Technical Vocabulary in Aviation
A Study of Private Pilot Students in Iceland

B.A. essay

Andrés Páll Baldursson
Kt.: 180890-3789

Supervisor: Erlendína Kristjánsson
May 2017
Abstract

Communication in aviation is of vital importance. A large number of all aviation incident reports worldwide are the result of miscommunication. By standardizing phraseology and vocabulary used by pilots and air traffic control (ATC), communication can become safer and more efficient. Aviation personnel can, however, not only rely on phraseological knowledge as there needs to be underlying language proficiency that supports the user, especially in unforeseen circumstances. English is the international standard language in aviation. The International Civil Aviation Organization (ICAO) has set certain language proficiency requirements (LPRs) to set strict English proficiency guidelines for aviation personnel to adhere to. Pilots and ATC need to learn and use complex technical vocabulary that is confined to aviation. This highly technical aviation vocabulary can be hard to master and there are various methods in teaching it. This essay examines the vocabulary proficiency of private pilot students in an aviation academy in Iceland. It attempts to find correlations between prior education and own perception of language proficiency, with vocabulary ability. Twenty students, enrolled in a 220-hour theoretical Private Pilot License (PPL) course took part in the study. They answered a simple questionnaire about themselves and two vocabulary tests, one based on the academic word list (AWL) and the other on aviation vocabulary (AVT). The students scored lower than expected on both tests, scoring 47% and 59% respectively on average. Many students would not have passed the LRP in vocabulary knowledge. The low scores on the AVT can be attributed to two external factors, shortage of flight instructors in the practical portion of the PPL program and to a move of operations. There is no link between prior education and scores in the sample, but own perception of proficiency does correlate to scores on both vocabulary tests.

Keywords: Aviation vocabulary, academic word list, phraseology, technical vocabulary, private pilot.
Table of contents

1. Introduction ...................................................................................................... 1
   1.1. Research of communication in aviation..................................................... 3
   1.2. Language testing- and training in aviation................................................. 6
   1.3. Vocabulary acquisition ............................................................................ 11
   1.4. Studies on aviation vocabulary................................................................. 13
   1.5. English in Iceland .................................................................................... 13
   1.6. Aviation in Iceland ................................................................................... 14

2. Methods ......................................................................................................... 17

3. Results ........................................................................................................... 19
   3.1. Questionnaire results .............................................................................. 19
   3.2. Academic vocabulary test results............................................................ 21
   3.3. Aviation vocabulary test results ............................................................... 22
   3.4. Aviation vocabulary texts ......................................................................... 24
   3.5. Interview with teacher .............................................................................. 25

4. Discussion ...................................................................................................... 26
   4.1. Exclusions and limitations of study.......................................................... 28

5. Conclusions ................................................................................................... 31

References ......................................................................................................... 33

Appendix A ......................................................................................................... 37
Appendix B ......................................................................................................... 38
Appendix C ........................................................................................................ 39
Appendix D ........................................................................................................ 40
1. Introduction

Learning technical vocabulary is a vital part of achieving mastery in subject and can be demanding for students, especially students of a non-native language (Gablasova, 2015). Like many other professions, aviation has a specific technical vocabulary used throughout the aviation community by both professionals and amateurs. The technical vocabulary is used in all activities associated with the field all over the world, with English acting as its official international language. This results in obstacles for those who do not have English as their first or second language (Gablasova, 2014). The international aviation community has developed key phraseology that is used widely, but the usage of the phrases is not an exhaustive list or skill that aviation personnel should master to communicate effectively in aviation. General language proficiency is highly important for the safe and efficient communication between pilots, air traffic controllers (ATC), and others in aviation.

Therefore, the International Civil Aviation Organization (ICAO), the United Nations’ agency governing aviation regulations, has provided English language skill criteria for pilots to comply with. The goal is to reduce communication difficulties by standardizing skill levels for pilots (Gardilcic, 2003; Tajima, 2004). The leading cause of aviation incidents, as evidenced by aviation incident reports, is communication difficulties, with two-thirds of reports citing some class of problem regarding information transfer. Technical, along with academic vocabulary, is distinguished separately from other vocabulary for the user’s ease in analyzing complex functions of language associated with diverse fields of study and practice. All education in both the first language and in the target language can improve students’ academic vocabulary acquisition, however, technical vocabulary is best learned from subject exposure and knowledge in the associated field (Nation, 2013).

English is widely used in Iceland, to the extent that the language is not regarded as a foreign language (Birna Arnbjörnsdóttir, 2011). Students learn English from a very young age in Iceland in addition, English proficiency of Icelandic university students is generally good (Ásrún Jóhannsdóttir, 2010; Birna
Arnbjörnsdóttir, 2011). However, university students are not adequately prepared in the mixed language approach of many university lectures, with most material in English and lectures and tests in Icelandic (Birna Arnbjörnsdóttir & Hafdis Ingvarsdóttir, 2010). With enough language exposure and technical subject exposure, academic and technical vocabulary can be learned. Aviation students need to have great English proficiency to practice flying safely, in addition to the language proficiency requirements for commercial flying. How good is private pilot student technical and academic vocabulary proficiency and does prior education and student perception of their own proficiency predict their vocabulary ability?
1.1. Research of communication in aviation

The importance of efficient communication in aviation is paramount. With international and intercontinental flights at an all-time high, airspace congestion has highlighted problems with communications and a need for standardization (Cutting, 2012; Seçer & Şahín, 2014; Tajima, 2004). Miscommunication in aviation has a large role in aviation accidents, with 11% of all fatal accidents worldwide between 1982 and 1991 being attributed to a lapse in communication (as cited by Tajima, 2004, pp 454). Pilots increasingly find that good communication is equally as important as the technical ability of flying (Tajima, 2004). A noteworthy example of this is a mid-air collision near Delhi, India in 1996, in which a Kazakhstan Airlines airplane collided with a Saudi Arabian Airlines jumbo jet. The crash left 351 people dead and was attributed to poor communication skills of the Kazakhstan crew, even though Indian ATC had voiced concerns “that pilots from the former Soviet Union have a poor command of English” (Tajima, 2004, pp 455). Moreover, the Kazakh pilot misunderstood commands about altitude that are “one of the most basic instructions for whoever flies airplanes” (Tajima, 2004, pp 455).

By using standardized phrases and vocabulary, pilots and ATC dispatch large amounts of information in a quick and efficient manner, “under normal circumstances, pilots use a vocabulary of around 200 phraseological English words and phrases” (Tajima, 2004, pp 454). By removing any formality and other social language factors from the speech, standardization of aviation phrases eliminates all ambiguity and provides the possibility of universally clear communication for all participants (Kim, & Elder, 2009; Tajima, 2004). These phrases and vocabulary are often limited to the aviation community and can therefore prove difficult for users to master, especially for those who do not have English as a first language when phrases and technical vocabulary can be lost in context (Aiguo, 2007; Seçer & Şahin, 2014; Tajima, 2004).

Aviation language and communication is susceptible to many “Englishes” during use. In other words, different kinds of pronunciation nuances and accents are being used in a setting where all communication is verbal and auditory, resulting in
miscommunication at times. A well-known example of this is the worst aviation accident in history on the Spanish island Tenerife, resulting in the death of 583 and injuring 61 in March 1979. This incident was in large part caused by code-switching misinterpretation between Dutch and Spanish speakers of English. After being given instructions about what to do after takeoff, without being given takeoff clearance, the Dutch captain of a KLM jumbo jet said: “We are now at takeoff” which “can be interpreted as either [...] “We are now at the takeoff position.” [or][…] “We are now (actually) taking off.” (Tajima, 2004, pp 460). The usage of the word takeoff had been free in all phases of flight up until this disaster. The ICAO and air crash investigation boards conducting the inquiry into the crash introduced new rules limiting the usage of the word takeoff only to the moment ATC gives clearance for takeoff. After this change, the aviation community use words like taxi, departure and line-up to reduce the likelihood of misunderstanding around one of the most crucial and dangerous phases of flight (Tajima, 2004).

