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Learning a Sport through Video Gaming: A Mixed-Methods Experimental Study

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Abstract

This study examined the impact of playing a sport video game on learning the sport as well as how the game may influence future intentions of watching or playing the sport. Utilizing American university students with little prior knowledge of cricket, this study employed a mixed-methods pre/post intervention design with randomized experimental (EG; n = 43) and control (CG; n = 46) groups. Results indicated that cricket knowledge significantly increased for the EG pre-test to post-test ($p < .05$, $\eta^2 = 0.19$; particularly regarding cricket rules, terminology, player positions, and field layout), while the CG did not significantly differ. A significant difference was also found between the EG and CG for interest in playing cricket ($p < .05$, $\eta^2 = 0.9$). Qualitative findings supported that video gaming motivated intentions to watch and play cricket. Sport video games can facilitate increased sport knowledge, sport appreciation, and intentions for future physical activity.

Author Keywords

Xbox; sport video gaming; instructional technology; eSport, Exergaming; cricket

Introduction

The popularity of video gaming within the United States (U.S.) is undeniable. An estimated 155 million Americans play video games with 42% playing three hours or more per week (Entertainment Software Association [ESA], 2015). Annual video and computer game sales reached $15.4 billion in 2013 (Siwek, 2014). Moreover, 80% of all U.S. households own a video game device, 51% own a dedicated game console, and the average gamer is 35 years old (ESA, 2015). Women make up 44% of gamers (ESA, 2015). Additionally, over 40% of U.S. high school students play video or computer games, or use a computer for something other than school work, for three hours or more on an average school day (Kann et al., 2014).

Video Games and Exercise

Much of the empirical sport and exercise-related research investigating video gaming has centered on participants' physical activity (PA) habits and body weight status. For example,

research has indicated that time spent playing sedentary video games is negatively correlated with Moderate-to-Vigorous Physical Activity (MVPA) and positively associated with increased weight status for both college-age males and children generally (Ballard, Gray, Reilly, & Noggle, 2009; Vandewater, Shim, and Caplovitz, 2004). Moreover, screen time (i.e., sedentary gaming, television watching, computer use, etc.) is negatively associated with bone mineral density among adolescent boys (Winther et al., 2015).

Sedentary video gaming is discouraged by many health promotion entities. *Healthy People 2020*, a report issued by the U.S. Department of Health and Human Services (2014), specifically recommends limiting video games to no more than two hours per day within its physical activity objectives for individuals aged two years to twelfth grade. Likewise, the Centers for Disease Control and Prevention (CDC, 2014) recommend that children attain at least 60 minutes of daily physical activity while reducing sedentary video game play.

Motion-based video games (MBVGs)

New research has come to light focusing on MBVGs. MBVGs, also called exergames, are active video games which employ technology where the player utilizes physical movements to play the game (Jenny, Hushman & Hushman, 2013). Software and motion-sensor cameras, flooring, or an infrared sensor are utilized in MBVGs that track human body movements, which are then displayed onscreen through the game's characters (i.e., avatar). Meta-analyses of studies that researched associations between MBVG energy expenditure (EE) and intensity levels compared to resting have found strong correlations between MBVGs and increased EE up to 300% above resting levels (Sween et al., 2014), with positive health outcomes such as "moderate" physical activity levels and increased heart rate, metabolic equivalents (METs) (i.e., burning calories), and VO_2 max (i.e., body's ability to consume and utilize oxygen) when playing MBVGs compared to resting levels (Gao, Chen, Paso & Pope, 2015).

MBVGs are believed to facilitate intrinsic motivation because they provide player control, challenge, curiosity, creativity, constant feedback, and competition (Sheehan & Katz, 2010). Likewise, one experiment found that future intentions to exercise was higher in college students who played a MBVG compared to a generic exercise group and obese participants enjoyed MBVGs more than generic physical activity (Garn, Baker, Beasley, & Salmon, 2012).

