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Review research paper

AB-INITIO PILOTS' PERSPECTIVES ON THE USE OF SIMULATION IN THE AVIATION ENGLISH COURSE

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Abstract. *Flying is costly, time-consuming, dependent on weather and maintenance, and sometimes simply does not match with schedules well. When flying a real aircraft is not a feasible or even preferable for one reason or another, a flight simulator could be remedy. Using a flight simulator to improve ab-initio pilots' knowledge and abilities may make their flying experience more effective and enjoyable. In this respect, this study aims to enhance aviation training through simulation-based learning and develop an understanding of how prospective pilots perceive the innovative approach of simulation integration in Aviation English courses. The X-Plane version 11 was used in conjunction with an introductory course in Aviation English and provided a substitute for an actual flight test experience at an aeronautical university. The sampling consisted of 20 tertiary level students enrolled in the Aviation English course. After the intervention, randomly selected 7 students were interviewed to gain insights into their perceptions about the use of simulation.*

Key words*: Simulation, Aviation English, ESP, iPad*

1. INTRODUCTION

The term "simulation" conjures images of sophisticated computer-generated replicas that closely resemble the look and feel of the cockpit for many in the aviation industry. Simulation had a far more modest beginning. The possibilities that flight may provide grew not long after the discoveries of the late 1800s and early 1900s that led to controlled, engine-propelled flight. Manned flight was swiftly embraced not just for transportation but also for many other civilian and military services, so that it was no longer the domain of a tiny band of daring souls who flew for novelty's sake. Nearly as soon as the aviation business took off, concerns about how to efficiently and swiftly educate pilots emerged. Many attempts were made to create simulated flight for training reasons due to the risk that early flying presented for pilots (Reid, & Burton, 1924; Clark, & Steward, 1962). However, the sheer volume of personnel that early military aircraft fleets needed to educate effectively made many early notions of simulated flying ineffective (Rolfe and Staples, 1987). As a consequence, most early pilots were forced to sit through lectures in class before engaging in actual flying training exercises. Flying might be seen as dangerous, even for veteran pilots, even though engineers continued to unravel the

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secrets of efficient aircraft design. Naturally, this risk was increased for novice trainee pilots. Flight simulators were created to increase safety in training as a result of the high cost of lives and airplanes lost alone during training (West & Cummings, 2007).

Simulation-based learning in aviation is important for individuals such as pilots, air traffic controllers (ATCs), maintenance, ground operations and safety board. These jobs required adept and expert workers to perform highly experienced and knowledge-based operations. Aviation training which is usually conducted in the training centers, technical schools or community colleges develops expertise in the industry through a combination of field training and theoretical knowledge gaining at schools. However, the high risk of acting in the field poses challenges for particularly prospective pilots as the probability of making mistakes might lead a disastrous accident. Serious thought, thus, has been given to the use of simulation in aviation training as a simulation, like a flight simulator, is a computer-generated imitation of the genuine thing (Lee, 2017). It helps trainees to experience real lifelike scenarios in the school environment. In other words, a scenario or process is imitated by using technology for training or education. When the actual system or environment cannot be utilized—for instance, because it is inaccessible or potentially dangerous—simulation is often employed (Kuofie & Suman, 2021). Simulations display the actual results of various circumstances and actions. It is also described as a technique to facilitate learning how to deal with real-life situations. In aviation, it is recommended by professionals to be involved in simulated-scenarios in the computer-based environment prior to attending physical pilotage. Therefore, simulation-based learning is utilized as a method of teaching and learning that makes use of direct experience and allows for critical analysis and introspection (Kincaid et al., 2003).