Pronunciation quality in the aviation community is highly important, and smooth communication often depends on participants’ origins and first language backgrounds. For instance, both native Thai and Korean speakers in aviation are most comfortable in communication with Thai and Korean speakers of English, respectively, followed by communication with native English speakers and non-Thai, non-Korean and non-native English speaking interlocutors (Kim, & Elder, 2015; Knoch 2014; Molesworth, & Estival, 2015). This shows “that accent is a critical factor in radiotelephony communication, especially when both interlocutors are from different NNES [Non-native English Speaking] backgrounds” (Kim, & Elder, 2015, pp 134).

Although phraseology and aviation vocabulary knowledge are tremendously important, general English proficiency is often missing.

[...] the language of international air-traffic control could be regarded as “special”, in the sense that the repertoire required by the controller is strictly limited and can be accurately
determined situationally, as might be the linguistic needs of a dining-room waiter or air-hostess. However, such restricted repertoires are not languages, just as a tourist phrase book is not grammar. Knowing a restricted “language” would not allow the speaker to communicate effectively in a novel situation, or in contexts outside the vocational environment. (Mackay, & Mountford, 1978, pp 4).

In other words, for interlocutors to be able to use the special repertoire in an efficient manner and communicate outside the aviation world, they need to have an adequate depth of proficiency in the target language, English. This shows that general language skills are the foundation of all efficient communication, especially in aviation. However, accidents have occurred when there is only phraseology competency with no other language skills supporting those few basic aviation phrases. A clear example of this is an accident, in Columbia in December 1995, in which 159 people lost their lives, that could have been avoided had the ATC controller had adequate proficiency in English in addition to his phraseological knowledge. The native English speaking pilots of American Airlines flight 965 made requests and asked questions about altitude and navigation of the Columbian non-native English speaking ATC, but he did not understand their requests. He stated during the investigation into the crash that had the pilots spoken Spanish, he would have asked them to elaborate on their request and their position, but he did not make any attempt in English (Tajima, 2004).

Another case is the 1990 crash of Avianca near New York city’s JFK airport that left 72 people dead. With critically low fuel, the Columbian pilots stated the “need for priority” instead of using unambiguous words like emergency or critical low fuel. By using such ambiguous wording, the pilots failed to communicate to ATC the seriousness of the situation. ATC consequently did not grant the pilots any priority in landing at the airport (Tajima, 2004). In these cases, simple instructions that go beyond phraseology are either misunderstood or misstated. In addition, research
has shown an increasing concern within the aviation community about the inability of some speakers to switch from phraseology to plain language when required in stressful situations (Kim, & Elder, 2009; Knoch, 2014).

Pilots and ATC repeat requests and read back instructions constantly, in addition, the pilots simultaneously operate other functions of the aircraft. The high workload in the flight deck is a challenging environment, made even more difficult with miscommunication and language difficulties. Efficient communication and dispatch of right information is not only based on knowledge and experience, but also on general cognitive abilities (Morrow et al., 2003). These difficulties highlight the importance of teaching not only phraseology and aviation language, but also general English. By having general language proficiency, speakers are better prepared to react in demanding situations, compared to those who only have simple phraseological knowledge. In addition, better general language proficiency expands the speaker’s comprehension of the phraseology used, improving their communication abilities in aviation (Cutting, 2012; Tajima, 2004).

1.2. Language testing- and training in aviation

The amalgam of pronunciation and lack of English proficiency present in the aviation community are being challenged actively by both efforts on behalf of various governments and the ICAO (Gardilcic, 2003; Aiguo, 2007). The ICAO set language proficiency requirements (LPRs) in 2003 in response to accidents and incidents involving miscommunication. The purpose of the LPRs was to set stricter guidelines for English proficiency in aviation by administering tests rating six language skills: Pronunciation, Structure, Vocabulary, Fluency, Comprehension and Interactions (Alderson, 2009; Kim, & Elder, 2015; Kraśnicka, 2016). To pass the LPRs, participants must score higher than Level 4 out of 6 levels. Level 4 is defined as having operational knowledge of the language- Level 5 is defined as having extended knowledge- and Level 6 is having expert proficiency in the language.
<table>
<thead>
<tr>
<th><strong>Language skill</strong></th>
<th><strong>Criteria for Operational Level (4)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pronunciation</strong></td>
<td>The speakers first language can influence pronunciation of English and can sometimes inhibit understanding.</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Both for grammar and sentences. Should be well controlled, but can deviate in unforeseen situations; however, they do not inhibit understanding.</td>
</tr>
<tr>
<td><strong>Vocabulary</strong></td>
<td>Should be adequate to communicate in aviation related interaction and the participant should be able to rephrase if lacking vocabulary in demanding situations.</td>
</tr>
<tr>
<td><strong>Language Production</strong></td>
<td>Should be at a steady pace, but pauses can be in natural, unrehearsed interaction.</td>
</tr>
<tr>
<td><strong>Comprehension</strong></td>
<td>Is precise in work related situations when pronunciation is clear but can be slower in demanding situations and can require clarification.</td>
</tr>
<tr>
<td><strong>Interaction</strong></td>
<td>Speaker responses are suitable and swift and the speaker uses strategies to mitigate misunderstanding in unexpected situations.</td>
</tr>
</tbody>
</table>

Table 1. LPRs Operational Level requirements (Alderson, 2009; "ICAO Language Proficiency Requirements (LPRs) - English For Aviation", 2012).
Those who do not pass Level 6 of the LPRs must take the test again every three years until reaching Level 6. Once that is achieved, participants gain licenses to operate for life. To pass the operational level, participants must meet certain criteria for each language skill, shown in Table 1. The higher levels in the LPRs (5 and 6) have increasingly higher standards for completion, with the Expert Level having little room for nonconformity in the different language skills. The ICAO has published resources to use in English language teaching, especially focusing on member states who are struggling with LPRs implementation. However, each member state is responsible for implementing its own language teaching curriculum so that students of aviation meet the LPRs standards (Kraśnicka, 2016).

Serious concerns regarding the implementation of test administration and evaluation across member states have been raised. In an extreme case, Polish aviation personnel who had previously failed a free exam provided by the Polish government could take paid tests in Germany, where most passed the Level 4 requirement. However, the German test provider had no qualifications to administer the test, and in addition was forging documents (Kraśnicka, 2016). Therefore, the participants paid for good results after having failed a free test. In other cases, the preparedness of many national civil aviation authorities to administer LRPs has been shown to be less than adequate. A large factor in this unpreparedness is lack of funds and political complexity of passing legislation affirming the ICAO protocol (Alderson, 2009).

Another criticism of the LPRs is highlighted in Knoch’s (2014) study of the South Korean aviation community, which found: “when asked to evaluate speech samples from a number of different aviation English tests, [native-English speaker pilots] drew on a wider range of criteria than those encompassed by the ICAO guidelines, including non-linguistic factors such as technical knowledge, experience and level of training” (Kim, & Elder, 2015, pp 132 citing Knoch, 2014). At first the LPRs were met with much opposition in the South Korean aviation community. All practicing and future personnel had to meet the LPRs, which made the passing of the LPRs in to Korean law extremely complicated politically, both in how to
administer the tests and how the evaluation was handled in cooperation with the aviation community. Ultimately, after many delays, all Korean aviation personnel passed the test, although 97% only passed the minimum requirements forcing them to take the tests again every three years until attaining the highest standard (Kim, & Elder, 2009).