Learning through Video Games

In a national survey of kindergarten through eighth grade teachers (n = 694) from across the U. S., 74% reported using video (i.e., digital) games for instruction, with 55% employing these video games weekly (Takeuchi & Vaala, 2014). These teachers also reported that video games help them deliver curriculum content mandated by local (43%) and state/national (41%) standards and assist in assessing students on supplemental (33%) and "core" knowledge (29%).

Moreover, for a decade, scholars have advocated for video game integration into learning environments (Annetta, 2008; Glazer, 2006; Griffiths, 2002; Wagner, 2007). Empirically, video games have been found to increase engagement in class material and result in higher exam scores with high school (Coyle, 2008) and college students (Poli et al., 2012) across varying academic content, as well as enhance cognitive functioning, particularly with older adults (Anguera et al., 2013; Toril, Reales, & Ballesteros, 2014). In addition, a recent report predicts that video games

(and "gamified learning environments") will make a significant impact in the way future K-12 schools approach the core missions of teaching, learning, and creative inquiry due to their potential to "motivate learners to engage with subjects in an emotionally stimulating way" (Johnson, Adams Becker, Estrada & Freeman, 2014, p. 39).

Learning and Motivation through Sport Video Games (SVGs)

Out of 14 groupings, SVGs (13.3%) are the third best-selling video game category behind action (28.2%) and shooter genres (21.7%) (ESA, 2015). For example, Madden NFL 15 was the second best-selling video game of 2014 and four other SVGs (i.e., NBA 2K15, FIFA 15, etc.) reached the top 18 (ESA, 2015). Hayes and Silberman (2007) recommend including SVGs into the physical education curriculum for their potential to increase student motivation, understanding, and performance of the sport. In concert with increasing cognitive knowledge of sport, the Society of Health and Physical Educators' (SHAPE) America (2014) national physical education standard two states that individuals who are physically literate can apply knowledge of concepts, principles, strategies and tactics associated with movement and performance. "Physical literacy programs seek to provide the movement skills and motivation to be active for life" (The Aspen Institute, 2015, p. 2). SVGs may assist students in reaching this standard.

Few studies have investigated learning sports skills through playing video games. In a mixed-methods multi-phase design with two randomized groups, Jenny and Schary (2016) researched the similarities and differences between a rock climbing MBVG (i.e., Xbox One's *Kinect Sports Rivals Rock Climbing*) and authentic wall/rock climbing as perceived by participants with no climbing experience. Results indicated that the MBVG may be useful as a pedagogical tool to teach tactics/strategies and arm movements of authentic wall/rock climbing, but lower body movements and the effort required the play the MBVG were not similar to authentic climbing. In another study which researched the effectiveness of utilizing MBVGs to motivate future physical activity, it was found that the authentic version of the sport (i.e., wall/rock climbing) motivated novice participants to want to pursue future wall/rock climbing more than the MBVG version of the sport (Jenny & Schary, 2015).

Moreover, EA Sports (2009) published a survey-based study where *Madden NFL* (Electronic Arts, Redwood City, CA) video game players and non-playing *Madden NFL* football fans (n = 9,000) were surveyed on their football knowledge through 5 questions in each of the following categories: game situations, general knowledge, history, rules, and business of sport. While this study was non-experimental, the *Madden NFL* video game players scored higher in all five categories and significantly higher in game situations/strategy (19%) and general knowledge (12%) compared to football fans who did not play *Madden NFL*.

Also, in a mixed-methods experiment which investigated whether the sedentary SVG *Madden NFL* can teach someone about American football and to what extent the video game can motivate someone to want to watch or play the sport, it was found that *Madden NFL* increased overall American football knowledge (e.g. regarding field layout, player positions, etc.) and assisted intentions to want to watch and play the authentic version of the sport (Jenny & Schary, 2014). Participants in this study were international college students with little prior knowledge of American football. The authors concluded that "replicating this study utilizing other SVGs may also be worthwhile" (Jenny & Schary, 2014, p. 85). However, beyond the Jenny and Schary

(2014) study, no additional studies could be found which empirically researched learning through playing SVGs. Thus, replicating this study where North Americans attempt to learn a sport unfamiliar to them (i.e., cricket) via video gaming appeared worthwhile.

