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CAN VIDEO GAMES BE VALID PREDICTORS OF SUCCESS FOR THE PRIVATE PILOT PHASE CHECK?

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A study was conducted at a Midwestern university to determine whether or not video game performance can be an accurate predictor of success on the private pilot phase check. In this study, there were thirty-three potential participants enrolled in AT 145, the private pilot flight training course. Twenty-three (70%) students agreed to participate. These volunteer participants were asked to complete a video game (Super Mario Galaxy). The items collected and time to finish a pre-selected level were recorded. These scores were correlated with the aggregated scores that the participants earned during their private pilot phase checks. Although a survey of literature suggested there might be a correlation between video game performance and pilot performance, the results of this study showed no significant correlation.

Collegiate flight training requires certain skills and abilities for students to be successful within the normal timeframe and expense of training. There are two different sets of competencies: motor skills and cognitive skills (Rao, 2005). A motor skill is the ability to make purposeful movements to perform a task. A skilled movement is the result of a combination of force, velocity, accuracy and purposefulness (Kent, 2006). On the other hand, cognitive skills are the mental processes used to think, analyze, and learn. Cognitive skills can be classified into different categories (Cognitive Definition, 2010):

- Processing speed refers to the efficiency the brain processes data.
- Auditory processing refers to skill of processing sounds.
- Visual processing describes the skill of receiving and manipulating visual data.
- Memory can be categorized into short and long term. Both are important parts of the learning process.
- Logic and reasoning are two skills required to compare data. These are particularly important for problem solving and planning.
- Attention skills refer to the ability to stay focused on a task while discarding irrelevant information.

Cognitive skills are important in a number of tasks, including flying, and therefore are vital to the future of a private pilot. However, the path to becoming a private pilot can be costly and time-consuming, especially for the students who might encounter learning plateaus during the training. Although all difficulties cannot be attributed to the lack of cognitive skills, cognitive deficiencies can be a factor. Many collegiate admissions offices currently use high school transcripts and Grade Point Average (GPA) as the main tools for selection of incoming students into flight education programs. Since there may be wide variability between high schools in determining what level of learning outcomes deserve an “A” or “B”. etc., the use of grades solely as a success predictor can be inconsistent. Clearly, it would be extremely useful to have additional metrics for predicting success. These additional selection tools might improve both the quality of admitted aviation professional flight students and increase their success rate.

Background

One aspect of cognitive skill crossovers was investigated by Hambrick, Oswald, Darowski, Rench, and Brou (2009). The authors investigated the determinants of success in a task designed to simulate multi-tasking, common to many occupations. The test subjects were given tests of working memory capacity and processing speed. The researchers were interested in their previous experience with video games. The results of this study uncovered a strong relationship between video game experience and multitasking, showing that multitasking is a trainable skill. The authors also found that individual differences in strategy accounted for a large proportion of the variance in multitasking.

Other aspects of cognitive skills involve visual processing. Green and Bavalier (2003) studied the underlying causes of the enhanced visual processing capabilities of action video game players. They measured the spatial resolution of a subject's visual field using the smallest distance a distractor could appear from a target and still be identified by the subject. The difficulty to differentiate between objects close together is known as crowding. The results suggested that video game players had an increased tolerance to crowding. The research also found that non-video-game players could enhance their visual resolution with training. This study provided a causative relationship between video-game play and augmented spatial resolution. As mentioned in Green and Bavelier (2003), it is possible that by selecting avid game players, the researchers chose a population that would have superior visual skills even without the difference in training.

More recently, hand-eye coordination has been a topic of interest for research focused on the benefits of video games. According to Green and Bavalier (2004), video games improve not only hand-eye coordination, hasten reaction time, and benefit peripheral vision, but also affect visual learning. The ability to infer the three-dimensional structure of an object from a two-dimensional representation is also critical for certain professions such as architects, engineers, pilots, mechanics and many more. These findings demonstrate that video game players can process a rapid stream of visual information with increased efficiency as compared to non-players.

Two years later, Green and Bavalier (2006) also conducted two studies to investigate the relationship between action video gamers and the ability to track multiple objects. Both groups, video game players and non-video game players, had a similar near-perfect performance until the number of objects became too great, at which point both groups' performances dropped drastically. However that critical number for the video game players was higher than for the non-video game players. Green and Bavalier found that the difference was due to an enhancement in the process of counting. A secondary study was set up to confirm that video games help in the processing of multiple objects at one time. Video game players were also able to allocate their attention to more items than non-video game players. The conclusion of the studies was that video game playing enhances the number of objects that can be apprehended due to changes in visual short-term memory skills.