The Civil Aviation Administration of China has specific rules regarding the teaching and use of aviation language. Aviation schools in China cannot teach aviation phraseology on its own, as they need to include extensive general English language teaching in their curricula. These curriculum improvements have stranded on the conservative language teaching method of Chinese schools, in which the Grammar-Translation method is widely used (Aiguo, 2007). As the Grammar-Translation method was first developed to teach Latin, an unspoken language, with translation and heavy focus on reading and writing skills, the method has proven to be less than successful in teaching aviation language where verbal and auditory communication are the primary skills (Aiguo, 2007; Larsen-Freeman, 2011). Language teaching methods are constantly evolving, and as Aiguo (2011) points out, with respect to aviation, they go through many different phases, the audio-lingual, audio-visual, structural, notional–functional, communicative, task based, lexical, EAP and needs analyses. The modern language teacher has a whole panoply of methodologies to choose from, many of which spring from advances in applied linguistics. Since aeronautical English lexicology consists of words and expressions from a large variety of fields, we must first be sure of our target students, their English level, their major and their needs. (pp 48).

Therefore, teachers of aviation language need to use methodologies available to them that encourage the students to learn the language in a more fitting student-
centered way. As with many other languages, speakers of Korean, Turkish and Chinese use different phonetic systems than that of English, making pronunciation and comprehension in aviation even more demanding (Aiguo, 2007; Kim, & Elder, 2009; Seçer & Şahin 2014). Chinese education has begun responding to the increasing globalization of English, as it is being taught at all levels of education, and extensive training and new approaches to language teaching have been implemented in China (Aiguo, 2007).

Local English language teachers can play a large role in developing specific aviation language courses that could apply to regions with distinctive language and linguistic repertoires (Tajima, 2004). The development of specific aviation courses has shown good results. The aviation language training is directly associated with students’ studies in aviation, giving them deeper exposure and connection to aviation language and their theoretical and practical training in aviation. In addition, students’ motivation to learn the English language increases with more exposure to the practical side of aviation training (Seçer & Şahin 2014). This is done by interlacing English lessons in basic aviation studies, teaching both theoretical and practical subjects using English and conjointly teaching language skills, listening, speaking, phonetics, etc.. Even though English is increasingly being taught in aviation studies, students need to have been exposed to extensive English training before beginning aviation training for them to be proficient enough for work in an international environment (Aiguo, 2007; 2008; Seçer & Şahin 2014).

Standardization of language proficiency requirements in the aviation community have brought new challenges to local governments. Developing new approaches to teaching English language in the aviation community is vital, and local teachers, both in aviation and language, can have a large impact on the field because of local language and dialect differences. Governments need to maintain transparent and uncorrupt testing and analyses on language proficiency. With the development of new methodologies, the teaching of specific aviation language has increased, especially in settings where the language is actively taught alongside theoretical and practical aviation studies.
1.3. Vocabulary acquisition

Acquisition of vocabulary is best done by active usage of the language, which entails reading, writing, listening and speaking (Gablasova, 2014; Nation, 2013). “Words are acquired gradually, in a process in which the knowledge of the word and its use is both expanded and refined” (as cited by Gablasova, 2015, pp. 64) Thus, all training and education in a language will benefit all speakers’ ability to acquire vocabulary. By knowing the first 1,000 of the most frequent word families (K1) in English, speakers have coverage of approximately 80% of the British National Corpus, a collection of texts containing 100 million words. Furthermore, by knowing the second 1,000 word families (K2), speakers add 8.1% coverage. The K1 and K2 words in English are called high frequency words (Chung & Nation, 2003). The coverage diminishes with every one-thousand-word family list, and by knowing the first ten thousand word families, speakers have coverage of over 98% (Nation, 2013, pp 21). “A very rough rule of thumb would be that for each year of their early life, starting at the age of three and probably up to 25 years old or so, native speakers add on average 1,000 word families a year to their vocabulary” (Biemiller, & Slonim, 2001 as cited by Nation, 2013, pp 13). When learning a non-native language, 1,000 words a year can be problematic, especially for a foreign language as opposed to a second language for which the exposure rates are higher (Nation, 2013).

Academic vocabulary “is like a specialized extension of the high frequency words. It covers on average 8.5% of academic text” and “is common to a wide range of academic fields but is not what is known as high frequency vocabulary and is not technical in that it is not typically associated with just one field” (Chung & Nation, 2003, pp 104). The Academic Word List (AWL) is a list of 570 word families that are not in the first 2,000 most frequent word families. “The list is not restricted to a specific discipline. The academic vocabulary has sometimes been called sub-technical vocabulary because it does not contain technical words but it contains rather formal vocabulary” (Nation, 2013, pp 30). AWL is especially suited for non-
native academic learners to further their academic language skills when using English (Nation, 2013).

Technical vocabulary is defined as words that are common in a specific field or topic that are not elsewhere. It “occurs in a specialist domain” and “is part of a system of subject knowledge. It could thus be identified by referring to specialists who have a good knowledge of the subject area” (Chung & Nation, 2004, pp 252). Technical vocabulary is usually a large part of a text dealing with a given subject, appearing with high frequency and having “a clear relationship to other terms in that area” (as cited by Gablasova, 2015, pp 63). For example, business, botany and computer programming all have specific vocabulary attributed to each field that readers of corresponding texts could use to decipher what topic is being written about (Gablasova, 2015; Nation, 2013). Technical vocabulary often not recurrent between different subject areas, in other words, it is often confined to a specific field and is not intelligible in other contexts. Alternatively, they can also be high frequency words that have a specialized meaning in technical context (Nation, 2013).

The technical vocabulary acquisition of L2 users is of lower standard than that of L1 users. Gablasova (2014; 2015) showed that technical vocabulary knowledge was much lower in L2 compared to L1 based on the same texts. L1 users had more depth of word knowledge and could provide better details of word meaning than L2 users. Furthermore, knowledge retention declined for the L2, meaning that L2 users were less likely to remember a new technical word they had previously known the meaning of one week before, compared to L1 users. When the L1 subjects had fully acquired the meaning of a word “their knowledge suffered nearly no attrition in the span of a week” (Gablasova; 2014, pp. 987). These findings can be attributed to a lower general language skill in the case of L2 users, with less exposure and context; especially in linking words together and finally, by a smaller vocabulary. In addition, L1 users could have had prior knowledge of the technical vocabulary (Gablasova, 2014; 2015). However, Gablasova’s findings show that L2 vocabulary retention increased with more, diverse inputs in language teaching (2014). The systematic teaching of technical vocabulary should be done in a similar fashion as teaching of
high-frequency words, by active exposure, usage and diverse input systems. Furthermore, technical vocabulary that intersects with high-frequency words needs to be highlighted, and users should be taught the connections and differences thereof (Nation, 2013).

