, p. 7). In other words, specialized vocabulary makes the language of the air transportation professional environment absolutely impenetrable for a layman.

The third, and probably most substantial, reason for the prime importance of aviation vocabulary lies within the main conceptual value of the sphere—transportation safety. Effective, clear and reliable communication between a pilot and an air-traffic controller is a vital element of safe air-traffic control (Kolosov & Ivanova, 2000, p.90).

The International Civil Aviation Organization (2010) explains: "With mechanical failures featuring less prominently in aircraft accidents, more attention has been focused in recent years on human factors that contribute in accidents. Communication is one human element that is receiving renewed attention" (p. vii). English is a working language in international aviation and mutual intelligibility for both native and nonnative English speakers is the main purpose of language cooperation between the participants in the air transportation sphere. In any communication situation within aviation discourse (which mostly involve the knowledge of ESP vocabulary, i.e. aviation specialized word store), even the most perfect knowledge of English is not enough to succeed in the communication process. Being a native speaker of English does not guarantee proficiency in Aviation English.

Aviation English vocabulary constitutes the core of the communication in the professional aviation environment, thus directly influencing its efficiency and security. If communicators lack specialized vocabulary, they tend to apply communicative strategies to avoid using these words which is completely inacceptable and disastrous in aviation due to its highly regulated language means usage.

Teaching Aviation Vocabulary

Dudley-Evans and St. John (1998) are of the opinion that teaching ESP vocabulary is defined by the same principles as teaching English vocabulary for general purposes, just as if in a L2 course. Therefore, general pedagogy and basic ideas on learning and teaching ESL vocabulary are well-applicable in the overview of Aviation English vocabulary acquisition. Nevertheless, given the nature of this specialized vocabulary, "the treatment of vocabulary in ESP courses may in some ways be more challenging than in general purpose English courses" (Hirvela, 2013, p.84). For instance, Coxhead (2013) emphasized that there are everyday words with specialized meanings and they "could present difficulties for teachers as learners struggle to learn new meanings and concepts for words that are already established in their lexicon in a particular way" (p.127). Thus, vocabulary instruction in ESP courses, and Aviation English as well, requires a well-planned and consistent method to help students cope with all the challenges they might face and eliminate possible difficulties for Aviation English teachers.

The authors are strongly convinced that acquiring new lexis for professional communication has to be systematic, logical and planned rather than spontaneous and extemporaneous. Since the civil aviation communication environment is well defined and requires the knowledge and usage of particular lexical items, relying only on incidental acquisition is not reasonable. The authors do not deny the potential value of unconscious or uncontrolled vocabulary learning, but being usually incidental and unsystematic, it is unlikely to develop deep and profound lexical skills proficiency. The authors admit targeted instruction has to be well-planned and stated clearly in syllabi, lesson plans and curricula. On the contrary, learning cannot be mandated - students are directed to study, but the act of learning is more of an internal process. However, according to Petty, Herold and Stoll (1968) using any vocabulary instruction is certainly better than no instruction at all. Sticking to any vocabulary teaching plan is more likely to be productive than spontanious and rash practices *Thus, any Aviation English Course is certainly planned* to systematically cover a certain scope of *vocabulary. However, the consideration is what approaches a teacher should adhere to and what methods and strategies he/she chooses to apply in each class in order to achieve the goals and satisfy the learner's needs.*

The previous publication (Fainman & Tokar, 2018) followed Graves, August and Mancilla-Martinez'(2013) ideas and worked out a four-component vocabulary teaching program for an Aviation English Course. The authors admit the need to involve students in implicit vocabulary expansion through reading and listening along with targeted, systematic and consistent vocabulary acquisition on the basis of an explicit teaching instruction. "From an educational point of view, incidental and intentional vocabulary learning should be treated as *complementary* activities which deserve both to be practiced" (Hulstijn, 2001, p. 272).

It is essential not solely to encourage students to devote much time to reading or listening to professional topics, because this is not sufficient to acquire the necessary lexical items, but it is also important to involve them in the reading and listening to subject-related tasks which would as well stimulate word encoding and processing in context. Exposure to language input does not necessarily result in effective vocabulary acquisition. The input must be easy to process and a richly meaningful context provides the best chance for the development of lexical knowledge. "Each successful encounter with a word increases the strength of the mapping between each word form and its different meaning and uses" (Barcroft, 2015, p. 35).

Furthermore, Sternberg (1987) emphasized the necessity of theory-based instruction concerning the importance of meaning inferring processes. This means students will definitely enrich their vocabulary if they are familiar with word-learning strategies and the role of word structures. Thus, teaching strategies for expanding vocabulary and developing students' learning skills, as well as promoting their awareness of subject-specific lexis and its importance in aviation have to be an essential supplementary part of the effective vocabulary teaching program.

Thus, the following four components of vocabulary teaching program in an Aviation English Course have been defined (Fainman & Tokar, 2018):

1. Explicit teaching of selected lexical items
2. Implicit vocabulary teaching by exposure to relevant comprehensible input
3. Teaching word-learning strategies
4. Fostering word consciousness.

The four-component vocabulary teaching program as discussed is quite comprehensible. However, there is a practical question which remains unsolved in Aviation English pedagogy: Which instruction, explicit or implicit, or a combination of both, is preferable in order to provide the most effects on students' vocabulary learning and retention?