One could claim that the aviation industry's rapid expansion and the nature of radiotelephony is the root cause of communication issues. Pilots and air traffic controllers who do not share the same native tongue use aviation English as the lingua franca. They are expected to maintain radio communication with the air traffic controller as well as operate the flight control surfaces simultaneously (Nesic & Hamidovic, 2022). Although technological advancements have made it possible to communicate even more clearly over radiotelephony, listening comprehension is still a major concern for aviation professionals because radiotelephony is still prone to background noise, which makes radiotelephony messages less understandable. This creates a high cognitive load on pilots, and it impedes the radio communication in the cockpit (Trippe & Baese-Berk, 2019). Additionally, lack of proficiency in English language has already resulted in fatalities, raising serious concerns among aviation authorities. Taking these issues into account, developing effective learning environments for ab-initio pilots is essential and crucial. Simulation is, hereby, comes into prominence as a facilitator in Aviation English trainings.

A significant change could be seen after integrating simulations into the classroom environment. According to the test results of American kids, Wenglinsky (1999) discovered that using classroom simulations was connected to several forms of social progress such as engagement, attendance rates, and reduced vandalism. Studies of the use of simulation for training in the aeronautical fields have shown similar excellent outcomes (Jentsch & Curtis, 2017). In another study by Dinçer and Dinçer (2021), the use of simulator-based games was found to enhance the vocabulary retention of prospective pilots. Delgado et. al, (2014), on the other hand, implies that simulators have been utilized without much consideration of how they might influence the engagement, perception, and retention. Therefore, a thorough grasp of what is known about how simulation affects

training is crucial for academics and practitioners. With this information, practitioners and academics will be able to design more effective trainings and conduct research that will direct the use of simulation in the aviation industry's growing future. Overall, this study, thus, seek out to understand the perceptions of ab-initio pilots who are trained with simulation-based learning in the Aviation English course. It is aimed to examine their attitudes, ideas, and beliefs on this innovative approach in the instructional delivery. For this reason, following research questions were addressed in the present study:

a) How do ab-initio pilots perceive the use of simulation in aviation English training?
b) Do ab-initio pilots favor the use of iPad in simulation-based aviation English course?

2. METHODOLOGY

2.1. Context

Turkey, particularly Istanbul, is fast becoming a hub for aviation since it hosts one of the biggest airports in the world. Accordingly, the number of institutions offering Aviation English courses has increased significantly in order to meet the demand on qualified pilots in terms of English language proficiency. These institutions mainly tap into coursebooks in the classroom. However, it has been recently reported that prospective pilots in Turkey lack hands-on experience in using Aviation English in the target setting (Demirdöken, 2022). Building on this issue in the Turkish context, the present study took place at a state university offering Aviation English courses for prospective pilots. These must-have courses are offered in an eight-semester-long academic program. While general English courses are offered in the first four semesters, Aviation English courses are offered in the remaining four semesters. The medium of instruction is English, and the course curriculum covers a range of aviation-related topics including aviation phraseology, radiotelephony communication, Meteorological Aerodrome Reports (METAR), aviation safety, and aeronautical information.

2.2. Participants

The participants were twenty student pilots who were recruited based on the purposive sampling technique (Maxwell, 1997). This technique calls for the deliberate selection of settings, people, or events and the data collected from such participants offer invaluable information that cannot be collected from other choices. At the time of data collection, the participants were in their fifth semester and were taking the Aviation English course. In addition, they had no prior Aviation English training or simulation-based learning experience. Therefore, the sampling served best for the purpose of the study. Participants' ages ranged between 20 and 22 (M=20,85), and their gender distribution was as follows: 17 males (85%) and 3 females (%15).

2.3. Instruments

The researchers have integrated a flight simulator called X-Plane 11 which is one of the most sophisticated and realistic simulation software in the market. The Luminar Research Company created and published it in 1998. It attempts to create a simulation of flying an airplane as precisely as possible. The degree of intricacy of the software combined with the visuals and processing power of computers allowed the application to depict flying in a highly

realistic way. Many real-world situations, aircraft and airports are available in the X-Plane's extensive collection of libraries. It can also imitate weather changes, aviation malfunctions, and it allows several types of vehicles, such as automobiles and boats, even if they are not actively utilized by the player. The game is incredibly realistic (see Fig. 1) and a strong option for use as a simulation engine thanks to all of a very robust physics engine, and a thorough API for programmatic access. Most importantly, the software could be used in PCs, IPADs, and Virtual Reality headsets. These attributes, particularly the realistic simulation engine and user interface, have also made X-Plane useful for a variety of other purposes, including the training of future pilots.