1.4. Studies on aviation vocabulary

Students learn aviation vocabulary in the same way as other language and vocabulary acquisition take place. Firstly, by immersing students in the culture of aviation, association and connection to the subject vocabulary and language is promoted. Secondly, the process of learning general English language is a deciding factor in the successful training of proficiency in the vocabulary of aviation (Aiguo, 2007; 2011; Seçer & Şahín, 2014). In addition, Seçer and Şahín (2014) showed that teachers, as well as students, are often restricted by their motivation in both aviation and English language learning. English language teachers do not necessarily have the skills nor the motivation to teach aviation language, even though they are extremely qualified in teaching general language, and the lack of aviation experience is often evident. This statement can also be juxtaposed to qualified aviation professionals, who are not necessarily equipped to teach language skills (Seçer & Şahín 2014). Aviation students are in general motivated to learn and participate in the aviation community. However, many students lack the motivation to learn English as foreign language, which directly impacts their aviation English proficiency. By actively linking the language lessons with aviation studies, the students become more motivated and aware of the importance the English language has in the international aviation community (Seçer & Şahín 2014).

1.5. English in Iceland

English language exposure in Iceland is vast and the magnitude of exposure and use has sparked questions of whether English should even still be considered
a foreign language (Birna Arnbjörnsdóttir, 2011). Students start learning English in school at a young age, and are even exceeding the curriculum goals set for their first years because of levels of exposure outside the classroom (Ásrún Jóhannsdóttir, 2010; Birna Arnbjörnsdóttir, 2011; Samúel Lefever, 2010). In Samúel Lefever’s study (2010), children age 8 were shown to have good English proficiency even before beginning English learning at elementary school. This knowledge is attributed to language exposure through media and computer games. Listening to English was the best developed language skill of the children, followed by reading, even though the students were not proficient readers in L1.

Even though Icelandic children start learning English at a young age, Birna Arnbjörnsdóttir and Hafdís Ingvarsdóttir’s study (2010) indicates that many tertiary level students find it difficult to use English textbooks, especially when their courses are taught in Icelandic. In addition, many students find that their workload increases with having a large proportion of textbooks in English, with as much as 9 in 10 of all academic curriculum in the University of Iceland being in English. In the same study, students felt well prepared to use academic texts in English and generally said they had good English proficiency: “Sixty five percent of respondents believed that their proficiency in speaking, comprehension and reading was good or very good. [...] 51% of respondents thought their writing was good or very good” (Birna Arnbjörnsdóttir & Hafdís Ingvarsdóttir, 2010, pp. 7).

1.6. Aviation in Iceland

The Icelandic Flight Academy (IFA) is one of four aviation schools providing Private Pilot License (PPL) training in Iceland, all of whom adhere to the European Aviation Safety Agency and Icelandic Transport Authority’s rules and regulations regarding training of flight personnel (“Einkaflugmaður”, n.d.; "Samþykkt þjálfunarfyrirtæki - ATO", 2017). The IFA provides PPL studies all year round, with classes beginning in January, June and September. Other schools provide similar amounts of classes (“Einkaflugmaður”, n.d.; Keilir Aviation Academy, 2017). Out of
the four schools providing PPL training, two offer further study in an Airline Transport Pilot License (ATPL) program. In addition to IFA, the Keilir Aviation Academy provides ATPL programs. Students must graduate from an ATPL program to be able to work commercially as a pilot. The PPL program is divided into theoretical and practical training. The theoretical part is in total 220 hours of on-site school lectures based on Saul-Pooley and Law’s *The Air Pilot Manual* (2014) series, with additional material from the Icelandic Transport Authority. The theoretical portion is divided into nine subcategories: air law, human factors and limitations (anatomy), meteorology, communication (radio telephony), principles of flight (physics), operational procedures, flight planning and performance, aircraft general knowledge (AGK) (mechanics) and navigation ("Bókleg próf", 2017; "Einkaflyglumaður", n.d.; "Flugskóli Íslands", n.d.). These subfields all have extensive technical vocabulary attached to them, and the mastery of the vocabulary is vital for subject knowledge and program completion.

The practical portion is a minimum of 45 flight hours, consisting of at least 25 hours with a teacher and 10 hours solo flying, not counting time spent with a teacher in preparation before- and debriefing after each flight ("Einkaflyglumaður", n.d.; "Flugskóli Íslands", n.d., Guðlaugur Sigurðsson, 2017). Like tertiary level education in Iceland, PPL training material is mostly written in English in both the theoretical and practical sections. However, most theoretical lectures are conducted in Icelandic with a mix of Icelandic and English presentation materials for support, and practical lessons are conducted with a mix of Icelandic and English instruction. Furthermore, PPL testing is done in either English or Icelandic, and the choice thereof is in the hands of each student, most of whom choose to take tests in their L1, Icelandic ("Bókleg próf", 2017; "Einkaflyglumaður", n.d.; "Flugskóli Íslands", n.d.). Commercial Pilot License tests, a part of the ATPL program, are only conducted in English ("Bókleg próf", 2017). Students of IFA are encouraged to take the practical course alongside their theoretical studies to better link the knowledge gathered from each section, and as motivation to learn the theory behind aviation (Guðlaugur Sigurðsson, 2017). This is supported by Seçer and Şahin’s (2014) findings that
motivation and immersion are key factors in the study of aviation, especially with regards to the language of aviation.

With the rapid growth of tourism in Iceland, and with increasingly more optimistic flight schedules, Icelandic airlines need more pilots. In response to pilot shortages, Icelandair and WOW have lowered their minimum flight hour requirements for new pilots. New pilots now must have a total of 300 flight hours to be able to apply for jobs with the airlines, as opposed to 500 hours before (Tryggvi Aðalbjörnsson, 2016). Flight hour requirements for admission to an ATPL program are 150 hours; the practical ATPL course is between 70 and 80 hours of flight time (Keilir Aviation Academy, 2017). When pilots graduate with ATPL, their overall flight time is approximately 220-230 hours if they have not flown privately alongside their training. This has led to less interest of newly graduated pilots in becoming flight instructors. Before, airlines required 500 hours which generally led pilots to study to become flight instructors to gather more experience and hours. Flight instructor training course are expensive, and pilots that are close to having 300 hours therefore have less incentive to train to become instructors. This has led to severe flight instructor shortages in Iceland (Guðlaugur Sigurðsson, 2017; Ingþór Ingólfsson, 2017).
2. Methods

This study consists of a quantitative questionnaire and vocabulary test administered to pilot students. The study also includes a qualitative interview with their teacher. The participants of this study are all students in a PPL program at the IFA. Twenty students, 14 male and 6 female, participated in the study. The questionnaire and test were administered in a classroom environment before one lesson at the end of the semester. The students had already finished eight out of nine subjects, with only aircraft general knowledge remaining. The class consisted of 40 students and half chose to partake in the study. Every student was informed that there was no obligation to take part in the study, and that there was no link between the research and the school. Students were given 30 minutes to complete both tests.

The study consists of a background questionnaire, an active academic vocabulary test, and a productive aviation vocabulary test. To begin with, participants answered questions in the questionnaire (Appendix A) concerning their age, prior education, English immersion in education and their own estimation of their general English proficiency. The questionnaire is based on Ásrún Jóhannsdóttir’s Background Questionnaire 3 (2016). Secondly, Participants answered the active academic vocabulary test (Appendix B) (Edgarsson, 2017), which is based on the AWL and consists of 18 statements, each containing word blanks. The word blanks constitute an academic word and the participants are given the first letter of each word and asked to complete it. Finally, participants answered a productive aviation vocabulary test (Appendix C) based on texts (appendix D) that were taken from the PPL curriculum textbooks (Saul-Pooley & Law, 2014).