Explicit, Implicit and Blended Vocabulary Instruction in an Aviation English Course

The instruction type is an important contributor to the development and consolidation of vocabulary knowledge. On the basis of the detailed analysis of current pedagogical studies (Hulstijn, 2001; Laufer, 2009; Nation & Webb, 2011; Schmitt, 2008; Sökmen, 1997) the distinction between explicit and implicit vocabulary learning has been elaborated in the background of this research. Methodologically, the difference is essential for any researcher intending to design a vocabulary learning experiment (Hulstijn, 2001). Herein, the authors suspect that the three kinds of vocabulary instruction under study will differently affect the result of students' vocabulary learning and retention of the target words in an Aviation English Course.

The emphasis of *explicit vocabulary instruction* in this research is on the implementation of the direct teaching of targeted vocabulary; students are informed that they will be tested on specific lexical items that are then taught explicitly. Explicit vocabulary instruction refers to a vocabulary learning activity where the learners consciously and intentionally learn the target vocabulary, such as when a student completing certain tasks is informed of the principal objectives, singles out new lexemes, focuses on them and resorts to a number of meaning inferring strategies.

Implicit vocabulary instruction refers to teaching lexical items involving students' vocabulary learned through an activity in which the new lexical items are mastered without the learners' being conscious of it, in particular during reading or oral communication, or as a secondary result of an activity. This is an automatic operation, characterized by limited premeditation. In the process of implicit vocabulary teaching, students get new vocabulary from the context, though they did not mean to do so. Thus, students concentrate on comprehending the general contents of the written text or the video, lexis enhancement becomes the natural outcome of this activity and a focused intention to learn is not needed. Grounded on this assumption, in this study, the implementation of implicit vocabulary instruction presupposes no attraction of students' attention to specific language aspects or lexical units in the video, listening or reading tasks.

However, the authors do admit that for the most part teaching vocabulary is not limited to the use of purely implicit or purely explicit methods. Vocabulary instruction varies significantly; the methods used can be greatly explicit as well as distinctly implicit, depending on a number of factors. Moreover, students function under an explicit condition when reading or listening to a piece of information with the purpose of answering the forthcoming questions concerning the contents, but they simultaneously function under an implicit condition as they are exposed to unknown words not expecting any monitor procedures or checks of these words.

One objective of this paper is to distinguish explicit and implicit vocabulary teaching in terms of the use of pre-learning instructions that either do or do not forewarn about the objective of the activity (such as learning a corpus of new lexical items) and the existence of a subsequent vocabulary retention test.

A number of experiments have already been conducted and further described in scientific publications as for L2 vocabulary teaching, but the researchers disagreed as to whether implicit or explicit approaches were more efficient. Thus, Zimmerman (1997) emphasizes the principle benefits and claims that implicit vocabulary teaching is highly connected with the context (a student learns about the meaning of a word and its usage) and it involves a learner into two kinds of activity at the same time— he/she reads (listens to/ watches) and enriches his/her vocabulary. Nevertheless, implicit instruction has its shortcomings. It may take students quite a considerable amount of time to guess the meaning from the context. Concerning this fact, Zhang (2008) noted that "heavy reliance on L2 vocabulary acquisition through inferring words from context seems to be a slow process. In natural contexts, incidental L2 vocabulary learning does not seem to contribute a lot to vocabulary retention" (p. 30). Moreover, the guesses may not always be correct or accurate enough (Huckin & Coady, 1999; Mukoroli, 2011), thus making the process of word acquisition not efficient.

Dakun (2000), dwelling upon the advantages of explicit vocabulary teaching, emphasized that in this way learners can use cognitive and metacognitive strategies which can facilitate their efforts. Schmitt (2000) stated that "certain important words make excellent targets for explicit attention, for example, the most frequent words in a language and technical vocabulary", while emphasizing that "some explicit learning is probably necessary to reach a vocabulary size 'threshold". At the same time the researcher has not denied it is "time-consuming and... too laborious" (p. 120-121). Nagy (1997) emphasized that the amount of words in a language is quite considerable and goes further, stating that direct vocabulary teaching is time wasting. However, the researcher acknowledged that the minor part of the vocabulary could be acquired more effectively by means of explicit instruction. Nation (2001), on the contrary, supported the idea of explicit vocabulary learning, emphasizing that the time spent on the process is worth it.

Since 2000, more and more L2 pedagogy researchers have started focusing on blended vocabulary instruction, stressing that implicit and explicit teaching should not be seen as opposing each other but as complementary activities. Sökmen (1997) has presented facts that the usage of solely implicit teaching methods will not invariably result into learning, and underlines "the need to accompany it with a much stronger word level or bottom up approach than had been previously advocated" (p. 239). The author has recognized that it is "worthwhile to add explicit vocabulary to the usual inferring activities in the second language classroom" (p. 239).

This research defines *blended vocabulary instruction* as the approach that combines aspects of both implicit and explicit vocabulary teaching in the act of involving students in the lexis acquisition process and can be described as an instruction which presupposes the use of a few treatment schemes for the purpose of improving the acquisition results. Herein, different sequences and combinations of tasks and

actions might be possible. For instance, providing meanings for a part of novel words can come first and then be followed by completing a reading or listening problem-solving task which presupposes inferring meaning for a number of non-presented lexical items; or some post-reading tasks are organized to explicitly focus on target words.