Fig. 1 X-Plane 11 Simulator

In the current study, a group of twenty prospective pilots received simulation-based instruction on the aviation English course. The researchers informed participants about the research before the intervention and got their written consents for taking part in the study. At the beginning, they watched tutorials about the application. Then, the intervention lasted six weeks and one hour per week was allocated for the intervention. The students gathered in a language learning laboratory in which there are computers and a 75″ LED monitor that can be used with IPAD, VR headset and a computer. The researchers connected IPAD to the screen. Every week 4-5 students used the IPAD to practice the target topic. During this time, others were taking notes while watching the simulation and listening to the instructor's instructions. The researchers provided guidance through the simulation demonstrating at the LED monitor. Also, IPAD was present in the lab apart from the lecture hour so that curious and willing students might benefit during the week. At the end of the intervention, semi-structured interviews were conducted with seven randomly selected students.

Table 1. Topics of the simulation-based learning

Date	Topic
Week 1	Parts of an Airplane
Week 2	Airport Layout
Week 3	Take-off
Week 4	Cruising
Week 5	Landing
Week 6	Marginal Weather

2.4. Research Design

The present qualitative study has employed a phenomenological research design in order to analyze simulation-based learning in aviation from the perspectives of prospective pilots. Phenomenology focuses on describing and understanding "the meaning for several individuals of their lived experience of a concept or a phenomenon" (Creswell, 2007, p. 57). A qualitative phenomenological approach stresses the value of the individual's viewpoint and interpretation of the event under investigation in the context of their surroundings while allowing for an attention on experience from the individual's point of view (Creswell & Poth, 2016). This study seeks to examine how students perceived simulation-based learning in aviation and to what extent they value and praise this innovative approach.

2.5. Data Collection and Analysis

Each participant in the current research had a one-on-one, in-person semi-structured interview. The interviews lasted between 20 and 35 minutes and started with an introduction discussing the purpose and scope of the research, anticipated interview length, purpose of the data, and some demographic inquiries. Students were questioned about their impressions with simulation-based learning approach and the software. They were also queried about their engagement, motivation, and suggestions for this implementation. The researchers recorded the interviews and later transcribed the data with the *Other.ai* software.

The interview evidence was subjected to inductive thematic analysis to extract, examine, and report on recurring themes. First, the researchers conducted the interviews, transcribed the recordings of individual interviews, and reviewed the data many times to become acquainted with the content, as recommended by Braun and Clarke (2012) in their six-stage method to theme analysis. The transcripts were examined in the software, *MaxQDA* which allow users to analyze data, text, and multimedia for qualitative purposes in a scientific way. Initial codes that were pertinent to the study's questions were then created, and the codes and the extracted data were combined. Then, themes and subthemes were constructed using the detected codes. The codes were not decided with the top-to-bottom approach, instead they came out during the analysis. The researchers also individually coded the data iteratively to compare with the outputs of *MaxQDA* to improve the analytic procedure, as advised by Joffe (2011). Finally, the analyses were cross compared by two researchers so that a final decision on the codes and themes could be made.

Table 2. Sample coding of simulation-based learning in aviation from the students' perspectives

Theme	Subthemes	Sample Codes
Learning environment	Hands-on experience	Risk-free opportunity to practice... Good to practice here... Better than theoretical education...
	Engagement	Such an engaging tool... Cannot stand passing to new scenario…
	Retention	Keep my mind better... Permanent learning... Learn better and faster...
	Vocabulary acquisition	Many words in contexts... Learning by interacting with words... Great chance to learn phraseology...
	Listening	Good to improve listening skill… Audios help us to understand context… Beneficial as auditory input…
	Situational awareness	Testing different conditions… Opportunity to practice in meaningful contexts… Real lifelike scenarios…
Instructional tool	Visual quality	Higher graphics... Stunning visuals...
	Interface	Easy to navigate in the main menu… Clear enough to find something… Simple and tidy menu type…
	Immersion	Desire to use it for hours.... Lose track of time and place... Such an immersive application…
Equipment	Usability	Hard to use without joysticks… IPAD seems strange... Prefer using PCs...