As the students had not completed AGK, the texts were based on other, prior completed subjects. One text was based on meteorology and included 433 words, and the other was based on navigation and included 446 words. Both texts were analyzed for high frequency, AWL and off-list words by using an online vocabulary profiler made by Cobb (n.d.). The test consisted of 16 questions concerning aviation vocabulary, 10 questions called for written answers and 6 were multiple choice.
questions. All words tested were included in the set of two texts that participants read, and they could hence reference the meaning of each word in the test with the text. Marking of both the active and productive tests was 1 mark for a right answer, 0 for a wrong or blank answer, and no deduction occurred for a wrong answer.

The interview with the teacher, Viktor Guðbergsson (2017), took place while administering the test, and one week later through electronic correspondence. Questions were asked about the class as a whole, about the teacher’s perception of students’ progress in his subject (AGK) and his perception of their motivation. A conversation about the underlying shortage of flight instructors also took place. By interviewing him, possible explanations of trends in test outcomes could be linked to students’ motivation and/or progress with the teacher’s perception.
3. Results

Out of 20 participants, only 18 were evaluated after scoring and comparing tests with the questionnaire. Two respondents, a male and a female, did not answer one or both test and were therefore excluded from the study. Further examination of this exclusion is in section 4.1.

3.1. Questionnaire results

Out the 18 participants that were evaluated, 12 or 67%, are 16-21 years old and 33% 22 years and older, with no one in the age gap 28-30 (Table 2). All but one began learning English before age 12, with half of respondents beginning at age 6-9. Half of the respondents understood English at age 6-9, while 6 did so at age 10-12, with the rest at age 13-15. Most respondents have taken 4 semesters or more in English language courses at secondary school (Table 3). Half of the students have finished secondary school, six are still in, or have finished, 1-3 years of secondary school while the remaining three have attended or finished undergraduate studies (Chart 1). Only one woman in the sample has finished secondary school, and she

<table>
<thead>
<tr>
<th>Age</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-18</td>
<td>5</td>
<td>28%</td>
</tr>
<tr>
<td>19-21</td>
<td>7</td>
<td>39%</td>
</tr>
<tr>
<td>22-24</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>25-27</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>28-30</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>31+</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2. Age of participants

<table>
<thead>
<tr>
<th>Semesters</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>17%</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>39%</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>22%</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3. Semesters of English taken in Secondary school
has a BA/BSc degree, whereas the other four are attending secondary school or have finished 1-3 years of secondary education.

The participants generally regard their English language skills as good or very good with only 3 or 17% of participants regarding their proficiency as fair. Those who regard their proficiency as fair are all 21 years old or younger. Those who have taken more than 4 semesters of English are more likely to regard their skills as better than fair. However, there is only little difference between having good or very good proficiency when comparing those who have taken more than 4 semesters of English language in secondary school. No women regard their proficiency as very good, as opposed to 5 men. Yet those men and women who regard their skills as fair have similar representation within each gender, 1 women out of 5 (20%) and 2 men out of
13 (15%) (Table 4). There is no discernable trend when comparing education and English proficiency (Table 5).

### 3.2. Academic vocabulary test results

The participants in the study scored an average of 47% in the active academic vocabulary test based on the AWL (AWLT). There is no trend between scores on AWLT and the age when participants first started learning English nor the age when they first realized they understood English. However, the participants in the age range 22-24 and those 31 years and older generally score higher than others (Table 6). Men score higher on average compared to women, 52% versus 32% (Table 7). There is generally no correlation between respondents that have taken more semesters of English in secondary school and test scores on the AWLT, however, those who have taken 4 semesters score the highest on average, with a gap of 13%

<table>
<thead>
<tr>
<th>Age</th>
<th>AWLT</th>
<th>AVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-18</td>
<td>32%</td>
<td>53%</td>
</tr>
<tr>
<td>19-21</td>
<td>46%</td>
<td>60%</td>
</tr>
<tr>
<td>22-24</td>
<td>65%</td>
<td>65%</td>
</tr>
<tr>
<td>25-27</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>31+</td>
<td>75%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Table 6. Age and scores in tests

<table>
<thead>
<tr>
<th>Gender</th>
<th>AWLT</th>
<th>AVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>52%</td>
<td>65%</td>
</tr>
<tr>
<td>Female</td>
<td>32%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Table 7. Gender and scores in tests
between them and those who have taken 8 semesters (Table 8). Those who have finished secondary school or a BA/BSc degree average higher scores than those who are attending secondary or tertiary level schools. However, only one respondent is attending tertiary level education (Table 9). Those that regard their proficiency as fair score on average 30%, whereas those that say it is good or very good score on average 51%. Generally, perception of proficiency is a good marker of scores in the AWLT test. However, several respondents are overestimating their proficiency, as many that say they have good or very good proficiency only score 20-30%. This lowers the average of those with high scorer, who have an accurate perception of own proficiency.

<table>
<thead>
<tr>
<th>Semesters</th>
<th>AWLT</th>
<th>AVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>6</td>
<td>25%</td>
<td>55%</td>
</tr>
<tr>
<td>5</td>
<td>47%</td>
<td>60%</td>
</tr>
<tr>
<td>4</td>
<td>63%</td>
<td>70%</td>
</tr>
<tr>
<td>3</td>
<td>35%</td>
<td>48%</td>
</tr>
<tr>
<td>2</td>
<td>20%</td>
<td>70%</td>
</tr>
</tbody>
</table>

Table 8. Semesters of English taken at Secondary school and scores in tests

<table>
<thead>
<tr>
<th>Education</th>
<th>AWLT</th>
<th>AVT</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 yrs Secondary</td>
<td>33%</td>
<td>53%</td>
<td>6</td>
</tr>
<tr>
<td>Secondary</td>
<td>56%</td>
<td>63%</td>
<td>9</td>
</tr>
<tr>
<td>1-3 yrs University</td>
<td>20%</td>
<td>40%</td>
<td>1</td>
</tr>
<tr>
<td>BA/BSc Degree</td>
<td>60%</td>
<td>55%</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 9. Level of education completed and scores in tests

3.3. Aviation vocabulary test results

The participants in the study scored an average of 59% on the aviation vocabulary tests (AVT). Comparing the test with each participant’s questionnaire
answers showed that there was no correlation between their age, age when they first started learning English, or the age when they first realized they understood English with their score in the AVT. No one age group is better than others in AVT scores, with the exception of the two participants who are 31 and older (Table 6). As with the AWLT, men score higher on average compared to women in the AVT, 65% versus 44%, respectively (Table 7). There is no correlation between how many semesters of English completed in secondary school and AVT scores. Those who have taken 4 semesters, which is the largest group when analyzing by semesters of English completed, score higher on the AVT than those who have taken more semesters (Table 8). Those who feel their proficiency is fair score the lowest, 31% on average. Those who indicate good proficiency average 61%, and the highest

<table>
<thead>
<tr>
<th>Proficiency</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>5</td>
<td>72.50%</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0.7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Good</td>
<td>10</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0.7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td>1</td>
</tr>
<tr>
<td>Fair</td>
<td>3</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.2</td>
<td>1</td>
</tr>
<tr>
<td>Grand Total</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

Table 10. Scores in AVT sorted by own proficiency perception
scores obtained were from those who rate themselves having very good proficiency, with 72.5% correct, on average (Table 10).

