APPENDIX A

TITLE PAGE

IS VIDEO GAME EXPERIENCE RELATED TO PROFICIENCY IN OPERATING OPTOMETRIC DIAGNOSTIC EQUIPMENT?

by

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This paper is submitted in partial fulfillment of the requirements for the degree of

Doctor of Optometry

Ferris State University
Michigan College of Optometry

May 2013

APPENDIX B

APPROVAL PAGE

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Has been approved

May 2013

APPENDIX C

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IS VIDEO GAME EXPERIENCE RELATED TO PROFICIENCY IN OPERATING OPTOMETRIC DIAGNOSTIC EQUIPMENT?

We, Jesse Rossow and Ryan Edwards, hereby release this Paper as described above to Ferris State University with the understanding that it will be accessible to the general public. This release is required under the provisions of the Federal Privacy Act.

3/26/13
Date

APPENDIX D

ABSTRACT

ABSTRACT

Background: This research study explores the link between past video game use and proficiency in operating optometric equipment, specifically the corneal topographer. Since the data collection with modern corneal topographers is much like a video game setup or interface, it is thought that perhaps the hand-eye skills developed during gameplay will transfer to the use of corneal topographers and other optometric instruments like it. *Methods:* Comprehensive surveys regarding video game usage throughout life were given to fifty optometry students of ages 21-26. Data was collected with regards to efficiency in using the corneal topographer based on accuracy and time. *Results:* Students who played video games more than 50 hours in their lifetime were 3.7% faster at performing the task in this study. Many other comparisons were made, such as males vs. females, and can be found in the full report. *Conclusions*: Individuals who spent more time playing video games during their lives were marginally more efficient at using the corneal topographer. It would seem, then, that recruiting optometry students who have spent more time playing video games or using video games for training optometry students would be of little value.

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Background

With each passing day, the world is becoming more technologically advanced. Information is being shared, processed, and transferred at rates faster than ever. As information is passed on so quickly, more is expected of people involved in professions that rely on technology. Students have easier access to information and they are expected to use these resources to gain knowledge and solve problems swiftly. As technology has advanced, so have video gaming consoles. The games are becoming more realistic, more addicting, and demand more coordination. A recent study reported that 135 million people play at least one hour of video games per month, compared to 58 million in 2008.[1] With more people playing video games than ever before, it may be feasible that there is a useful correlation between individuals who play video games and their ability to master operating optometric equipment.

Studies have shown that when a physical movement is learned, a corresponding connection of neural tissue is formed in the brain. As those movements are repeated, the connection formed is reinforced. The thought is that individuals with experience in tracking multimedia games are more visually acute and better at spatial awareness. They're better at hand-eye coordination tasks and skilled at zooming from site to site, along with being more proficient at sorting, sifting, and assessing information.[2,3]

The traditional method of learning has been around for a long time. In optometry school, technical skills are learned by using the actual equipment that is being used in the exam rooms. However, access to this equipment is limited, and finding another person to sit as a patient can often be difficult. Recent studies in relation to surgical skills have shown that video game technology has been beneficial in improving the necessary technical skills for the job without needing practice patients or putting real patients at risk.[4,5] As technology is improved, training also has the ability to improve, as in this example. It is important that the educational system be willing to evolve in order to improve learning. This study explores the possible correlation between past video game experience and efficiency at operating optometric diagnostic equipment.

Many incoming first year optometry students have not had the opportunity to operate some of the critical diagnostic instruments used in optometry. These instruments include slit-lamp biomicroscopes, corneal topographers, optical coherence topographers, and fundus cameras. Because optometrists are required to use the aforementioned instrumentation in the diagnosis and treatment of their patients, optometry students are exposed to the instruments on multiple occasions throughout the curriculum and are required to gain an advanced level of competency with the equipment prior to graduating.