Contrary to the existence of multiple EFL studies, ESP pedagogy is not really rich in research and experimental evidence on the efficiency of either explicit, implicit or blended vocabulary instruction. A thorough review of related literature has discovered that very little research has been conducted on examining which kinds of vocabulary teaching approaches are the most effective in ESP classes. Kusumawati and Widiati (2017), having conducted an experiment, stated that explicit vocabulary teaching in English for engineering courses leads to better results than implicit teaching. Ozola (2015) dwelled on using audio materials for ESP vocabulary acquisition and on the basis of a case study found implicit lexis teaching to be rather efficient. Nevertheless, to the best knowledge of the researchers, no studies at the international level have been conducted investigating the impact of applying explicit, implicit and blended vocabulary teaching strategies so as to improve an Aviation English Course. Therefore, this study is expected to be an effort in the right direction in investigating the influence of vocabulary instruction type on the students' progress in Aviation English lexical competence.

Certain conditions need to be outlined for our research. It cannot be really objective without taking into consideration the factors which directly affect the efficiency of the teaching process. The authors accept the viewpoint (Takač, 2008) that the role of the implicit vocabulary instruction, such as exposure to multiple language contexts, in the initial stages of vocabulary learning is relatively negligible. Beginners do not have enough linguistic knowledge which is critical for success of contextual inferencing. Besides, more than language competence is needed to understand aviation texts. It is possible for a student to know all the words in a passage and still not make any sense of it if he has no prior knowledge of the topic. To make constructive use of vocabulary the student also needs a threshold level of knowledge about the topic. This enables him to make sense of the word combinations and choose among multiple possible word meanings (Hirsch, 2003). Since the Aviation English Course presupposes learners' specific professional needs and in Ukraine they usually take the course within a complex higher education training program, without having any prior background knowledge in this area, we realize that there is very little influence of implicit vocabulary instruction at the beginning stages of the Aviation English Course. Thus, our research involves only the later stage which covers the third and the fourth years of teaching Aviation English.

Method

Participants

The participants of the study were selected from among the fourth-year undergraduate students at the Flight Academy of the National Aviation University in Kropyvnytskyi, Ukraine. All were native speakers of Ukrainian and Russian and had at least 5 years of experience studying general English at secondary schools. All of the students passed the External Independent Evaluation Exam in English when leaving school and overcame the threshold level of 124 points.

All the participants had been studying English at the academy for three years and had taken the same number of courses. They took part in a pretest which was used to check the homogeneity of the group in terms of their proficiency level. According to the results from the pretest, three out of the five groups of students were selected for this pedagogical experiment as those that turned to be most homogeneous. All of the participants were males. They varied in age from 20 to 22 years and were all initially at about the same level of Aviation vocabulary proficiency. Each group consisted of 12 students. Thus the total number was 36.

Limitations of the study

First of all, the authors acknowledge that one of the limitations of this study was the low number of participants—only 36 students overall with 12 students in each group. The lack of representation of population may result in a kind of sampling error, but the number of students chosen was the only possible option predetermined by several reasons. The academy takes only 4-5 groups of students for pilots' training every year, as it is rather costly and requires special technical facilities. A maximum of three groups could be included in the research to maintain homogeneity. As the only institution of its kind in Ukraine, it was impossible to involve more students in the experiment. Thirdly, the authors could not implicate foreign students studying at the Flight Academy, unfortunately. We are strongly convinced that for the sake of providing true results only homogenous groups of students could take part in the experiment. The fact is all the Ukrainian students pass External Independent Evaluation Test in English before entering the Academy and get not less than 124 points, while foreign students do not take the same examination. What is more, foreign students constitute separate groups and study separately from Ukrainian students, though covering the same curriculum. Thus, their level of English might be significantly lower or higher when getting to the academy or even after 3 years of studying. These implications have been as well backed up by the results of the pre-test, since the group of foreign students turned to be not homogenous in terms of their proficiency level and that is why was not designated in the research.

In addition to the limitations described, the study was conducted within a relatively short, 6-hour period of time, covered one vocabulary topic, and spanned three classes. While a profound research, covering vocabulary acquisition within more than one topic, would be more impressive and powerful, the authors plan to include this in future scientific projects.

Finally, the participants were only undergraduate students already having a certain level of background knowledge in aviation, aerodynamics, meteorology, and other relevant topics.

Materials and validity of the instruments

The authors prepared the pretest, the posttest and the delayed test . For the sake of validity the tests were given to a group of Aviation English experts at the Flight Academy of the National Aviation University (Kropyvnytskyi, Ukraine) to examine for test accuracy and adequacy. The group consisted of five associate professors who all teach Aviation English Courses. The authors received their critical reviews and made all the necessary modifications according to the comments mentioned.

All three tests used various question types—gap filling, multiple choice, matching, word building, and others—setting primary focus on the target vocabulary. The sample of the post-test is presented in Appendix A. Before the research execution phase all the tests had been piloted to provide the clarity of the instructions and evaluate the timing of each task.

Authentic texts on the professional topic containing the selected target vocabulary as well as the corresponding audio-visual materials were chosen for implementing the teaching program.

Data collecting technique

The data collecting technique in this research was conducted in several steps as follows:

1. All of the participants (N=36) were asked to take the pretest, which was administered one week prior to the study. The pretest was carried out to make sure that the target words in

this experiment were unknown to all students. On the whole there were 33 target words relating to the topic (see Appendix B).