Cricket

While it has similarities to baseball, "few North Americans play [cricket] or even understand its complex rules" (Petersen, 1998, p. 86). Dating back to the late 1700s, cricket is a worldwide immensely popular warm-weather striking and fielding sport. In 1883 the first official U.S. cricket club was created at Haverford College, outside Philadelphia, but the sport has never gained wide-spread popularity in America compared to many other countries (Hanlon, 2009). As Wilson (2013) put it, "to the uninitiated, cricket can appear an incomprehensible spectacle acted out by eccentrics in long pants" (p. 136). Nonetheless, cricket is one of the most popular sports in the world, which garnered over 1.56 billion viewers of the 2015 ICC Cricket World Cup (PricewaterhouseCoopers Australia, 2015).

Globally, 105 countries are members of the sports' governing body – the International Cricket Council (ICC, 2016). The top-ranked countries which play cricket with "full" ICC membership are Australia, Bangladesh, England, India, New Zealand, Pakistan, South Africa, Sri Lanka, West Indies, and Zimbabwe (ICC, 2016; Wilson, 2013). In India, where the sport is a national obsession (Petersen, 1998), television audiences can reach 400 million viewers for some of the biggest cricket matches, which is nearly 40% of the country's population (Wilson, 2013).

Study Purpose and Significance

The purpose of this study was to determine to what extent playing a sport video game can teach rules, terminology, player positions, field layout, and umpire signals to those who are not familiar with the sport. In addition, this study also investigated whether playing a sport video game can influence someone's intention to watch or play the sport. The research questions (RQ) which guided this study included:

RQ1

To what extent can playing the video game *Don Bradman Cricket* assist someone in learning about cricket?

RQ2

Does playing the video game *Don Bradman Cricket* motivate someone's intention to watch and/or play cricket?

This study is significant because it has the potential to elucidate whether playing SVGs can increase sport content knowledge, which could influence sport appreciation and/or physical activity through motivating physically playing the sport.

Methodology

Design and Participants

Prior to the start of the study, Institutional Review Board approval was granted and participant consent was attained. Participants included a criterion-based convenience sample of 89

undergraduate and graduate students (47 females; M_{age} = 21.47, SD_{age} = 3.19) aged 18 years or older enrolled at a liberal arts university located in the southeastern region of the U.S. As seen in Table 1 below, Caucasians (n = 56) and African Americans (n = 30) made up the majority of the sample (96.63%). Modelled after Jenny and Schary's (2014) methodology, the study used a mixed-methods pre/post intervention design with randomized experimental (EG; n = 43, M_{age} = 21.21, SD_{age} = 2.10) and control (CG; n = 46, M_{age} = 21.07, SD_{age} = 3.92) groups. The groups were slightly uneven due to participant dropout during the study. Prior to the study, 52% of the participants (EG = 29, CG = 18) either liked or really liked playing video games, playing an average of 8.01 hours per week (EG = 10.05 hours, CG = 6.72 hours). Moreover, prior to the study, a strong majority of participants had never physically played cricket (n = 86, 96.63%) or had ever watched cricket (n = 73, 82.02%).