Although many students may have not had the opportunity to operate advanced diagnostic and therapeutic instrumentation before entering into an optometry program, it is very likely that they have had access to video gaming consoles. Because much of the equipment used in optometry requires the use of joysticks, video monitors, and hand-eye coordination, one may assume that there is some benefit to prior exposure to video games. This study explores the idea that incoming optometric students who have video gaming experience may have an edge in learning how to operate certain optometric equipment.

If incoming students who have played a certain number of hours of video games are better able to adapt and learn how to operate optometric equipment, this may provide an alternative method for selecting and training optometry students. If video game play is linked to proficiency in operating optometric equipment, this training could even take place before optometry school. A game or series of games could be developed to help train students before school without having to locate or purchase expensive optometry equipment.

Objectives

This study will attempt to make a connection between individuals who consider themselves "gamers" and their ability to learn how to proficiently operate optometric diagnostic instruments such as a Medmont corneal topographer. If there is indeed a connection, administrators and optometric educators might chose to use previous video game experience as supporting evidence that the candidate would be proficient with equipment that required an advanced level of hand-eye coordination. Additionally, if incoming students are not proficient "gamers", they may be encouraged to expose themselves to playing video games in an attempt to increase those skills. One aspect this study did not consider more specifically is the type of games the subjects played. A specific type or style of game may be more beneficial than others, but this study does not aim to explore that. Remote control designs vary and may also contribute to how beneficial the video games are to becoming proficient at using optometric equipment, but again, this study does not focus on that aspect of research.

Two separate studies have examined a similar relationship in regards to hand-eye coordination and surgery in the medical field. A study by Badurdeen et al revealed a potential positive connection between the Nintendo Wii and basic laparoscopic tasks.[2] A study by Rosser et al showed that subjects who used a video game suturing program called Top Gun committed 33% fewer errors than those who did not use the program. Additionally, volunteers who played three hours a week or more committed even fewer errors than those who used the program for less time.[4] These two studies have shown a very positive correlation between video games and proficiency in surgery, stating that the hand-eye coordination gained by playing video games can be very beneficial in the field. At this time, no previous studies could be found that have explored the relationship between video games and proficiency with optometric instrumentation.

If playing video games can be shown to help students be more efficient at operating diagnostic optometric equipment, perhaps a program or game can be developed to be distributed to incoming students to help them feel more comfortable and learn skills quicker. This comfort and background would provide a higher starting baseline of skill to further build upon. Less time could be allotted learning how obtain information with technical skills and more time could then be spent analyzing data, again speeding up the learning process. It is crucial for students to develop as clinicians who make decisions quickly and accurately, and helping them to get to the decision-making stage faster instead of struggling with the technical aspect of operating the equipment could be greatly beneficial.

Methods

Subjects included first and second-year optometry students who have not had experience with or formal instruction on corneal topography or slit-lamp biomicroscopy. Volunteers were asked to fill out surveys in regards to video game experience. Additionally, they were asked if they had any previous experience using a Medmont topographer. The survey also asked a series of other questions in regards to cumulative hours of video games played, perceived skill level, and gaming systems used for play.

Volunteers were given the same standardized directions as to how to operate the Medmont topographer. They were then asked to acquire a topography reading on the right eye of a single patient with a normal corneal topography and tear film layer. The participant was stopped after attaining three accuracy/quality readings of at least 96 (considered a good quality reading by the authors). This was repeated three times per participant, and the time it took to get the three readings of ≥96 was recorded each time. The single patient was the same throughout the study in order to standardize patient cooperation/difficulty in the results. The actual quality value was documented for every set of readings during the study, but those values are not reported later in the report as they are very similar between subjects and irrelevant for differentiation since all the values were over the selected benchmark.

Data Collection and Analysis

Data from 50 first or second-year optometry students was collected. Three performance times were recorded, as mentioned above in the methods section. The first performance value was discarded and the second two values were averaged to get an overall performance time for each subject that is used in the calculations hereafter. It is thought that the first recorded value includes a slight learning curve to get accustomed to the device, and the first value also involves the most nervousness from the subject – two things we wanted to remove from the study. The data from seven subjects were eliminated based on prior experience with a corneal topographer. Including these values would compromise the data, as the experiment relies on no prior experience with the device (a confounding factor). The values for one other subject were eliminated because her performance time was an outlier and would also skew the results. These discarded values are highlighted gray in Table 7.