3. FINDINGS

This section outlines the main findings of the study. In the course of this work, we discovered that students' responses to interview questions fall into three main themes, namely learning environment, instructional tool, and equipment.

3.1. Learning Environment

Students developed different attitudes towards simulation-based learning and the learning environment appeared as the first theme in our analyses. It consisted of six sub-themes: hands-on experience, engagement, retention, vocabulary acquisition, listening, and situational awareness. Based on students' reflections it was found out that integrating simulation into Aviation English course offered hands-on experience for student pilots. For example, S5 commented "I find it useful to do some practice on iPad because I do not take any risks." In a similar vein, S1 reported "I am aware of various aviation accidents, and it is therefore a big opportunity for me to get this experience in the classroom before I fly an airplane. It is far better than pure theoretical flight training." Referring to a similar point of view S4 stated "For me, flying is a dream that has come true thanks to simulation. Although I need more practice to

become a pilot, it is quite expensive to simulate flying in your home. Therefore, I can spend a lot of time on iPad to get the basic flying experience I need."

Student pilots also perceived simulation as engaging, which were reflected in their responses. For instance, S7 said "I believe that X-Plane is taking me on a journey. It is more than completing a flying mission. I always look forward to unlocking the upcoming missions." On similar grounds with her, S2 commented "At first, I thought it was a game but then I realized that it was more than a game with various missions to be completed. Also, unlocking the next mission was extremely rewarding and engaging for me."

Qualitative data analysis based on students' perceptions revealed another sub-theme, retention. The student pilots highlighted the issue of retention by comparing simulation-based learning to conventional learning. As such, S3 reported:

> I learned English in a traditional way in high school. The teacher used only the coursebook and PowerPoint presentations, which was dull for me. However, learning via X-Plane was a totally different experience in that it enabled me to keep the aviation terms in my mind easily. I believe that learning English in this way is a very innovative.

In addition, S6 reported "When I was enrolled in motivational flight, I benefited from what I learned in simulation sessions since they provided lasting learning." It was also concluded that responses of student pilots pointed out developing listening skills and acquiring new words through simulation. To illustrate, S5 commented "I cannot easily comprehend the auditory inputs, particularly radio messages. That is why X-Plane was a great tool to hear aviation terms in real setting, which helped me develop not only my listening skill but also my word-hoard." Comments such as "I thought I was learning by interacting with words" (S4) and "We all learn new words by memorizing but we cannot learn how they are used in real life, so I enjoyed learning new words in the simulation sessions by seeing explicit use of those words in the flight" (S1). What is more S5 highlighted how she benefited from the simulation sessions with regard to developing her listening skill before the English language proficiency test:

> For me, the most difficult skill to develop is listening because it is not easy to understand some English-speaking pilots on the radio due to their heavy accent. I can be successful in the exam (referring to International Civil Aviation Organization's English Language Proficiency Test) only if I can develop my listening skill. Therefore, I found out a new way to do some listening practice.

With regard to the learning environment, the last inference from student pilots' responses was situational awareness which appeared in different ways during the interviews. While S2 highlighted that he tested "…different conditions, and it was like a challenge for me", S3 stated "I felt as if I was completing some real-life missions." S7 also elaborated on this matter and said that "I was able to realize what was really going on and I enjoyed practicing in a meaningful context."