2. One week after the pretest, the researchers began the session for each group which required three regular classes covering one topic according to the teaching program (One class = 80 minutes). The detailed steps of treatment in the explicit, implicit and blended groups will be explained later within this paper.
3. Two days later in the next class a posttest (on those 33 target words) was conducted to measure students' immediate vocabulary mastery.
4. A delayed test after two weeks from the treatment was carried out to measure students' vocabulary retention.

Experimental Manipulations

The explicit vocabulary instruction. The explicit vocabulary instruction of target words was carried out in accordance with the procedure thoroughly described by Tokar & Fainman (2018). All 33 vocabulary units were presented by the teacher; meanings were conveyed using visual methods (demonstrating objects, pictures, movements, etc.) and through context or illustrative sentences, definitions or comparison. The teacher addressed the word form (pronunciation and spelling) and worked on the possible word collocations first. After that, multiple exposures to targeted words (such as practising word recognition or production in different kinds of collocations, entences and texts) were provided. Finally, this was followed by active involvement in different kinds of speech acts, short dialogues and monologues by means of a variety of practical tasks and exercises.

The implicit vocabulary instruction. In the implicit group, the students' only job in the session was to comprehend the general storyline or the message. The target words were neither presented by the teacher, nor were their meanings conveyed.

The students were asked to concentrate on the texts, videos or recordings with no explicit vocabulary instruction prior or later. Moreover, the teacher did not ask them to consider any specific lexical items or expressions, so the students did not really realize there were any words to memorize from the materials.

The instructor nudged the learners to grasp the subject matter of the videos, texts and recordings by giving hints relating to the content, but in a restricted manner. The instructor did not purposefully focus on the meaning of particular words.

After reading a text, listening to a recording or watching a video the participants fulfilled the tasks where they were to match the parts of the sentences, tick true or false sentences, discuss the possible pilot's actions in the situations presented. The authors did not inform the students of the forthcoming posttest and the delayed test as well, because such kind of notice is in no way entailed by implicit teaching methods.

The blended vocabulary instruction. The blended vocabulary instruction as described earlier presupposed combining aspects of both implicit and explicit instructions with the intention of facilitating vocabulary learning. Thus, the researchers randomly selected 17 vocabulary items to be learnt explicitly partly in pre-reading (pre-watching/listening) and partly in after-reading (after-watching/listening) activities and the other 16 items for implicit acquisition. In spite of the difference in the delivery mode, the texts and audio-visual materials used for blended vocabulary instruction remained the same as in the other two experimental groups.

Thus, in the pretasks before reading the texts, watching a video or listening to a piece of information, as well as in the activities afterwards, the teacher paid special attention to the words that were meant to be learnt explicitly. Their meanings were conveyed directly, students were involved in work with word forms, collocations, and usage. As for the vocabulary units for implicit instruction, fulfilling the corresponding tasks, the students did not realize the necessity to memorize the words; they were rather focused on getting the general ideas of the proposed texts, videos and audio recordings. The tasks completed before and after reading, listening and watching the aforementioned materials in no way attracted the students' attention to particular target words, though the teacher could give students clues or direct their actions to understand their meanings with the help of True or False exercises, questions with synonymic or paraphrased vocabulary items.

The authors did not inform the students of the future immediate and delayed tests. The authors considered it inappropriate, as the new vocabulary units were delivered through partly-explicit and partly-implicit instructions. However, the authors believe that the students expected an immediate posttest, at least on vocabulary units that were taught explicitly, as such kinds of tests are usually conducted in an explicit approach.

Results and Discussion

The present study set out to explore the effects of applying implicit, explicit and blended vocabulary instruction in the Aviation English Course for the fourth-year undergraduate students. First, the pretest was conducted in order to identify the initial vocabulary knowledge of the students before the experiment itself. The total maximum, possible to get, was 100 points. The data obtained from the pretest is presented in Table 1.

Table 1
Descriptive Statistics of the Pretest Data

Group	N	Minimum	Maximum	Range	Mean Score	Std. Dev.
Implicit VI	12	2	19	17	8.58	5.13
Explicit VI	12	0	17	17	9.42	5.07
Blended VI	12	4	16	12	9.17	3.66

The students were shown to have no significant proficiency in the vocabulary intended to be taught and the three groups were found to be similar concerning their English target vocabulary knowledge levels at the beginning of the intervention. Based on Table 1, the students' scores in the implicit vocabulary instruction (IVI) group appeared to be between 2 and 19. Thus, the range and the standard deviation were 17 and 5.13, respectively. Meanwhile, the students' scores in the explicit vocabulary instruction (EVI) group showed that the interval ranged from 0 to 17, and the standard deviation was 5.07. The blended vocabulary instruction (BVI) group turned to have a maximum students' score of 16 points and the minimum one of 4, with the range of 12 and the standard deviation of 3.66. See Figure 1 for the mean scores of the IVI group, EVI group and BVI groups.