A scatter plot was made to visually compare the data of game playing time to performance (Figure1). Subjects with 500 hours or more of video game experience were not included in this graph because these values compromise the ability to appreciate the lower values due to scaling effects. It is interesting to note that three of the four performances of those subjects with more than 500 hours of game playing time were slightly faster than the average of the entire lot of subjects, while the subject with the most video game experience overall was significantly slower than the average time of 23.19 seconds for the entire group.

Performance values were averaged and compared for two groups first – those that played more than or equal to 50 hours of video games in their lifetime (considered a significant amount for the purposes of this study), and those that have played less than 50 hours in their lifetime. Relating cumulative video game playing time to performance is the main focus of the study and is therefore the most important calculation from which conclusions will be drawn. 50 hours was chosen as the cutoff between the groups because it divides the data into two fairly equal groups. Data for each group was then statistically analyzed and compared. The mean values for performance time were calculated for both the groups with under 50 hours of video game experience and those with 50 or more hours of experience. The mean time for the group with <50 hours of video game experience was 23. 63 seconds, with a standard deviation of 10.97 seconds. The mean time for the group with ≥ 50 hours of video game experience was almost a second faster at 22.75 seconds, with a standard deviation of 9.12 seconds. These results and other calculations are shown in the results section and addressed later in the discussion section of this report.

The data was also analyzed from a male/female perspective, and a table was created with regards to gender and performance, independent of video game experience. This was done since many sources claim male superiority in hand-eye coordination and video games both.[6,7] There were many more females involved in the study than males, but this closely represents the current breakdown of female-to-male students who were accepted to optometry schools last year. The usable study data includes 65% females and 35% males. Last year, 64% of students accepted to optometry schools were females and 36% were males.[8]

Current age was not used as a factor in performance as the age range was only 4 years and thus participants were too close in age to derive significant comparison values. The average age of participants in the study was 22.6 years old, with a standard deviation of 1.25 years. A further study with a different design and including a larger spread of ages would be necessary to evaluate the effect of age on performance. While age data was collected to help limit confounding factors for the study, this report will not address the effect of current age because it was not designed to do so.

The age range during which subjects played video games the most was taken into consideration for this study. This was done to evaluate if playing games during a specific time in development had an effect on our study results. The thought is that the amount of hand-eye coordination gained or retained during those years may differ based on brain development or other factors. Few subjects reported playing games most during the 5-10 and 20-current age ranges, so these results are statistically unreliable. The average time for the 10-15 age range (age during which subjects played most) was 24.97 seconds, while the average time for the 15-20 age range was over 5 seconds faster at 19.06 seconds. This suggests that hand-eye coordination may be gained or retained better in the late teens. Further discussion of this will follow later in the report.

Joystick experience was also used to calculate average performance values for the study. It was hypothesized that since the topographer involves the use of a joystick, people with joystick experience would have a higher aptitude at using the topographer because of prior experience with a similar hand control. This seems logical, and the results are shown and evaluated below.

Another perspective by which the data was analyzed is that of personal views. The performance values of those who thought they were good at video games were compared to those that thought they were not good at video games. Confidence is often thought to play a large role in performance, and this evaluation helped us to determine if performance may have been affected by confidence in video games. The average time of the 8 subjects who thought they were good at video games was 23.88 seconds, while the average time of the 34 participants who did not think they were good was 23.03 seconds, slightly faster. This suggests that confidence may not have an impact on performance, or it may even hinder performance at such a task.

The final way in which data was compared involved the gaming system that subjects used most. Due to differences in game-play and interface, one system might be correlated with better scores when compared to others. The top three systems that the subjects indicated they used most were Nintendo/Super Nintendo, PlayStation, and Xbox. The Nintendo/Super Nintendo controllers do not have a joystick, while the PlayStation and Xbox controllers both have two, thumb-driven joysticks (unlike the large joystick used for the topographer). The results are discussed in the next section of this report.