Many studies have identified the cognitive skills acquired by video games, but few have investigated the relationship between video games and flying abilities. A study was

accomplished at the school of the Israeli Air Force to test the transfer of skills from a complex computer game to flight (Gopher, Weil, & Bareket, 1994). Gopher et al. compared training strategies of two groups: one focusing on the specific skills required in performing the game, the other to help cope with the high attention load of the flight task. The two groups received 10 hours of training, while a third group received no training or game experience. The two trained groups scored higher in the following test flights than the untrained group. With large group of participants this study illustrated the benefits of video gaming to improve flight training. However, the results might not be applicable to U.S. civilian or military flight training.

Another way to consider the use of video games is the study of Mautone, Spiker, and Karp (2008). This study focused on improving training via the use of video game technology. A specific game was developed to train pilots on the use of the flight management system (FMS). The test subjects were students from Arizona State University's flight training program. Two groups were randomly set up: half of the subjects were given game-based training (GBT) FMS instruction, while the other half received standard computer-based training (CBT). Access to the training material was automatically recorded in a database. A test was then given to both groups to test the transferability of the training to an actual FMS. The results showed that the GBT group scored higher on the test and retained the knowledge better than the CBT group. An analysis of the training database also indicated that the GBT group accessed the training material more than the CBT group.

Video gaming has many positive outcomes, such as improvements in visual processing, short-term memory skills, quickness of reflexes, eye-hand coordination, counting

process and target identification, and attention-management skills. Some of these previously discussed studies also showed better performance in flight training and check ride ratings for video game players than non-video game players. While some of these advantages might not be useful for some careers, clearly they would be of value to pilots in general aviation, the airlines, or military. All of these studies imply that there is a measurable correlation between video game performance and skills needed for flight. This paper aims to determine the possible impact of video game skills on flight training candidates, as a possible predictor for private pilot training success.

Research Question & Hypothesis

Recently, researchers have studied the relationship between video game performance and cognitive ability. Many agree that gaming can boost a player's cognitive and attention skills (Gagnon, 1985; Green & Bavalier, 2003, 2004, 2006; Triplett, 2008). However, very few studies have looked for a relationship between gaming success and success in early flight training. These earlier investigative efforts, often outdated and sometimes inapplicable to modern video games, served as a catalyst for this research effort. As a result, the research question became: Can video games serve as a valid predictor of success for private pilot flight progress checks?

After developing the research question, it was necessary to choose an appropriate video game for the experiment. In order to find a video game that might mimic the cognitive skills needed for flying, the types of video games were investigated. Video games are usually classified into action, adventure, role playing, arcade, strategy, simulation, driving, and puzzle.

From previous research, action video games stood out as the type of game with the most transferable skills to pilots (Achtman, Green, and Bavelier, 2008). In order to choose an appropriate video game for this study, the video game ratings created by the Entertainment Software Rating Board were consulted. Some action video games are rated Mature or Adults Only. However, to avoid any harm to the subjects, this research used a video game rated E for everyone. According to Nintendo, Super Mario Galaxy is a game rated for everyone with only mild cartoon violence (Super Mario Galaxy Wii, 2010). The game meets the standard of an action video game without the negative aspects of a violent game.

After choosing a video game, the completed research question of this paper became: Is Super Mario Galaxy a valid predictor of success for the private pilot phase check in a university flight program? The null hypothesis of this research is that Mario Galaxy is not a valid predictor of success for the private pilot phase check. The alternative hypothesis is that Mario Galaxy is a valid predictor of success for the private pilot phase check conducted at Purdue University.

Methodology

Participants

Participants for this study included 23 Professional Flight students (2 women and 21 men) enrolled in AT 145 (Private Pilot Flight) at Purdue University during the fall semester 2010. A total of 33 students were enrolled while 23 volunteered. Of the 23 volunteers, three did not complete both parts of the experiment and were not included in the statistical analysis.