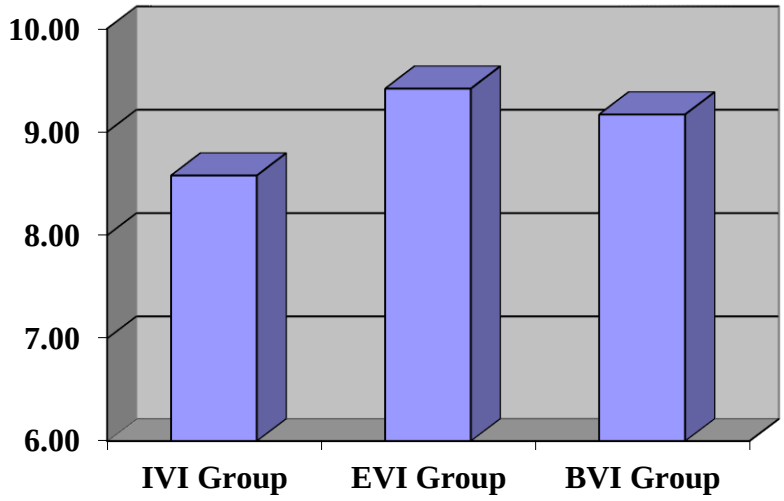

Figure 1. The Pretest Mean Scores of the Treatment Groups

The mean scores of these three groups were verified through a one way analysis of variance (ANOVA) and proved to have no statistically significant difference, thus being equal before the intervention. $F = 0.1$, whereas $F_{cr} = 2.47$ for $P \leq 0.01$. *Thus,* $F_{emp} < F_{cr}$, i.e. the difference between the groups before the experiment is statistically insignificant.

During the experiment session 33 vocabulary items were taught implicitly, explicitly, and via blended instruction to the three groups of students respectively. All of the words were chosen from the same teaching material. A 100-points test was administered as the posttest to the same groups after the teaching process. The goal was to compare the groups' progress in their vocabulary knowledge. The results gained in posttest are presented in Table 2.

Table 2
The Descriptive Statistics of the Posttest Score

Group	N	Minimum	Maximum	Range	Mean Score	Std. Dev.
Implicit VI	12	48	74	26	63.17	7.87
Explicit VI	12	64	95	29	79.41	10.39
Blended VI	12	62	93	31	79.0	9.80

The students gained significantly in terms of their aviation vocabulary skills in all the three groups. As shown in Table 2, the students' scores in the IVI group ranged from 48 to 74, with the mean score being 63.17, while the standard deviation was 7.87. The students' scores in the EVI group showed that the interval ranged from 64 to 95 and the standard deviation was 10.39. Meanwhile, the BVI group turned to have maximum score of 93 points and the minimum one of 62, and the standard deviation 9.80.

The EVI group mean score appeared to be the highest (M=79.41, SD=10.39), with the BVI group result slightly lagging behind (M=79.0, SD=9.80) and the IVI group's points being the lowest (M=63.17, SD=7.87). One way ANOVA of the posttest results proved statistically significant difference of the 3 groups of students ($F = 13.88$, whereas $F_{cr} = 2.47$ for $P \leq 0.01$, thus $F_{emp} > F_{cr}$), thus concluding the difference appeared due to the implemented teaching techniques.

The mean scores of the IVI group, the EVI group and the BVI group at the pretest and at the posttest were compared and the difference is illustrated in Figure 2.

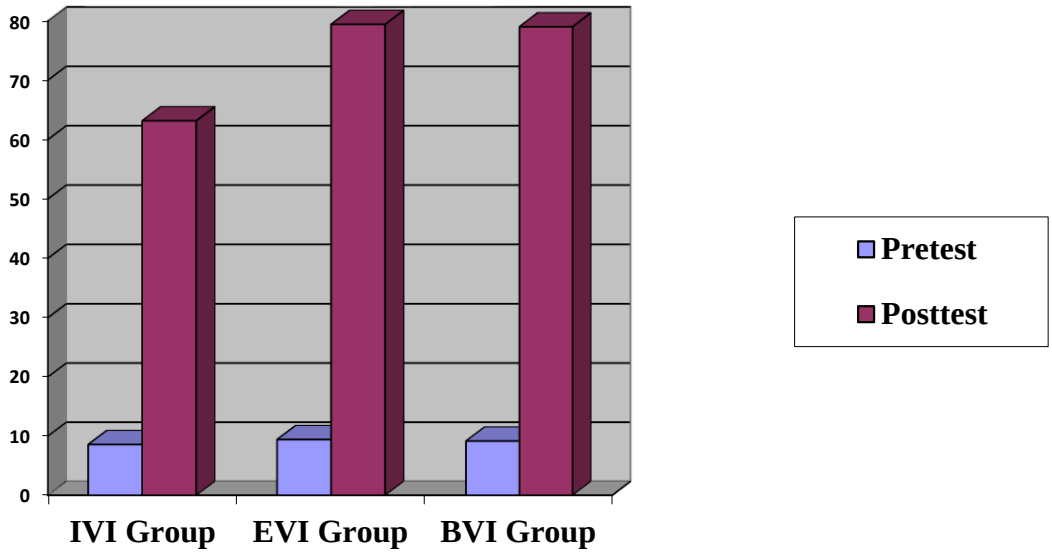

Figure 2. The difference of the mean scores at the pre test and the posttest

As shown, the mean score of the implicit vocabulary instruction group was raised from 8.58 at the pretest to 63.17 at the posttest.The explicit vocabulary instruction group registered the mean score 9.42 on the pretest and 79.41 on the posttest.In its turn, the blended vocabulary instruction group scored a mean of 79.0 on the posttest compared to 9.17 at the pretest. To examine the significance of the pretest and the posttest results' difference, a paired sample t-test was used. Table 3 shows the statistics.

