



Exploring the adoption of desktop simulators in pilot training: An ethnographic approach

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Aviation has been using flight simulators for pilot training for a long time. Desktop simulators are a more cost-effective, efficient and accessible alternative to an expensive high-cost, high-fidelity flight training devices. Despite the benefits, desktop simulators are rarely seen in flight schools and flight instructors hardly recommended them for early stages of training. Therefore, this study investigated the perception of flight instructors about the usefulness of desktop simulators in flight training and the ways they can be used in the early stages the training. An ethnographic study was conducted in a flight school in Australia via observation and in-depth interviews. Despite the documented benefits of using desktop simulators, there seems to be a hesitancy by flight instructors to encourage students to use these devices because students: build bad habits if they misinterpret what they have been taught and practise without supervision, tend not to trim the aircraft, apply too much force on the controls, and look down at the instruments very often and do not look out. We conclude that this negative perception about the technology can be holding back further progress in improving the quality of flight training and preventing students from embracing the technology to enhance their learning.

Keywords: pilot training, aviation education, flight simulator training, desktop simulator

Introduction

Flight training can be improved by embracing new technologies (Hunter, 2021). Flight simulators are evolving at the same pace as technology and playing an essential role in flight training. They are cost-effective and efficient instructional tool that can improve students' performance (Rigby, 2015) in a safe environment. The rapid technological advances in commercial computers has allowed the development of desktop simulators, also known as Personal Computer-Based Aviation Training Devices (PCATDs). These devices are a more affordable alternative to traditional simulators and a valuable instructional tool (Reweti et al., 2017). Since students now can access simulators in their homes, it is important to understand how flight schools can use desktop simulators when students first start learning to fly. Nonetheless, PCATDs are still seen with scepticism and their adoption are slow.

Ensuring that technology is being effectively used for learning is a persistent problem in education, particularly because of rapid technological advances, high costs and slow adoption (Burke et al., 2018). In higher education, millions of dollars have been spent in teaching technologies, however academics and lecturers are not adopting them, due to lack of equipment, time, training or for certain beliefs about teaching and the technologies (Reid, 2014). Given the benefits of PCATDs and flight simulators used at home but the low adoption of the new technology in learning and teaching environments, the objective of this study is to investigate the perception of flight instructors about the usefulness of desktop simulators in flight training and the ways they can be used in the early stages of pilot training. We are particularly interested in understanding the reasons why the technology has not been adopted widely in flight schools in Australia. Therefore, we conducted an exploratory research using an ethnographic approach at one Australian flight school.

Literature review

Flight training organisations worldwide have been investigating ways to enhance training through the use of flight simulators. PCATDs were introduced into the aviation education community as a more affordable alternative to the Flight Training Device (FTD). Instead of using mechanical instrumentation, these devices display the virtual instruments and indicators on the screen, making them a more accessible option for training

without compromising the student's performance (Beckman, 2009; Callender et al., 2009; Reweti et al., 2017). The research suggests that PCATDs can be as helpful as FTDs for the early stages of pilot training, especially for developing instrument flying skills. However, PCATDs can be limited to only teaching the procedural elements of flying and may not be suitable for developing fine psychomotor skills, because to the lack of haptic feedback through the flight controls (Reweti et al., 2017).

Students can also benefit from practicing on flight simulator platforms at home, such as Microsoft Simulator X (MSFSX), Lockheed P3d, and X-plane. A study conducted by Beckman (2009) revealed that student pilots find MSFSX useful and effective to practice instrument approach procedures, holding patterns, basic attitude instrument flight and en-route navigation. (Callender et al., 2009) showed that students that train on MSFSX before training in an aircraft perform better than those who train directly on an aircraft. Beckman (2011) concluded that students studying private pilot ground school classes using MSFSX displayed better Aeronautical Decision-Making (ADM) skills than students who only studied the subject through the traditional class format, including oral presentations and PowerPoint.