Results

The results of the study, both the surveys (excluding irrelevant data) and the performance times (excluding accuracy values, which were all over 95 per study parameters), are included in table format below. They are discussed in the following section of this report.

Figure 1.

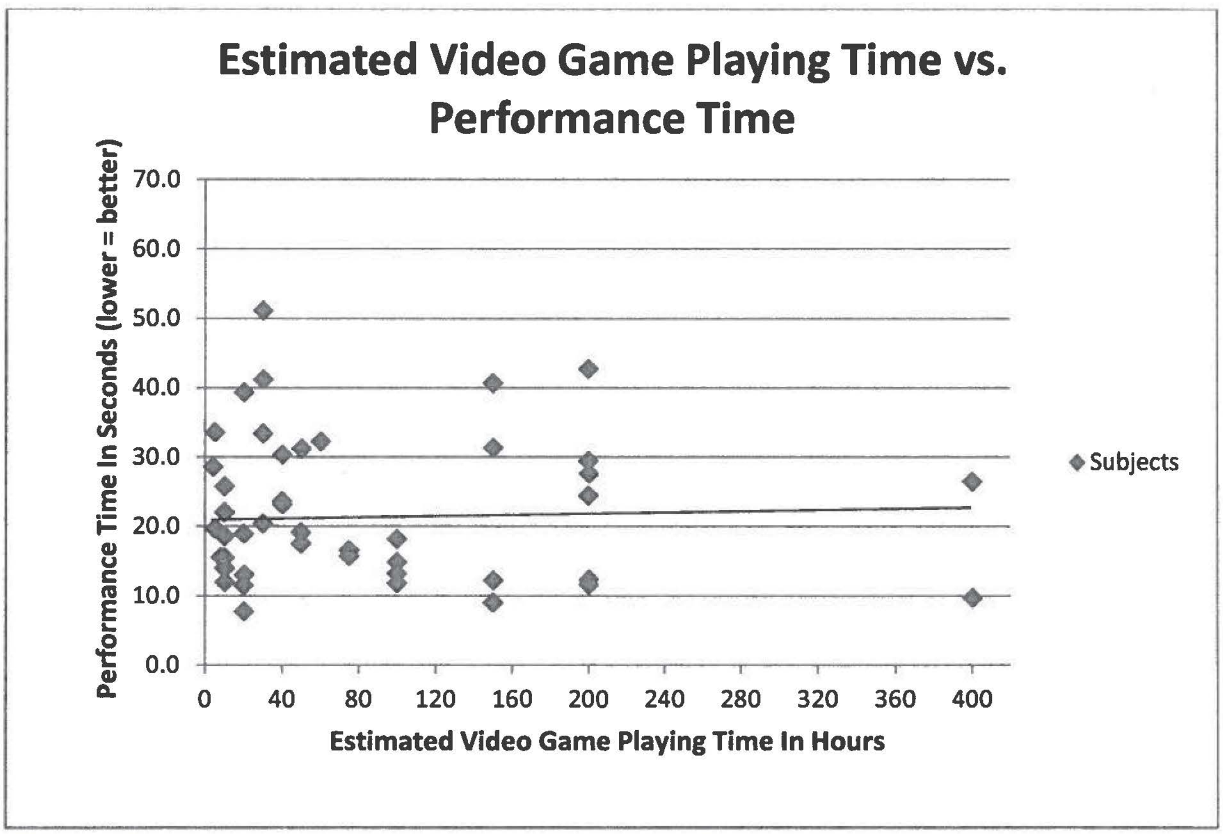

Table 1. More Than or Equal to 50 Hours vs. Less Than 50 Hours

Including previous topographer experience		**Excluding previous topographer experience**		**Std. Dev.**
Mean performance value of those who have played less than 50 hours lifetime	23.56 seconds	Mean performance value of those who have played less than 50 hours lifetime	23.63 seconds	10.97 seconds
Mean performance value of those who have played more than or equal to 50 hours lifetime	21.40 seconds	Mean performance value of those who have played more than or equal to 50 hours lifetime	22.75 seconds	9.12 seconds
9.16% faster for people with more than or equal to 50 hours of video game experience		**3.73%** faster for people with more than or equal to 50 hours of video game experience		