3.4. Aviation vocabulary texts

Two texts were provided alongside the AVT, one about meteorology (which corresponded with questions 1-8) and another one about navigation (which corresponded with questions 9-16.) Each text was examined through a vocabulary profiler to see how the vocabulary of each text was categorized in terms of high frequency, AWL and other word lists (Cobb, n.d.). The meteorology text had a higher

<table>
<thead>
<tr>
<th></th>
<th>Families</th>
<th>Types</th>
<th>Tokens</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1 Words (1-1000):</td>
<td>102</td>
<td>117</td>
<td>313</td>
<td>69.40%</td>
</tr>
<tr>
<td>K2 Words (1001-2000):</td>
<td>10</td>
<td>10</td>
<td>16</td>
<td>3.55%</td>
</tr>
<tr>
<td>AWL Words (academic):</td>
<td>30</td>
<td>34</td>
<td>50</td>
<td>11.09%</td>
</tr>
<tr>
<td>Off-List Words:</td>
<td>?</td>
<td>38</td>
<td>72</td>
<td>15.96%</td>
</tr>
<tr>
<td>Total</td>
<td>142+?</td>
<td>199</td>
<td>451</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 11 Navigation Vocabulary Profile (Cobb, n.d.)

<table>
<thead>
<tr>
<th></th>
<th>Families</th>
<th>Types</th>
<th>Tokens</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1 Words (1-1000):</td>
<td>109</td>
<td>129</td>
<td>325</td>
<td>75.23%</td>
</tr>
<tr>
<td>K2 Words (1001-2000):</td>
<td>21</td>
<td>23</td>
<td>29</td>
<td>6.71%</td>
</tr>
<tr>
<td>AWL Words (academic):</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>3.47%</td>
</tr>
<tr>
<td>Off-List Words:</td>
<td>?</td>
<td>46</td>
<td>63</td>
<td>14.58%</td>
</tr>
<tr>
<td>Total</td>
<td>144+?</td>
<td>213</td>
<td>432</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 12. Meteorology Vocabulary Profile (Cobb, n.d.)
percentage of high frequency words, 81.9% compared to the navigation text 73%, which had a higher percentage of AWL and off-list words (Tables 10 & 11). Off-list words in these texts are generally technical words and technical abbreviations. Examples of these off-list words in the navigation text are departure, aerodrome, elevation and VFR (visual flight rules). The meteorology portion of the AVT questions had an average score of 58%, and the navigation portion questions had a similar average of 60%.

3.5. Interview with teacher

The spring semester of 2017 is one of the first in which the IFA has had two classes in the PPL program. With more than 40 students attending the program, the teaching has been divided into two groups. The groups get staggered instruction in most subjects. In AGK, the groups were merged together so that the teaching could be completed before a set deadline. The teacher was happy with the students’ competency in the theoretical aspect of the PPL program, but he could not attest to their English language proficiency, as they are not required to take tests in English and they were all native Icelandic speakers. When asked if he knew the proportion of students that were actively taking practical flight lessons, he stated that unusually few students had begun flying at the time. Reasons for that, he said, were twofold. Firstly, Icelandic airlines were heavily recruiting flight instructors and newly graduated commercial pilots, leaving the IFA with a backlog of students waiting for flight instructors. Secondly, the IFA had been planning to move the location of their practical training location to a newly renovated hangar and a new reception and office building at the Reykjavik airport. The move was planned to take place approximately one week after this study was conducted. Because of this move, office staff and instructors were busy planning and preparing and could therefore not take on more students, especially with the underlying severe shortage of instructors (Viktor Guðbergsson, 2017).
4. Discussion

Scores in both tests show the overall lack of vocabulary proficiency in the sample. The AVT scores are overall better than those of the AWLT, 59% versus 47%, respectively. If these findings correlate to the overall English language proficiency of the group, many of the students would not pass the LPRs set by the ICAO, and thus would not be able to fly commercially. As this study only focuses on the vocabulary ability of the students, and no other language skills, this finding can only be applied to the vocabulary section of the LPRs. When comparing the AVT and AWLT to the questionnaire, no apparent trend has been evident with regards to education and level of English language study. Scores in the tests fluctuate when comparing with level of education completed, and are thus not a reliable indicator.

The same situation occurs with the number of semesters of English language taken at secondary school. Those who have taken four semesters score the best in both tests, but most groups do better in the AVT test. The only participant who has taken 8 semesters does better in the AWLT compared to their AVT scores. This could indicate that taking 8 semesters gives students better preparation in terms of academic vocabulary. Score differences between groups are typically within 15-20 percentage points, however, the one student that has only taken two semesters has a difference of 50 percentage points between AWLT and AVT (20% and 70%, respectively). This could indicate the student has not had enough academic vocabulary training with only 2 semesters, while aviation vocabulary knowledge is better than the average.

Whereas prior education and English language training do not clearly relate to test scores, the age and gender of respondents appear to be related. Each age gap, as shown in Table 6, has comparable results in both tests, with the youngest students having the largest deviation between tests, 21 percentage points. Those 31 years and older score the best, and would achieve level 6 on the LPRs. Respondents aged 22-24 score the second highest of age groups, with the same in both tests; they would score at levels 5-6 of the LPRs. Male students score considerably higher than female subjects on both tests. This large difference could be explained by the
small number of women having finished secondary school in the sample. However, the only woman that has completed secondary education, with 8 semesters of English, and has also finished an undergraduate degree at university, only scored 31% in the AVT and 50% on the AWL test. Furthermore, the women in the sample generally rate their own language proficiency lower than the men, with no woman perceiving her proficiency as very good, as opposed to 38% of men (Table 4). Overall, students’ perception of their own proficiency in the English language is the best indicator of vocabulary knowledge in this study. This is especially true for the AVT, as shown in Table 10. There are, however, several students that overestimate their ability in both tests.

An analysis of the texts that were used to support the AVT show that the number of technical and high-frequency words varied. The navigation text had more of a technical and AWL vocabulary focus, whereas the meteorological text was closer to regular lexical structure with 75% K1 and 7% K2 words (Cobb, n.d.). This difference was not shown in the AVT, as both sections Q1-8 and Q9-16 had similar scores on average. Students in this sample are learning PPL studies by reading intensive and complex technical texts that are in English, while at the same time being instructed with a mix of technical Icelandic and English, and finally, compiling that information to be able to take exams in Icelandic. This language conflict can be a factor in low scores on the AVT test, and could also be a deterrent for the students in attending further studies in the field. This is supported by Icelandic studies of tertiary level students and their perception of academic study in conflicting languages (Birna Arnbjörnsdóttir & Hafdis Ingvarsdóttir, 2010; Birna Arnbjörnsdóttir, 2011). A possible way to reduce the impact of this language conflict is for schools and teachers to actively incorporate the English vocabulary in their curriculum. By using this method, students could be more exposed to the vocabulary and with more diverse input systems, which is beneficial when learning technical vocabulary in another language (Gablasova, 2014; Nation, 2013).

Students of the PPL program have not been able to attend practical courses as much as school administrators and teachers would want. This is a direct result of
expansions in the Icelandic airline sector, which cause severe shortages of instructors that can take on new PPL students (Guðlaugur Sigurðsson, 2017; Íngbóra Ingólf Ólafsdóttir, 2017; Tryggvi Ásgeirsdóttir, 2016; Viktor Guðmundsson, 2017). The fact that few students in this sample are not actively taking practical courses and flying could be another reason for low scores in the AVT. Students miss out on opportunities of linking the theoretical knowledge and the technical vocabulary with the act of flying, which is their ultimate goal when enrolled in a PPL program. In addition, Chung & Nation stated that “Technical vocabulary is part of a system of subject knowledge” and it “occurs in a specialist domain” (2004, pp 252). In that case, to be able to learn aviation vocabulary, the learner needs to be in the aviation domain to use frequency as a help in acquisition of vocabulary, otherwise the aviation vocabulary is of too low frequency. This is supported by Gablasova (2014) in terms of general technical vocabulary and Seçer & Şahin (2014), first that repetition of technical vocabulary helped with retention of knowledge, and second that students that are more involved in the aviation studies had better ability than others. Motivation is also a key factor in all education and the students could be more motivated in acquiring the technical vocabulary once fully involved in the practical field of aviation (Seçer & Şahin, 2014). Therefore, the low number of students that are flying may directly relate to their motivation and vocabulary acquisition.