Table 3
Paired Sample T-test Statistics (Pretest vs. Posttest)

Group	N	t	df	Sig.
Implicit VI	12	21.68	11	.000
Explicit VI	12	18.17	11	.000
Blended VI	12	23	11	.000

There was a significant increase in vocabulary knowledge from the pretest to the posttest in each group. The IVI Group pretest M = 8.58, SD = 5.13, posttest M=63.17, SD =7.87, $t(11) = 21.68$, $p < .001$. The EVI Group pretest M = 9.42, SD = 5.07, posttest M=79.41, SD =10.39, $t(11) = 18.17$, $p < .001$.The BVI Group pretest M = 9.17, SD = 3.66, posttest M =79.00, SD =9.80, $t(11) = 23$, $p < .001$. The level of significance was 0.00, less than 0.05, indicating a significant difference between the mean scores of the pretest and the posttest in each group. The difference showed that the students had gained a higher level of aviation vocabulary knowledge having been taught aviation vocabulary during the two-week session.

The results of the study, and the posttest in particular, thus support the earlier findings (Zimmermann, 1997; Ozola, 2015) stating the pedagogical efficacy of implicit vocabulary instruction; they are also in agreement with studies by Dakun (2000) and Nation (2001), who emphasized the

advantages of following an explicit vocabulary teaching approach. More importantly, the learning outcome of blended vocabulary instruction group adds evidence to Sökmen's (1997) statement on the efficacy of combining explicit vocabulary techniques with usual inferring activities in the second language classroom. Therefore, each of the three vocabulary techniques has advantages and leads to significant vocabulary enhancement.

A delayed test was carried out after 2 weeks after the sessions to measure the students' vocabulary retention. The authors would like to lay emphasis here that no other session on the targeted vocabulary was provided within these two weeks. All of the three groups of students continued their Aviation English Course as usual according to the curriculum established. The data obtained from the delayed test is presented in Table 4.

Table 4
Descriptive Statistics of the Delayed Test Data

Group	N	Minimum	Maximum	Range	Mean Score	Std. Dev.
Implicit VI	12	50	72	22	62.5	7.02
Explicit VI	12	61	92	31	77.5	10.18
Blended VI	12	67	96	29	81.16	9.75

As shown, the students' scores in the IVI group were now between 50 and 72, with a mean score of 62.5, while the range and the standard deviation were 22 and 7.02, respectively. The students' scores in the EVI group showed that the interval ranged from 61 to 92 and the standard deviation was 10.18. Meanwhile, the BVI group turned to have maximum score of 96 points and the minimum one of 67, with the range of 29 and the standard deviation of 9.75.

The BVI group mean score now appeared to be the highest (M = 81.16, SD= 9.75), with the EVI Group result slightly behind (M =77.5, SD = 10.18) and the IVI group's points being the lowest (M = 63.17, SD=7.87).

The mean scores of the IVI group, the EVI group and the BVI group at the pretest, the posttest and the delayed test were compared and the difference is illustrated in Figure 3. As shown, the mean score of the implicit vocabulary instruction and the explicit vocabulary instruction groups slightly decreased from 63.17 and 79.41 at the posttest to 62.5 and 77.5 at the posttest respectively, while the blended vocabulary instruction group showed some increase in terms of vocabulary retention, comparing 79.0 mean score at the posttest to 81.16 at the delayed test.

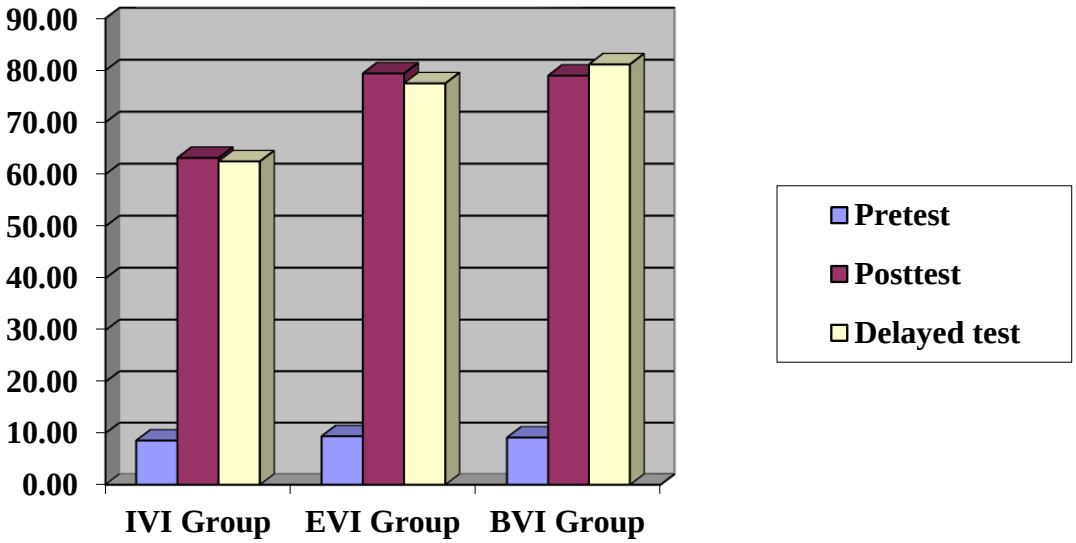

Figure 3. The difference of the mean scores at the pretest, the posttest and the delayed test

The results presented, on one hand, support the claims (Zhang, 2008) that the implicit vocabulary teaching instructions do not turn out to be extremely effective in terms of vocabulary retention, however, on the other hand, they as well disagree with Nation's (2001) statement that spending a significant amount of time on explicit instruction is always worthwhile, since the mean score of the EVI group shows a decrease in the delayed test as compared to the posttest outcome. At the same time the results in the BVI turned out to show a slight increase, thus proving to be the most impactful and powerful.