Method

The project uses ethnography, which is defined as the act of "studying, describing, representing, and theorising with a certain degree of particularity a culture or social world" (Harrison, 2018, p. 4). Based on the ethnographic principle of immersing in the real study context to gain in-depth knowledge (Queirós et al., 2017), the first author spent eight months in a CASA-approved flight school in Brisbane, Australia, one cohort of five student pilots. They were enrolled in the Graduate Diploma in Flight Management, a program offered by the university and delivered by the flight school. The first author adopted an insider role where one does not actively participate in all the activities but does attend the activities. This allows close access to the students, instructors and managers' perceptions and views (Angrosino, 2007). The study received approval from the Griffith University Ethics Committee (#2021/718). All five students form the cohort, three CASA certified instructors actively involved with this cohort were observed and interviewed, while the base manager of the program, the Head of Operations, and the Chief Executive Officer were only interviewed. A total of 11 in-depth interviews, between 30 and 40 minutes, were carried out. Three open-ended questions and covered their view and beliefs on the use of PCATD at the early stages of flight training. Data was collected between 22nd November 2021 and 14th April 2022 while the cohort completed the Recreational Pilot License and Private Pilot License. Daily field notes were taken during lectures, lessons in the aircraft and the simulator and covered the activities undertaken by the students, the tools used, any struggles encountered during the activities, any meaningful communication among them or with the instructors, and any remarks instructors made about the students' progress. The first author, who had no prior flying experience in aircraft or simulator, also took five flight lessons to deeply understand what students go through in the very early stages of flight training and to be able to relate to them. Notes were taken after each lesson about how the first author felt during the lesson and the feedback given by the instructor, which were kept in a reflective journal.

Discourse analysis has been used to analyse the interview transcriptions and notes taken throughout the exchanges amongst students and instructors that the researcher witnessed. This approach is based on the belief that the words chosen to talk about a topic reflect how an individual feels and thinks about it (Willig, 2014). The interview transcripts were read three times focusing on the words participants used to describe their opinion on the use of PCATD. Thematic analysis was used as the approach to determine the resulting themes by searching for common threads the data (Bowen, 2009). Three common themes were found across the data: (i) perceived usefulness of desktop simulators, (ii) encouragement to use simulators and (iii) formation of bad habits (heads down and look in, control force and trim). Each theme will be further developed in the next section.

Results and Discussion

Perceived usefulness of desktop simulators

According to one of the flight school managers, the great advantage of practising flight procedures in the simulator before the flight lessons is that students feel less overwhelmed when they are in the aircraft. It has also been mentioned during the interviews that practising in simulators is especially useful in navigation phase of the Private Pilot License (PPL) training program. The simulator helps students identify visual features that identify the route (e.g. towns, mountains, or roads) so when they are in the aircraft they can easily identify those features. Similar advantages have been reported by Beckman (2009). In a slightly different perspective, the instructors believe simulators are useful once students already know how to fly, so they are aware of the limitations of the simulator and will not have a wrong perception of how the aircraft behaves in flight. From the

flight school management perspective, simulators are also useful for students to practise flight procedures as they strengthen the 'procedural muscle memory', helping them remember how to configure the aircraft on the ground and when flying. The instructors agree and emphasise that desktop simulators can only be used to practise flight procedures instead of learning to fly because the haptic feedback would be needed. This finding corroborates Reweti et al. (2017) conclusion that desktop simulators are especially useful for learning the procedural elements of flying and that they are limited in developing psychomotor skills due to the lack of haptic feedback from the controls.