Measures

The video game Mario Galaxy was administered using a television set, game console, and a controller. During the video game, players must move the main character "Mario" through a 3D spatial world while defeating foes, collecting coins that will award extra lives, and collecting jewel shards to be used throughout game play. For the purposes of this study, the items collected (coins and shards) and time to complete a specific level of the game were recorded. At the appropriate time, the aggregate score for each participant on the private pilot phase check was also recorded. This flight progress check normally occurred toward the end of the semester and was evaluated by a full-time faculty instructor employed by the university.

Procedures

This experiment was advertised via electronic mail to all the students enrolled in the AT 145 class in the fall 2010 semester. All of the students willing to participate were included in this study. The experiment was organized in two different parts over the entire fall semester.

The first part consisted of completing the video game exercise near the beginning of their fall flight training. The participants were required to finish only one level of the video game. However, prior to data collection, they were allowed one practice session to become familiar with the basic operation of the game. Data was then recorded during the following level.

The second part of the study was accomplished upon completion of the private pilot phase check. When a student met all the requirements to take the private pilot phase check, the instructor recommended him/her for the exam. Purdue University employed eight full-time

flight instructors who were responsible for grading the phase checks. The participating students were divided equally between each phase check instructor. The phase check is graded according to a standardized list of maneuvers and an established grade scale. Once the phase check was completed, the grade was recorded for each participant. If a student failed the phase check, they were required to complete additional training. Afterwards, they could try to pass the phase check during a second try. However, the student only received one grade for the phase check, regardless of the number of tries. The data recorded was statistically analyzed to determine whether or not there was a correlation between a high score on the video game and the phase check score.

Results

The results of this study were analyzed using the tool Statistical Analysis Software (SAS). The data was assumed to be a normal distribution. A QQ plot confirmed this assumption. Another graph confirmed the equal variance assumption. The video game variables (time, coins, and shards) were not found to be correlated to the score of the phase check:

- Time: p-value of 0.1248
- Coin: p-value of 0.4964
- Shard: p-value of 0.1157

The p-values suggested that time to complete the video game level and shards collected might be more correlated to the score received on the phase check than the coin variable. However, a significance level of $\alpha = 0.05$ was used to access the p-value. All the p-values were much larger than the significance level of 0.05. Therefore, the data does not provide sufficient

evidence to conclude that the ability to play Super Mario Galaxy on the Wii -video game system is correlated to the score received during the phase check.

Discussion & Recommendations

At the completion of this study, a better understanding of video games as they relate to the cognitive skills needed for success on the private pilot phase check was acquired. While not statistically significant the p-value of time indicates an ability to correlate the ability to play Mario Galaxy Wii to the success of acquiring flight skills by slightly less than 88%. While this is not high enough to generalize and base future decisions on these facts, it does provide more information than is currently available. The cost of flight training is significantly high and while an inability to play Super Mario Galaxy would not preclude an individual from pursuing his/her hope of flight, it would give a person enough information to re-evaluate their decision to proceed. That being said, there was insufficient evidence to reject the null hypothesis. Had the null hypothesis been rejected, the video game could have been incorporated into the selection process. Additionally, if the video game was not used as a selection tool, it could have been used to identify student cognitive shortcomings in those individuals who might struggle to complete training. This would suggest matching them with more experienced flight instructors or offering them additional training. However, the results were not conclusive enough to make such sweeping recommendations.

Nevertheless, some improvements could be made for future study. The low number of participants (23) made it difficult to obtain significant results. A larger number of participants is recommended for future research. In addition, the low number of female participants (2)

prevented the researcher from examining the differences in scores between males and females. Although it might be a difficult task in a largely male-dominated environment, efforts should be made to increase the number of female participants. The research could be expanded to a larger sample size as well as other flight schools' students in the United States to determine if the results are generalizable to a larger population. Finally, a future study could also consider the correlation between video game performance to other flight courses, such as commercial, instrument, and multi-engine training.

Super Mario Galaxy was chosen for this study. This specific game includes multiple variables to assess performance (time, items collected, etc). This study suggested that shard and time were the only variables that might be correlated, however not significantly. This might indicate that all variables of a video game might not transfer to flight training performance. The choice of other video games should also be considered.

Although a survey of literature suggested there might be a correlation between video game performance and pilot performance, the results of this study showed no significant correlation. Further research, taking the authors' suggestions into consideration, could lead to different results and enhance the body of knowledge in pilot performance prediction.

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