Overall descriptive statistics for the data obtained in the whole experiment can be visually presented in one form and are given below in Table 5.

Conclusions

This study investigated the effect of explicit, implicit and blended vocabulary teaching approaches on the learning and recall of vocabulary items by aviation students. In the course of the study the three groups of students were taught by means of explicit, implicit and blended vocabulary strategies. The findings of this research agree with other studies that both the implicit and the explicit teaching of vocabulary are effective, but prove that the blended approach is superior to both.

The participants showed an increase from the pretest to the posttest, thus it can be claimed that implicit, explicit and blended vocabulary instructions had a positive effect on the learning and recall of vocabulary. Explicit vocabulary instruction, nevertheless, proved to be more effective regarding immediate word acquisition. However, the results of the delayed test appear to suggest that blended treatment tended to achieve the best results concerning keeping the learnt vocabulary units in memory after a period time. Thus, the combination of both implicit and explicit vocabulary teaching techniques in the act of involving students into lexis acquisition process, the blended instruction for example, was shown to be the most efficient approach for the acquisition of lexical items in the Aviation English Course, whereas either a solely implicit or a solely explicit approach tended to produce less significant delayed results.

Table 5
Overall Descriptive Statistics for the Groups

	Groups	N	Mean score	Std.Dev.	ANOVA	Paired samples *t*-test
Pre-test	Implicit	12	8.58	5.13	$F_{emp} = 0.1$ $F_{cr} = \begin{cases} 3.30\ for P \le 0{,}05 \\ 2.47\ for P \le 0{,}01 \end{cases}$ $F_{emp} < F_{cr} \rightarrow$NS (nonsignificant)	
	Explicit	12	9.42	5.07		
	Blended	12	9.17	3.66		
Post-test	Implicit	12	63.17	7.87	$F_{emp} = 13.88$ $F_{cr} = \begin{cases} 3.30\ for P \le 0{,}05 \\ 2.47\ for P \le 0{,}01 \end{cases}$ $F_{emp} > F_{cr} \rightarrow$ S(signif.)	$t_{cr} = \begin{cases} 2.20\ for P \le 0{,}05 \\ 3.11\ for P \le 0{,}01 \\ 4.44\ for P \le 0{,}001 \end{cases}$ $t = 21.68$ *p*-value = .000
	Explicit	12	79.41	10.39		$t = 18.17$ *p*-value = .000
	Blended	12	79.0	9.80		$t = 23$ *p*-value = .000
Del. test	Implicit	12	62.50	7.02		
	Explicit	12	77.5	10.18		
	Blended	12	81.16	9.75		

To summarize, in the light of the present study, the following implications and recommendations are suggested:

1. All three types of vocabulary instruction provide considerable vocabulary development and thus should be viewed as an indispensable part of language teaching in the Aviation English Course.
2. As far as the pedagogical and methodological implications are concerned, the findings indicate some fundamental imperatives which may affect aviation vocabulary learning and acquisition. The authors conclude that learners should be guided through the balanced amounts of the implicit and explicit vocabulary instruction for the sake of the best learning outcome.
3. Due to the limitations of the study, the authors recommend more detailed research on the efficacy of numerous vocabulary teaching methods and tools in the Aviation English Course. Additional research – both longitudinal and quantitative - will allow future efforts in this area to more fully meet their intended goals and objectives. Furthermore, the authors consider it

necessary to research what vocabulary teaching methods turn out to be more effective for first- and second-year students, while making a more profound analysis of how the teaching strategies should change as students' language proficiency increases.

Finally, these findings and their significance to vocabulary instruction are particularly useful for Aviation English teachers in planning vocabulary activities and also for syllabi and materials developers in preparing textbooks and tasks for language learners.

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Appendix A

Aviation English Course
Vocabulary Quiz 3B

Name: _____

Group: _____

Fuel.

1 Match a verb on the left with a definition on the right. 2 definitions are not used.

1. Emit _ 2. Leak _ 3. Suck _ 4. Strap _ 5. Corrode _	a) to fasten something in position by fastening a narrow piece of leather or other strong material around it. b) to move somewhere quickly and suddenly. c) to send out a beam, noise, smell, or gas. d) be slowly damaged by something such as rain or water. e) to remove ice. f) (of a liquid or gas) to escape from a hole or crack in a pipe or container**.** g) remove smth using the force of air.

/5

2 Rearrange the letters to form the missing words.

Most recently built planes have two fuel **(1) nstka** _____ or cells which are located in the wings. The fuel **(2) tacpaiyc** _____ for each aircraft is determined by its wing geometry. In a lot of aircraft, (3) **smpup** _____ are required to feed the fuel through (4) **soshe**_____ from the cells to the engine. For every fuel cell there is a fuel (5) **eagug** _____ that the pilot can read from the cockpit in order to keep an eye on the fuel (6) **esprruse** _____. The continuous movement of fuel is called fuel (7) **oflw** _____ and the fuel (8) **scnoupitmon** _____ is a measure of the fuel used by the engine. If the movement of the fuel is somehow slowed down, or if there is a (9) **ethasgor** ____ of fuel, this can cause fuel (10) **vistanrato** _____, which in turn can cause loss of power in the engine.