Encouragement to use desktop simulators

The instructors did not seem assured that simulators are completely beneficial for students. As one of the instructors mentioned, 'I would say it's harmful more often than it's helpful, but when it does work in the right scenario, it really helps.' According to the students, instructors are afraid that PCATDs would give them bad habits and, therefore, the use of PCATDs is not encouraged in the flight school. One of the students stressed: 'at the flight school, they (flight instructors) really hate them [desktop simulators] because they teach you bad habits.' A student reported hearing the same from their peers, particularly if used before starting the training program. Based on the interviews, it seems the perception is that 'bad habits' could be formed if students are not shown the right way to perform an action, procedure, or manoeuvre from the beginning. It is also believed that practice without the presence of an instructor creates the condition to form a bad habit, regardless of how often that behaviour has been repeated or whether making mistakes could lead to learning. One of the students had been practising procedures, landings and en-route navigation on his PCATD at home before starting the training program in the flight school. He believed the simulator had helped him perform well during the flights, since he was familiar with most of the procedures, techniques and visual cues during the flight. The ethnographer mentioned this fact to another instructor, to which he claimed, 'maybe that's why he's quite good at procedures.' Interestingly, it could be implied that when bad habits are formed, they are easily attributed to the simulator and unsupervised training. However, when a student performs especially well at something, it is not easily acknowledged that it could be due to the unsupervised practice in the desktop simulator.

Formation of bad habits

A habit is a behaviour that is repeated automatically, and may take on average 66 days to be formed (Lally et al., 2010). By analogy, a bad habit is an undesirable behaviour that is repeated automatically. Despite the definition, the concept of bad habit is normally employed by instructors and managers regardless how often that behaviour has been repeated. The term has been used mainly to refer to the learning activity that occurs outside the aircraft and without supervision. The instructors are concerned about students misinterpreting what they were being taught when practising in the simulator by themselves without proper supervision. It seems the term 'bad habit' is used to represent a personal judgment based on limited knowledge of what a desktop simulator can contribute to pilot formation and on the assumption that the complex set of skills required to fly an aircraft can be reduced to manually handling and attention allocation. For example, according to one instructor, by practising in the simulator, students tend to focus too much on the inside of the cockpit, instead of outside, which is undesirable. However, according to the CASA's Recreational Pilot License competence-based syllabus (CASA, 2020), a student performing the tenth flight of their flight training program should be competent in 26 different units of skill.

Currently, there is little evidence in the literature regarding students developing bad habits from using PCATDs. Lubner et al. (2017), for example, advocates that practising in the flight simulator without supervision can cause the development of improper flying skills and result in the negative transfer of learning. Nonetheless, the author does not specify exactly what habits and skills are negatively developed. It appears that instructors and managers place too much emphasis on the possibility of students forming bad habits from using desktop simulators rather than on how they can facilitate learning. It seems that when students do not perform correctly at the early stages of the training, they are considered to have bad habits, rather than it being a natural part of learning. There is still a belief that the student must learn the right way at the first time and should carry throughout the learning journey the only right way to act. There is no acknowledge the performance may be good some days and not so much in other days and that making mistakes is part of the learning process.

The fact that instructors are constantly worried about students misinterpreting the lessons and building bad habits if they practise without supervision in simulators appears to reduce the opportunity for the student to practice before the flight. It was observed that students only read the procedures before the flight, without the opportunity to translate the written instructions into actions. Students may also have been somewhat influenced by the instructors' belief that extensive simulator practice leads to negative learning. It was observed that some

students have doubts whether practising in desktop simulators without supervision could help them.

Heads down and look out

The managers believed students should not overly use the simulators to practise because they tend to look down at the instruments too much. One of the managers explained that 'because they have done extensive amounts of simulator, they know how to fly by instruments, (...) but not by visual attitude'. According to another manager, 'one of the downsides of the desktop simulators is that it just bends their neck down and they focus on the procedures. It's a really hard habit to break, to get them to look out.' To break that habit, one of the managers mentioned that 'quite often I do have to cover instruments to get them to see what the aeroplane looks like. So that is where it is a very useful tool, but it's not effective in the right way.' One of the managers believed that when starting training with no prior exposure to simulators, students are the easiest to train because 'they come with no premeditated ideas' and therefore they do not have to 'break that habit'. However, it stands out that during the first author's flight lessons, she was told by the instructor that she had the habit of looking down too much. Interestingly, this happened even though the first author had not had any previous exposure to simulator training or desktop simulators. And the exact same behaviour at the very first flights was reported by other students in the cohort who also have never used desktop simulators before. This evidence could indicate that students tend to look down too much by instinct, or for any other reason, at the early stages of the training, regardless of their experience with desktop simulators. In fact, Dubois et al. (2015) suggest that novice pilots tend to look down too much, overly focusing on reading the gauges and instruments. Attributing this habit to the use of simulators seems not to be based on research evidence but rather on pre-assumptions. It could therefore be implied that simulators might be blamed for creating bad habits as a way of portraying resistance to changes that the technology could bring into flight training.