Table 2. Males vs. Females

Comparison Category	Average Performance Time	Subjects Included	Standard Dev.
Females	25.10 seconds	31	10.36 seconds
Males	17.82 seconds	11	6.90 seconds

Table 3. Age Range Played Most

Age Range During Which Played Video Games Most	Average Performance Time	Subjects Included	Standard Dev.
Ages 5-10	21.77 seconds	3	3.37 seconds
Ages 10-15	24.97 seconds	24	10.49 seconds
Ages 15-20	19.06 seconds	12	8.41 seconds
Ages 20-current age	24.95 seconds	4	11.72 seconds

Table 4. Joystick Experience

Comparison Category	Average Performance Time	Subjects Included	Standard Dev.
Joystick Experience	23.27 seconds	23	10.58 seconds
No Joystick Experience	23.10 seconds	19	9.49 seconds

Table 5. Confidence

Comparison Category	Average Performance Time	Subjects Included	Standard Dev.
Consider Self Good	23.88 seconds	8	9.37 seconds
Consider Self Not Good	23.03 seconds	34	10.26 seconds

Table 6. System Played Most

System Played Most	Average Performance Time	Subjects Included	Standard Dev.
Sony PlayStation	27.00 seconds	8	13.36 seconds
Microsoft Xbox	15.93 seconds	6	3.27 seconds
Nintendo System	25.85 seconds	18	7.90 seconds

Table 7. Survey Data Results

Participant	Est. Video Game Time (hrs)	Performance Time (seconds)	Sex	Age	Used A Topographer	Consider Yourself Good	Age Range Most	Joystick Game Exp.
Subject 1	100	13.2	M	26	n	n	10-15	y
Subject 2	40	23.2	F	23	n	n	10-15	n
Subject 3	200	27.6	M	22	n	y	15-20	y
Subject 4	100	14.8	F	21	y	n	10-15	y
Subject 5	20	7.7	F	23	n	n	15-20	n
Subject 6	150	12.2	M	22	n	y	15-20	n
Subject 7	60	32.2	F	22	y	n	10-15	n
Subject 8	10	18.5	F	21	n	n	5-10	n
Subject 9	30	51.1	F	22	n	n	10-15	y
Subject 10	20	13.0	M	26	n	n	10-15	y
Subject 11	30	33.3	F	24	n	n	10-15	n
Subject 12	10000	33.5	M	25	n	y	20-cur	y
Subject 13	200	12.3	F	25	y	n	10-15	y
Subject 14	4000	18.6	M	23	n	y	15-20	y
Subject 15	5000	19.4	M	24	n	y	15-20	y
Subject 16	200	11.6	M	21	y	y	10-15	y
Subject 17	3000	18.8	M	22	n	y	15-20	y
Subject 18	10	25.7	F	21	n	n	10-15	y
Subject 19	50	19.1	F	22	n	n	15-20	y
Subject 20	150	9.0	F	22	y	n	10-15	n
Subject 21	200	29.4	F	22	n	n	10-15	n
Subject 22	300	57.9	F	22	n	y	15-20	y
Subject 23	50	31.2	F	23	n	n	10-15	n
Subject 24	20	39.3	F	23	n	n	20-cur	n
Subject 25	20	11.5	F	22	n	n	20-cur	n
Subject 26	50	17.5	F	22	n	n	10-15	y
Subject 27	40	30.3	F	22	n	n	10-15	n
Subject 28	150	40.6	F	21	n	n	15-20	y
Subject 29	75	16.5	F	23	n	n	10-15	y
Subject 30	4	28.6	F	24	n	n	10-15	y
Subject 31	100	11.8	M	26	n	n	15-20	y
Subject 32	100	18.2	M	22	n	y	15-20	y
Subject 33	400	9.7	M	22	n	n	10-15	y
Subject 34	150	31.3	F	22	n	n	10-15	y
Subject 35	200	42.7	F	22	n	y	10-15	y
Subject 36	30	20.4	F	22	n	n	5-10	n
Subject 37	10	14.0	F	22	n	n	10-15	n
Subject 38	5	19.6	F	21	n	n	10-15	n
Subject 39	10	22.0	F	20	y	n	15-20	n
Subject 40	200	24.4	F	22	n	n	10-15	y
Subject 41	30	41.2	F	22	n	n	10-15	n
Subject 42	8	15.5	F	22	n	n	20-cur	n
Subject 43	10	15.4	F	22	n	n	10-15	n
Subject 44	400	26.4	F	23	n	n	5-10	y
Subject 45	1000	20.1	F	23	y	n	10-15	y
Subject 46	20	18.9	F	22	n	n	10-15	n
Subject 47	75	15.7	F	22	n	n	15-20	y
Subject 48	5	33.6	F	23	n	n	10-15	n
Subject 49	10	11.9	F	23	n	n	10-15	y
Subject 50	40	23.6	F	22	n	n	10-15	n