3.2. Instructional Tool

The second main theme that emerged from qualitative analysis was named instructional tool, and it reflected the way student pilots perceived X-Plane as an instructional tool in the Aviation English course. Responses that were associated with this main theme included

references to visual quality, interface, and immersion. As such, S1 mentioned the user-friendly interface of X-Plane: "I never had any difficulty in navigating to a different menu which was a good thing for me as a student. Besides, the images were clear, and it was a lot of fun to fly an airplane with such graphics." The same feature was also highlighted by S6 who commented "It was easy to find what you were looking for in the simulation because the navigation menu was simple enough." Another comment regarding the user-friendly interface of the software was as follows: "It was the first time I used software to simulate flying but everything was well-organized and unbelievably realistic, so it did not take me too long to get used to the software" (S7). Comments regarding visual quality and user interface also included the following compliment:

> I was particularly impressed by the graphics. I had never seen anything like this before. It was almost the real aircraft in front of me on the LCD display…It was an awesome experience, … and it was like high-end flight simulators I saw on YouTube. Learning is a lot of fun with such good graphics, and I think everybody wants to have one of them in the classroom. (S4)

Student pilots also reported being immersed by the flying experience X-Plane offered. For instance, S2 stated "… it was difficult to keep track of time and place when flying." In a similar vein, S5 commented "It was an immersive application and I never wanted to stop flying." Building on this view, S3 further stated "My desire to use it for hours and hours may never end. I think it is as real as it gets."

3.3. Instructional Tool

The qualitative data analysis called forth the third and last theme, equipment. Unlike the others, this theme mainly included student pilots' negative reflections on the use of simulation in the Aviation English course. S5, for instance, argued how it felt to control an aircraft on an iPad: "I think holding the iPad with your hands was not comfortable for me since I also needed to control flight instruments on the touch screen." This issue was also highlighted by S2 who commented "… no matter how enjoyable it is to fly on an iPad, I have to admit that it can be less painful to control the aircraft with a flight control stick or a yoke" and by S3 who said "However, when it comes to controlling the aircraft on an iPad I would definitely prefer a different control device because I sometimes have difficulty in reaching out some buttons on such a big touch screen." Apart from these comments, S7 further commented that she would prefer a desktop for the same purpose:

> I mean it is not perfect. For example, you need to multi-task when flying, and it includes not only holding the iPad for a long time but also controlling different surfaces and displays in the aircraft. At the end of the day, it becomes really tiring. Therefore, I would prefer different software that can be run on a desktop."

4. Discussion and Conclusion

The present study aimed to explore student pilots' perspectives on the use of simulation in the Aviation English course. In the light of participants' responses, it is conceivable that the learning environment was a key component in ESP teaching, and the students engaged highly

in the simulation-based learning environment. Student engagement is known to contribute positively to both student achievement and academic performance (Dotterer & Lowe, 2011; Harbour et. al, 2015). A notable example of student engagement in our study was that student pilots regarded simulation as an engaging tool that made their dreams come true and innovated the learning environment which, in turn, resulted in students being more interested in the course. Simulation, serving as an innovative instructional tool, can therefore be argued to have flattened conventional teacher-centered methods. In this sense this finding is a significant contribution to ESP teaching in that no study has reported on student engagement in Aviation English context except few studies that adverted this issue in ELT context (Davis & McPartland, 2012; Kurt et al., 2022) and provided similar findings. To illustrate, Kurt et al (2022) reported that motivation, concentration, and active participation were closely related to the instruction, which implied that instruction boosted affective, cognitive and behavioral engagement. Along similar lines, it was concluded in this study that prospective pilots enjoyed the simulation-based instruction and found what they were looking for. As a result, it can be hereby concluded that innovating the ESP classroom through simulation is believed to be rewarding for prospective pilots, and serious thought should be given to simulation integration for learning gains.

Another issue emerging from the findings of the present study relate specifically to effective and efficient incorporation of instructional tools into the language learning process for the purpose of equipping students with 21st century skills such as critical thinking, collaboration, and problem-solving which are also key skills required in the aviation industry. As discussed earlier, simulation is particularly preferred when it is potentially dangerous to reincur the real settings (Kuofie & Suman, 2021), and it clearly sets forth the actual results to be obtained in these settings. Therefore, the use of simulation may be linked to facilitating learning how to deal with real-life problems. Concordantly, the responses of participants in this study explicitly showed that engaging in such simulated learning environment was like completing real-life missions. A possible explanation for this might be that it was the very first simulated flight experience for these participants, and they were immersed in this simulated environment to such an extent that they found it appropriate to compare it to real life. Their reflections might be true in that they had already completed some motivational solo flights despite having no prior experience in any type of flight simulator. These results further shows that technology integration ameliorates the quality of learning experiences to entertain students towards constructing relevant knowledge. This finding broadly supports the work of other studies in this area linking technology integration, particularly simulation, with the attainment of 21st century skills. For instance, Živković (2016) argued that integrating technology into ESP classroom will facilitate learning and thus, ESP students "will become creators of knowledge, competent and productive communicators, successful collaborators, independent and inventive thinkers, problem solvers and career experts" (p. 154). All things considered; the present research study has made a substantial contribution by building on prior research into technology-enhanced ESP learning environments.