4.1. Exclusions and limitations of study

Two respondents in the vocabulary tests did not finish their tests within the allocated time limit, and one did not answer either test but only answered the questionnaire. This respondent was male and marked fair when asked about general English language proficiency, even though he had finished 8 semesters of English in secondary school and attended 1-3 years of university. After answering the questionnaire, he had 30 minutes to answer both vocabulary tests. He likely lacked the motivation to respond to the tests, based on his own perception of language proficiency, as opposed to running out of time. The other respondent finished just
under one half of the AWL test and did not answer one question in the aviation vocabulary test. This respondent was female and rated her English language proficiency as very good after 8 semesters of English in secondary school. However, she marked “other” when asked about previous education and gave no indication of what that entailed. She either seriously overestimated her English proficiency and ran out of time after having answered eight questions out of 18 total in the AWL test, scoring 5 right (62.5% of her answers); or she lacked motivation in answering other questions.

Both participants are excluded from all results in the study. As it was made clear to all participants that only those who wanted to participate in the study should take the tests, the lack of answers is surprising and is likely attributed to overestimation of own English proficiency, lack of motivation or time constraints. Other participants answered most questions and they guessed more, as no deduction was given for wrong answers in the study. In general, the score outcomes of both tests were lower than expected with the average of tests at 47% and 59%. The better outcome of the AVT compared to the AWLT was expected as the students are exposed to the aviation domain more than the academic during their studies.

By excluding two participants, one of whom is a female, the number of female represented in this study is only 5 versus 13 males, with a total of 18 participants. The few number of subjects does not necessarily constitute a typical sample of the PPL student community in Iceland as the test was conducted in only one school out of four and only one semester out of three. However, they can represent those who study at IFA fairly well, as the sample was roughly one half of active PPL students at the time. One possible limitation could be the language proficiency of the students that did not take part in the test. As the respondents chose to take part in the test, students with low English language proficiency could have chosen to abstain from testing to conceal their ability. However, there is no evidence of this. The study lacks questions about motivation and ambition in the aviation community. As mentioned above, the motivation of aviation students plays a large role in their successes in study and practice, especially with regards to aviation language. Therefore,
questions that could arise about test scores and proficiency cannot be linked to the motivation of each individual person.

As the IFA was in the process of moving its practical teaching school, few students in the sample had begun practical training. As this is a temporary situation that was only in effect in and around the time the study was conducted, other similar studies could have different themes with regards to motivation and student immersion in aviation if conducted at a time when there was no such external factor involved. This cannot be said about the instructor shortage, as that issue is prolonged.
5. Conclusions

Student perception of own English proficiency can predict technical and academic vocabulary proficiency of the private pilot students in the sample, but prior education does not. In general, both the technical and academic vocabulary proficiency were lower than expected. The low scoring can be attributed to two factors, first the language conflict during study, where the students read complex material in English, listen to lectures and take exams in Icelandic, which corresponds to Icelandic university student’s experience. Second is the lack of practical experience, this is the result of both a severe instructor shortage and the school’s operations move. This results in a lack of domain exposure, which is one of the best ways in developing good technical vocabulary knowledge. The age and gender of this sample’s participants was also a good predictor of vocabulary proficiency. This showed that certain age groups fared better than others and that men were better than women. But with only 5 women versus 13 men, this result is not definitive.

Good English language proficiency is crucial for safety and efficiency in aviation. A large portion of all aviation incidents are a result of poor communication and language barriers need to be actively challenged to mitigate their effects on communication. Governments need to be active in the implementation and examination of the LRPs set forth by the ICAO to standardize English proficiency requirements for pilots and ATC. By adhering to the LPRs, pilots and ATC will ultimately lessen the impact of miscommunication in aviation by better understanding one another. In order to gain an adequate language proficiency to pass the LPRs, students need to have access to holistic learning approaches in both aviation and language studies.

Because of varying complexity in learning technical subjects with mixed input language, in this case Icelandic and English, aviation schools should incorporate more language teaching in their curriculum. This could be done by first, actively using the target language in instruction alongside the instruction language. Secondly, in severe cases of poor language proficiency, the schools should provide an additional language course aimed especially at gaining vocabulary linked to the field. The
courses could be structured as extra material that should be learnt at home while studying for the nine subfields of the PPL studies. By scaffolding these approaches, the schools would diversify the input of language available to the students, thereby increasing their ability to acquire language as shown above. In further study of this subject, the questionnaire should include questions regarding the participants’ motivation and their exposure to the practical aspect of flying. By doing so, the study could better link findings of vocabulary or language proficiency to the participants’ motivation and whether an active participation in the practical field has any impact on proficiency and theoretical knowledge.
References


Appendix A

Informant #_________

1. Age?
   ______ 16-18 yrs.
   ______ 19-21 yrs.
   ______ 22-24 yrs.
   ______ 25-27 yrs.
   ______ 28-30 yrs.
   ______ 31+ yrs.

2. Gender? ______ Male    ______ Female

3. Education?
   ______ Primary school
   ______ 1-3 years of secondary school
   ______ Trade or technical school (not in traditional secondary school)
   ______ Completed secondary school (or equivalent)
   ______ 1-3 years of University
   ______ B.A./B.Sc degree
   ______ M.A./M.Sc/MBA (or equivalent)
   ______ Ph.D.
   ______ Other

4. When did you begin learning English?
   ______ Before 5 years
   ______ 6-9 years
   ______ 10-12 years
   ______ 13-15 years
   ______ 16-20 years
   ______ After 20 years
   ______ I have never learned English.

5. When did you first realize that you could understand (or use) English?
   ______ Before 5 years
   ______ 6-9 years
   ______ 10-12 years
   ______ 13-15 years
   ______ 16-20 years
   ______ After 20 years
   ______ I have never learned English.

6. If you attended secondary school, how many semesters did you take of English?
   ______ 803 (8 semesters/4 years)
   ______ 703 (7 semesters)
   ______ 603 (6 semesters)
   ______ 503 (5 semesters)
   ______ 403 (4 semesters)
   ______ 303 (3 semesters)
   ______ 203 (2 semesters or less)
   ______ Other
   ______ I didn’t go to secondary school

7. General English Proficiency (How good do you think your English is)?
   ______ Very good
   ______ Good
   ______ Fair
   ______ Poor
   ______ I don’t speak English

Based on Ásrún Jóhannsdóttir’s Background Questionnaire 3 (2016).
Appendix B

Vocabulary test-Active

Participant #:________________________________________

For each question, complete the word on the line. Only the first letter is given. Use the context to help you. An example is given (0).

0. My ambition is to write books and I want to do it for a living. In other words, I want to become an author.

1. In some parts of the country there is a shortage of people with proper training or job qualifications; that is, some regions simply lack skilled l__________.

2. You need to obtain more information about the views of the people in this area and for that you need to carry out a s__________ as part of your study.

3. We need to collect money to finance a project like this; I’m sure there are some government f__________ that could help us get started.

4. I won’t agree to a big celebration but I might give my c__________ to a small party.

5. For a period of 10 years I was married to this horrible man so I feel a whole d_________ of my life has gone to waste!