Table 8. Recorded Performance Results

Participant	Time 1 (sec)	Time 2	Time 3	Total Time	Avg Time	**Avg 2&3**
Subject 5	24.8	8.7	6.7	40.2	13.4	**7.7**
Subject 20	15.6	9.3	8.7	33.6	11.2	**9.0**
Subject 33	22.6	10.9	8.4	41.9	14.0	**9.7**
Subject 25	16.2	14.0	8.9	39.1	13.0	**11.5**
Subject 16	17.8	11.3	11.9	41.0	13.7	**11.6**
Subject 31	7.9	10.8	12.8	31.5	10.5	**11.8**
Subject 49	22.2	13.3	10.5	46.0	15.3	**11.9**
Subject 6	19.4	13.8	10.6	43.8	14.6	**12.2**
Subject 13	16.3	10.1	14.5	40.9	13.6	**12.3**
Subject 10	19.0	12.2	13.8	45.0	15.0	**13.0**
Subject 1	28.0	14.7	11.7	54.4	18.1	**13.2**
Subject 37	16.8	12.1	15.9	44.8	14.9	**14.0**
Subject 4	11.5	16.0	13.6	41.1	13.7	**14.8**
Subject 43	16.3	19.5	11.3	47.1	15.7	**15.4**
Subject 42	29.3	14.4	16.6	60.3	20.1	**15.5**
Subject 47	22.4	15.9	15.5	53.8	17.9	**15.7**
Subject 29	16.2	21.8	11.2	49.2	16.4	**16.5**
Subject 26	7.8	13.1	21.8	42.7	14.2	**17.5**
Subject 32	23.2	19.8	16.6	59.6	19.9	**18.2**
Subject 8	46.7	23.0	14.0	83.7	27.9	**18.5**
Subject 14	13.6	18.6	18.6	50.8	16.9	**18.6**
Subject 17	25.6	21.3	16.2	63.1	21.0	**18.8**
Subject 46	37.0	19.9	17.9	74.8	24.9	**18.9**
Subject 19	36.8	18.9	19.2	74.9	25.0	**19.1**
Subject 15	21.7	14.9	23.8	60.4	20.1	**19.4**
Subject 38	20.4	14.9	24.3	59.6	19.9	**19.6**
Subject 45	40.7	13.3	26.8	80.8	26.9	**20.1**
Subject 36	36.5	27.9	12.9	77.3	25.8	**20.4**
Subject 39	42.1	28.5	15.4	86.0	28.7	**22.0**
Subject 2	59.2	32.5	13.9	105.6	35.2	**23.2**
Subject 50	47.1	15.9	31.2	94.2	31.4	**23.6**
Subject 40	27.8	24.0	24.7	76.5	25.5	**24.4**
Subject 18	41.3	14.9	36.4	92.6	30.9	**25.7**
Subject 44	22.0	30.1	22.6	74.7	24.9	**26.4**
Subject 3	17.0	46.5	8.6	72.1	24.0	**27.6**
Subject 30	46.2	36.3	20.8	103.3	34.4	**28.6**
Subject 21	34.8	26.5	32.2	93.5	31.2	**29.4**
Subject 27	96.1	30.5	30.0	156.6	52.2	**30.3**
Subject 23	74.3	37.4	24.9	136.6	45.5	**31.2**
Subject 34	19.0	30.6	32.0	81.6	27.2	**31.3**
Subject 7	20.3	57.2	7.1	84.6	28.2	**32.2**
Subject 11	70.4	44.5	22.1	137.0	45.7	**33.3**
Subject 12	28.4	39.2	27.7	95.3	31.8	**33.5**
Subject 48	35.7	19.7	47.5	102.9	34.3	**33.6**
Subject 24	35.8	61.2	17.3	114.3	38.1	**39.3**
Subject 28	38.6	38.1	43.1	119.8	39.9	**40.6**
Subject 41	28.0	48.2	34.1	110.3	36.8	**41.2**
Subject 35	101.1	37.7	47.7	186.5	62.2	**42.7**
Subject 9	37.9	54.2	47.9	140.0	46.7	**51.1**
Subject 22	38.3	88.3	27.4	154.0	51.3	**57.9**