The last finding to emerge from the qualitative data analysis related to the use of appropriate equipment in the ESP classroom. It is interesting to note that student pilots did not favor the use of iPad as an instructional tool so much as they favored the simulation-based learning environment. No matter how engaging the instruction and the setting were, participants still reported dissatisfaction with extended periods of iPad use. It was, however, mostly originated from the design of the instructional tool itself, not the software. A possible explanation may be the lack of adequate equipment that can serve for this purpose. However, the most significant

cause can be the challenging nature of technology integration. Even if ESP teachers have access to different modes of technology, it can sometimes be difficult to choose the most appropriate tool among many others. As discussed by Harrell and Bynum (2018), external factors such as poor infrastructure, inadequate technology, lack of sufficient technological tools, and effective professional development as well as internal factors such as low teacher self-efficacy and teacher perceptions affect technology integration. Therefore, it is of utmost importance for ESP teachers to develop a solid understanding of innovations in instructional tools as well as software that can suit best for the needs of their students. As for the present study, iPad was instrumented to run the X-Plane software, and it was inferred from participants' responses that iPad was a good but not the best instructional tool in a simulation-based learning environment. Nonetheless, this research is a first step towards a more profound understanding of using iPad for instructional purposes in ESP context, particularly Aviation English. Prior studies that have noted the efficacy of iPad as an instructional tool are limited to primary school (Henderson & Yeow, 2012; Hutchinson et al., 2012). Alternatively, iPad was reported as a useful tool to handle the result of pre-neurosurgical simulation in the field of medicine (Maruyama et al., 2014). Consequently, it has been shown for the first time that iPad can be instrumented in ESP classroom effectively to simulate real flight conditions for prospective pilots.

5. Limitations and Further Research

The present study has some limitations associated with the use of simulation in aviation. First and foremost, the sampling is limited to twenty, which was, in fact, the highest number of student pilots available at the time of study. The findings obtained from this sampling may, therefore, be further compared in a separate study to be conducted with more participants. Another limitation in this study concerns the time allocation and the availability of instructional tools. That is, there was only one iPad and participants had to experiment with it during the class-hour only. This resulted in the total amount of simulation time for each participant to be relatively limited. For these reasons, the same research design can be replicated with more iPads and for a longer period of exposure to the simulation software, X-Plane. Last but not least, the instructional tool itself can be discussed as a limitation of the present study. Despite iPad being instrumented as the instructional tool to run X-Plane version 11, different platforms including desktops or gaming consoles. In addition, virtual reality (VR) can be included in further studies.

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APPENDIX 1

Interview Protocol

1. How was your simulation experience?
2. How can you describe your simulation experience in comparison with your previous learning experience?
3. How can you describe the positive and negative aspects of simulation-based learning on your experiences?
4. How do you think that simulation-based learning contributed to your learning process?
5. If any, what were your challenges regarding simulation-based learning?
6. What would be the best word that describes your attitude toward simulation-based learning?
7. How would you consider learning Aviation English through simulation in the future?
8. How do you think simulation-based learning affected your overall learning performance?
9. How do you think that simulation-based learning was relevant to your studies?
10. How do you think about simulation-based learning in its contribution to the development of any skill other than language skills?
11. How do you think that your simulation-based learning process was meaningful to you?
12. What would be your biggest gain through simulation?
13. How did you feel while using IPAD to fly an airplane in a virtual environment?