/20

3 Complete the sentences with the correct form of the words in capitals

0 The police have been very **<u>ineffective</u>** in cutting car crime in our town. **EFFECT**

1 The European Commission has suggested limiting CO2 _____ for all planes departing from EU airports. **EMIT**

2 A controller will always ask the pilot to state the aircraft's fuel _____ **.** **ENDURE**

3 Initial reports indicate problems with fuel system. It seems that the cockpit instruments were _____. **OPERATE**

4 We had no indication of a fuel _____. **SHORT**

/4

4 Make words that match the definitions by adding the prefixes in one box to the words in the other box. Some prefixes can be used twice while the others can be not used at all.

re-	**de-**	**ab-**	**in-**	**un-**	**dis-**	**out-**	**over-**	**mis-**	**under-**

ice	**estimate**	**operative**	**accurate**	**weight**	**fuel**	**diagnose**
	normal	**sufficient**	**compression**			

1 to remove ice _____
2 not working _____
3 not enough _____
4 to put more fuel into an aircraft _____
5 a reduction in pressure around something _____
6 not usual _____
7 heavier than it is allowed _____
8 to state that a device has a particular condition, when in fact it has a different one _____
9 not completely correct or exact _____
10 to fail to guess or understand the real cost, size, difficulty, etc. of something _____

/20

5 Use the words from task 4 and fill in the gaps. Change the form of the verbs if necessary.

1 They (1)_____ the problem as fuel freezing, when in fact there was no fuel left in the tank.
2 I think the altimeter is giving (2) _____ readings – we are clearly higher than 500 ft.
3 The aircraft is (3)_____ for landing, so we'll have to dump fuel.
4 They (4)_____ the amount of fuel needed for the journey, so the aircraft had to divert to (5)_____.

/10

6 Read the definitions and write the terms for them.

1 a weakness that develops in metal structures that are used repeatedly _____
2 to bend something or become bent, often as a result of force, heat, or weakness _____
3 a serious decrease or exhaust of the abundance or supply of smth _____
4 a device that opens and closes to control the flow of liquids or gases _____
5 a reduction in the amount or degree of noise _____
6 an aircraft's ability to keep flying; how long the aircraft can fly _____
7 a small hole made by a sharp object, especially in a tyre _____
8 to (cause something to) explode, break, or tear _____

/16

7 Choose the correct words to complete the sentences.

1 They began descending but the fuel ***starvation/ flow/ endurance*** stopped completely.
2 The aircraft had serious ***corrosion/ emission/ abatement*** due to operating in a salty environment.
3 After the fuel ***valves/ hoses/ gauges*** are removed the fuel load is checked.
4 They lost both engines due to fuel ***capacity/ starvation/ shortage***.

5 The European Federation for Transport and Environment disagrees with the conclusion and describe the information as ***operative/inaccurate/ overweight***.
6 Attention turned to how an aircraft had run out of fuel. It emerged that a serious fuel ***leak/ pump/deice*** had developed in one of the aircraft's two engines.
7 Climate change mitigation policies for aviation may ***diagnose/ overestimate/ rupture*** the benefit of alternative fuel use on the global climate system.
8 The structure of the aircraft has been designed to ***refuel/ endure/ buckle*** for decades thanks to its metal structure.
9 Emissions from aircraft engines change the chemistry of the atmosphere and can modify the global climate and cause ***depletion/ decompression/ deice*** of the ozone layer.

/9

8 Complete the sentences by adding one word in each space

1 They decided to open cross-feed _____ to divert fuel from the wing tank which was functioning properly to the engine with the leak.
2. Concerns over aircraft noise led to noise _____ procedures to minimize noise for people living near the airport.
3 The first question a pilot needs to ask is what should be the normal fuel _____ assuming all goes according to plan en route.
4 Air transport contributes 2% of global CO2 _____.
5 When you say *puncture* you mean a large hole in the cabin causing explosive _____.
6 If the design of the aircraft is such that gravity cannot be used to transfer fuel, fuel _____ are installed.
7 Turbine engines burn fuel faster than reciprocating engines do. Because fuel needs to be injected in to a combustor, the injection system of a turbine aircraft must provide fuel at higher _____ and flow compared to that for a piston engine aircraft.
8 Special fluid, a mixture of a chemical called glycol and water, is generally heated and sprayed under pressure to _____ the aircraft.

/16

TOTAL /100

Appendix B

Theme: Fuel

Word list

1 emit – emission
2 leak
3 suck out
4 strap
5 corrode – corrosion
6 fuel tank
7 fuel capacity
8 pump
9 hose
10 gauge
11 fuel pressure
12 fuel flow
13 fuel consumption
14 fuel starvation
15 fuel shortage
16 deice
17 (in)operative
18 (in)sufficient
19 (over/under)estimate
20 (mis)diagnose
21 (in)accurate
22 overweight
23 refuel
24 abnormal
25 decompression
26 endure - endurance
27 metal fatigue
28 rupture
29 buckle
30 depletion
31 valve
32 noise abatement
33 puncture