Discussion

As a hypothesis for this research, it was thought that prior video game experience may have a positive effect on an optometry student's efficiency at using a corneal topographer or other optometric devices that use a joystick, such as a slit lamp. Since virtually all video games involve the use of a joystick or hand motion at least, it was thought that the skills or hand/eye coordination may translate to the use of joystick-operated optometric equipment. According to the hypothesis, as video game playing time increases, the performance time with the instrument should decrease due to the hand/eye coordination experience. Thus, the dots in the plot of Figure 1 should form a negative slope from left to right. As can be seen in Figure 1 above, this is not the case. A best-fit line demonstrates the overall trend of the data, but as can be seen, the line does not have a significant slope and is almost horizontal, suggesting a minimal relation between prior video game experience and efficiency with the corneal topographer.

After analyzing the collected data, it was evident that previous video game experience had little effect on performance using the corneal topographer. This may be due to one or more of several reasons. First, the topographer is physically different than video games and does not work in the exact same fashion. Second, use of the topographer may have incited some level of anxiety of the part of the subject because it involves a real human that could be potentially injured if performed improperly. Unfortunately, subject anxiety level during the procedure was not assessed. Finally, performance with the topographer might be more closely tied to hand/eye coordination gained from experience with another activity, such as playing sports.

While video games and virtual experience software are becoming more prevalent in society, this study concludes that traditional video games will not effectively prepare optometry students for the use of diagnostic instrumentation, particularly the corneal topographer. However, the authors suggest that a more optometry-specific device may be created to effectively train optometry students prior to exposure to instrumentation. This might be inefficient, though, as developing a device and building or training on it could be less productive and more expensive than just using the actual instrument itself to train as is being done at the present. Earlier exposure to training techniques before school may help certain students to use the equipment more effectively sooner, but due to the steep learning curve, many students will catch up in no time and thus deem prior training worthless (as this study may suggest).

Comparing those who played at least 50 hours (deemed a significant amount for this study) of video games to those who played less than 50 hours in their lifetime showed a 3.73% better time on average for those who played more (refer to Table 1). This value is minimally significant and excludes participants with previous topographer experience, a confounding factor for the study. However, if these subjects are included in the calculations, the group of more experienced video game players performs 9.16% faster than the less experienced group. Six of the seven participants who had previous experience with the topographer were included in the ≥50 hours group, accounting for most of the difference. This difference of almost 5.5% suggests that previous experience with the topographer plays a significant role in operating it in the future. Basically, skills with it are learned and retained, which is why these participants were excluded from the rest of the calculations in the study.