6. How much does the proofreader charge for her work? I mean what’s her f__________?

7. The media maintained he broke the rules; however, the manager said he did not act in v__________ of the regulations.

8. Iceland has seen a gradual reduction of trust of government lately; in fact, there has been an e__________ of public confidence in the parliament and politicians in general.

9. Smoking can cause lung cancer; in fact, many cases of lung cancer are directly l_______ to smoking.

10. Be certain that you will be able to accomplish what you set out to do; that is, before you set your targets, make sure that they are a____________.

11. In a clever and rather dishonest way, Jane has got the media to do what she’s wanted. In other words, she’s m_____________ the media for years.

12. Mary’s latest book will come out by the end of this month. At least we won’t have to wait for too long before it’ll be p__________.

13. Many people regard a good health care system more important than almost anything else in their society. It’s also been a p__________ concern among most politicians.

14. I think he’s been having some problems with money lately, which shouldn’t be a surprise; he’s always had problems with his f____________.

15. The new Volvo car is the fanciest car I’ve driven and it’s so comfortable; I mean, this car is the u__________ luxury car!

16. My doctor said I could choose treatment instead of undergoing an operation. I was quite glad that he offered me an a__________ to surgery.

17. In many parts of the world there is a lot of prejudice against people of a certain race or culture and this can be hard to tolerate, especially for the e__________ minorities.

18. When Sue retires, she’ll get 90,000 dollars from her company, which is quite a large s__________, isn’t it?

(Edgarsson, 2017).
Appendix C

Participant number: ____

1. What does the word **cumulonimbus** describe and entail?

2. What does **aviator** mean in this context: "They constitute a severe hazard to the **aviator**, especially in light aircraft."

3. What does **static** mean? Mark the correct answer:
   - Electric spark
   - Lack of movement
   - Something impossible
   - Rapid movement

4. What does **lapse rate** mean? Mark the correct answer:
   - Time passed since last fix
   - Temperature increase/decrease by day
   - Temperature increase/decrease with altitude
   - Rate of Climb

5. What is **convergence**:

6. What is **dewpoint**:

7. Briefly explain what the words **cumulus stage** entail:

8. What is a **diameter**:

9. What does **aerodrome** mean. Mark the most correct answer:
   - Another word for air traffic control
   - International airport
   - A place from which aircraft flight operation take place
   - Airport control zone, designated with the letters A, B, C, D, E, F and G

10. In the text, **procedures** are: Mark the most correct answer
   - Mechanical operation
   - Formula/equation
   - A series of actions conducted in a certain order
   - Aircraft performance

11. In the text, **bearing** is the following: Mark one option.
   - The direction or course of motion
   - Mechanical wheel bearing
   - The way one behaves or conducts oneself
   - Level of tolerance

12. Explain the following: **left hand circuit**:

13. What does **manoeuvre** mean:

14. What do the words **departure** and **route** each mean in the text:
   - Departure:
   - Route:

15. What does **top-of-climb** mean. Mark the correct answer:
   - The maximum height at which an aircraft can sustain a specified rate of climb dependent on engine type
   - the operation of increasing the altitude of an aircraft to a predetermined level
   - The transition from the climb phase to the cruise phase of flight
   - The height above ground or water of the lowest layer of clouds
Appendix D

Thunderstorms

Thunderstorms generate spectacular weather which may be accompanied by thunder, lightning, heavy rain showers and sometimes hail, squalls and tornadoes. Thunderstorms are associated with cumulonimbus clouds and there may be several thunderstorm "cells" within one cloud. They constitute a severe hazard to the aviator, especially in light aircraft.

Associated with thunderstorms is lightning, which is a discharge of static electricity that has been built up in the cloud. The air along the path that the lightning follows experiences intense heating. This causes it to expand violently, and it is this expansion which produces the familiar clap of thunder.

The Three Necessary Conditions

Three conditions are necessary for a thunderstorm to develop:

- **Deep Instability** in the atmosphere, so that once the air starts to rise it will continue rising (for example, a steep lapse rate with warm air in the lower levels and cold air in the upper levels);
- **A High Moisture Content**;
- **A Trigger Action** (or catalyst) to start the air rising, from:
  - a front forcing the air aloft;
  - a mountain forcing the air aloft;
  - strong heating of the air in contact with the earth's surface;
  - heating of the lower layers of a polar air mass as it moves to lower latitudes (i.e. towards the equator); or
  - convergence of air flow, eg. a pressure through or a sea breeze which forces air to rise.

The Life Cycle of a Thunderstorm

The Cumulus Stage

As moist air rises, it is cooled until its dewpoint temperature is reached. Then the water vapour starts to condense as liquid droplets and clouds form. Latent heat is given off in the condensation process and so the rising air cools at a lesser rate. At this early cumulus stage in the formation of a thunderstorm, there are strong, warm updrafts over a diameter of one or two miles, with no significant downdrafts.

Air is drawn horizontally into the cell at all levels and causes the updraft to become stronger with height. The temperature inside the cloud continues to build to greater and greater heights. This often occurs at such a rate that an aeroplane cannot outclimb the growing cloud.

The strong, warm updrafts carry the water droplets higher and higher, to levels often well above freezing level, where they may freeze or continue to exist as liquid water in a supercooled state. The liquid droplets will coalesce to form larger and larger drops.

The cumulus stage typically last 10 to 20 minutes. The cumulus stage involves small cumulus cloud developing and growing rapidly into towering cumulus cloud which may rise to over 20,000ft above ground level.


The Flight Sequence

Departure from an Aerodrome and the Initial Fix

The aim, at the start of flight sequence, is to depart from the aerodrome safely whilst ensuring that an accurate heading from a convenient geographical point for the first leg of flight is achieved. Dead reckoning navigation depends upon flying valid heading between two geographical points based on precise timings. If the initial set heading point is not targeted accurately at the start of the leg, errors will occur that will place extra demands on you to correct, en-route.

The actual method of departure from an aerodrome will depend upon factors such as: the circuit direction; VFR arrival and departure routes; IFR procedures; the proximity of controlled airspace and the need to route via access lanes. Other aerodromes may have local restrictions due to heavy traffic, high terrain or nearby built-up areas calling for special departure procedures.

Three methods of departure will be considered: the set heading point method; the overhead initial fix and the estimated initial fix. In each explanation, the pilot is trying to fly to a turning point on a bearing of 150°M from the aerodrome using runway 06 with a left hand circuit; the aerodrome elevation is 1,200 ft amsl.

Method 1: The Set Heading Point Method

Traditional navigation methods use the departure aerodrome as the default set heading point. This requires the pilot to take off, safely manoeuvre the aircraft to the aerodrome overhead, set heading and determine (and log) the actual time the leg commences. This imposes a very high workload on the pilot at a time when lookout and other airmanship factors are essential. Furthermore, overhead departures may not be permitted at certain aerodromes particularly those within the control zones and/or under the control areas of major airports. The use of Entry/Exit Access Lanes also prevents the use of overhead departures.

In this situation, you should consider selecting a familiar, neutral geographical point, with respect to VFR and IFR departure routes, approximately 4 nm from the aerodrome in the approximate direction of 150°M. This would be outside of the limit of any controlled airspace restrictions. This allows you to settle after take-off and top-of-climb (FREDA) checks and prepare the chart and flight log for use. You can also follow ATC instructions regarding exit for controlled airspace without distraction.

The flight to the set heading point would not be considered a formal leg with regard to the flight log: in this case the first leg starts at the set heading point and not the departure aerodrome. It is, however, important to build the route from the departure aerodrome to the set heading point into fuel plan.