Controls force

Another bad habit related to simulator training is applying too much force on the controls when the students transition to an aircraft. It has been explained that students can be 'too rough' with the controls in the aircraft because they would fly as if they were flying in the simulator. Nonetheless, the first author was told during her flight lessons that she was being rough on the controls and needed to be gentler with the yoke. It stands out that the first author did not have any practice in desktop simulators either, yet she was told to have that habit too. It could then be implied that students tend to hold the controls too hard at the beginning or for other reasons, regardless of having been practising in simulators.

Another anecdotal evidence came from the instructor's feedback to one of the students who was a military pilot before. The instructor also recognised that the student was being 'too rough' on the control, but instead, he justified the excessive control input as part of the students' learning process to transition from one type of aircraft to another, and not a bad habit. It seems the concept of bad habit depends on contextual factors and not on the action itself; if a habit, on the eyes of the instructor, was acquired in a desktop simulator and not an aircraft, and it is undesirable or not compatible with the expectation, then it is a bad habit.

Trim

Another bad habit linked to simulator training is students not trimming the aircraft to relieve pressure on the control yoke. It has been reported that students do not tend to trim the aircraft because when they practise in the simulator, they do not get feedback from the controls, and therefore, it is harder for them to get used to trimming the aircraft. It has been explained that feeling the resistance from the controls is fundamental for trimming, which students cannot get when practising in the simulator. One of the managers emphasised the importance of getting into the habit of trimming the aircraft by stating 'if you can't trim the plane, you can't fly a plane, the plane is flying you and not the other way around (...), and that's where the [the desktop simulators students have access in the University] can potentially cause some conflict.' Nevertheless, there is no research evidence associating the habit of students not trimming to practice in simulators. The first author realised during her flight lessons that it was not hard to remember to trim as the resistance of the controls could feel excessive at times, and it would not feel comfortable. Moreover, instructors teach students acronyms for the order of procedures they have to perform, which helps them remember to trim.

Conclusion

This study explored the perception by instructors of utilising desktop simulators in a flight school and the encouragement for its use in the early stages of pilot training. Although it has been recognised that the devices are useful for students to practise flight procedures, there seems to be hesitancy towards the technology in flight schools, because of the perception that students will acquire bad habits, particularly if they misinterpret what

they have been taught or practise without supervision. The examples of students' tendency to not trim the aircraft, applying too much force on the controls, looking down at the instruments too much and not looking out of the aircraft are common. As demonstrated though, these bad habits can be associated to the lack of experience of the students and can be part of the learning process.

The negative perceptions about the technology in the flight school could be explained by a hesitancy to accept change in how flight training has been conducted traditionally. Since simulator sessions are generally carried out in a one-on-one format where one instructor is needed per student, the concept of unsupervised practice on a PCATD and instructors not being needed for students to refine the skills could explain the hesitancy towards the technology. Similarly to the proposition of (Lei & Morrow, 2010), in order to overcome this barrier, we need to assist managers flight school managers and instructors to understand the benefits of the new technology and pedagogy, involve them in the decision-making progress so the process and better explain how the bad behaviours could be compensated in a flight lesson. The negative perception associated with desktop simulators could refrain managers, instructors and students from embracing what the technology has to offer, which could ultimately be holding back aviation. Further research is needed to prove whether using desktop simulators leads students to develop bad habits. Future studies could explore the relationship between VR and the development of bad habits during simulation practice. One limitation of this study was the small sample of participants. This may have resulted from the cohort undertaking the training in the context of the COVID-19 global pandemic, and as such more research would be beneficial.

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