The average time for males versus females was also calculated for evaluation in this report (refer to Table 2). Males performed faster than females by an average of 29%, which is a very significant number. However it must be noted that actual game-playing time was not included in this calculation, and also that there was a much fewer number of males included (11 males to 31 females) than females due to the composition of our subject base. Due to the low number of males, the results may be inaccurate compared to a study involving a more equal number of subjects. However, this subject base does represent the current female-male population base of first-year students in optometry school at this time.[8] This comparison could actually be a function of something else, such as video game playing time, hand-eye coordination gained in sports, emotions (such as not wanting to hurt the patient), or a variety of other factors than just gender. A female had the best overall score, but a female also had the worst overall score.

In comparing the performances based on which age range the subjects played the most, it appears as though those who played most during the 15-20 age range performed considerably better. There were not enough participants that played most during the 5-10 and 20-current age ranges to be significant, but if you look at Table 3 you can see that those subjects that played most during the ages of 15-20 performed on average almost 6 seconds better than the 10-15 age range. Perhaps from this we can assume that hand-eye coordination is improved or retained better during this age range. Of course, this comparison is disregarding the actual amount of playing time in the calculation, so further studies would be needed to prove this is the case.

Joystick experience seems to have no effect on performance with the corneal topographer. In comparing the subjects with joystick video game experience (which one would think may translate to use of a joystick with the corneal topographer) to those without joystick experience, it appears that there is no advantage to having used a joystick previously in regards to proficiency with the topographer. Table 4 shows that participants who had previous experience with a joystick completed the three readings in an average of 23.27 seconds, while those without previous joystick experience averaged 23.10 seconds. These numbers are very similar and suggest a negligible relation.

Personal views or confidence also seem to play a limited role in performance in this case. Participants who thought they were not good at video games actually performed slightly better in the study. Therefore, one could conclude that confidence may even hinder performance, if only by a slight amount. Table 5 shows the data for this comparison.

The top three most-played systems were also compared to see if subjects who used one system more performed better than those who used a different system (Table 6). Nintendo was by far the most-played system in this study. Nintendo (and Super Nintendo) systems do not have a joystick, so this might be a factor to consider in determining why this study might not have shown a more positive correlation between video game playing and good performance with the topographer. People who played Xbox most performed better (an average of at least 9 seconds or 30% faster) using the corneal topographer than those who played PlayStation or Nintendo most. But, once again, this is not taking into account actual game-playing time, which may have more effect on performance than the system used. Further studies would be needed to correlate the Microsoft Xbox system with better results. Also, there were many fewer subjects who used PlayStation and Xbox the most in comparison to those who used Nintendo/Super Nintendo the most.

Some possible shortcomings of the study could be a variety of confounding factors. The surveys were created to be as comprehensive as possible so that we could analyze a variety of perspectives, but due to great subject variability, it is difficult to attribute performance to any one of the variables independently. Other confounding factors to the study might be subject anxiety or inadvertently false reportings on the surveys. The types of games played on the systems (shooting, singing, racing, etc.) might also factor into the results. By setting an accuracy threshold that needed to be attained for recording time performance values in the study, we were not effectively able to compare accuracy of the readings. This was done by design, since the topographer automatically starts recording values when the cornea nears the device. Thus, the user cannot control when he/she wants to record a reading, so comparing the accuracy of the first three values recorded by each participant was out of the question. Comparing the accuracy of readings by participants would have been another way to gauge performance.

Conclusion

According to our research, it would seem that video game training for proficiency in optometric equipment would be of little value. Even if specific programs are developed for the use of students who have chosen optometry as a career, it is hypothesized that these video games would be no substitute for using the actual devices on a real patient. At the very least, they would be much less efficient. Due to the various confounding factors that arose during the study, a more in-depth study may be useful in confirming or refuting the results of this study. According to the results above, the current process of training students seems to be minimally improved by previous video game experience. While surgeons may benefit from playing a significant amount of video games, the field of optometry may just have to wait for some other method of advanced training to be developed.[2,3,4,5]

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