Table 1: Participant Demographics

Variable	Experimental	Control	Total
Gender			
Male	24	18	42
Female	19	28	47
Age (*SD*)	21.21 (2.10)	21.07 (3.92)	21.47 (3.19)
Race/Ethnicity			
African American	16	14	30
Asian/Pacific Islander	0	1	1
Caucasian	24	32	56
Other	2	0	2
Type of Student			
Undergraduate	40	42	82
Graduate	1	5	6
Other	1	0	1
Interest in Playing Video Games (prior to study)			
Strongly Dislike	2	7	9
Dislike	4	6	10
Neutral	7	16	23
Like	16	9	25
Really Like	13	9	22
Avg. Hours/Wk Playing Video Games (*SD*)	10.05 (8.33)	6.19 (6.72)	8.01 (7.72)
Played any Xbox Gaming System Before			
Yes	37	32	69
No	5	15	20
Avg. Hours/Wk Playing Xbox (*SD*)	7.38 (7.05)	3.64 (3.90)	5.40 (5.89)
Played any PlayStation Gaming System Before			
Yes	38	38	76
No	4	9	13
Avg. Hours/Wk Playing PlayStation (*SD*)	4.83 (4.36)	3.40 (3.07)	4.08 (3.78)
Watched Cricket Before			
Yes	4	12	16
No	38	35	73

Physically Played Cricket Before			
Yes	0	3	3
No	42	44	86

Instruments

Questionnaire

Demographics such as gender, age, race, and type of student were first collected via a questionnaire (see *Table 1*). In addition, participants were asked their prior experience and interest in playing video games, as well as, their prior experience with cricket, including their perceived knowledge and intention to watch or play cricket. Intention to watch or play cricket questions were modelled from Jenny and Schary (2014) and the "Intention to be Physically Active" scale (Hein, Müür & Koka, 2004).

Cricket Pre/Post-test

Human Kinetics' *The Sport Rules Book* (Hanlon, 2009) was used to amass 50 cricket knowledge questions regarding the rules, terminology, player positions, field layout, and umpire signals of the sport – 10 per category. To ensure content validity, the survey was then reviewed and tested by a former Australian junior elite cricket player (a content matter expert). Each multiple-choice question had four possible options with only one correct answer.

The survey was distributed online via Qualtrics software (Qualtrics, Provo, UT). Sample questions included: "How many players per side?" (rules); "What is a 'hat trick'?" (terminology); "A cricket field is shaped like a ___?" (field layout); and "A ___ fielder's job is to field any balls hit deep behind the batter?" (player position). Lastly, all umpire signal questions included an image of a cricket umpire with the following question: "What is the umpire call based on the picture below?"

Equipment

Cricket Video Game

Don Bradman Cricket 14 (Big Ant Studios, Melbourne, Victoria, Australia), a cricket video game employing the T20 (20 overs) form of cricket, was utilized in this study. This sedentary SVG is played with a handheld controller. Sophisticated offensive and defensive play options as well as high quality graphics allow for realistic looking batting, bowling, and fielding game features. Additionally, voice commentary critiques concurrent game action, permitting players to hear the game being commented on as if it were a live television broadcast.

Video Game Consoles

One PlayStation 4 (PS4; Sony Interactive Media, San Mateo, CA) and three Xbox One (Microsoft, Redmond, WA) consoles were utilized to play the *Don Bradman Cricket 14* video game in this study. The video game is identical on each console.

Procedures

All participants first completed the demographics questionnaire and cricket pre-test. Participants were then randomly assigned to either the EG or CG. The CG did not perform any video gaming.

Those in the EG completed four one-hour video gaming sessions (twice a week for two weeks), playing *Don Bradman Cricket 14* on either the Xbox One or PS4 gaming console against one other participant. The first session started with each participant completing the bowling, batting, and fielding tutorials within the game. This was recommended by Jenny and Schary (2014) in an effort to more quickly familiarize the participants with the game's controller buttons so that more attention can be paid to learning the sport. Head-to-head game play then commenced. The remaining three sessions only included game play. An entire cricket match was never completed as this would take three to five hours. Participants played on the same gaming console throughout the study in order to reduce any confusion as the controller buttons are slightly different between the Xbox One and PS4 devices.

After completion of the two weeks of gaming, all participants (EG and CG) were given the exact same assessment (i.e. cricket post-test) in order to determine any changes. Finally, two one-hour focus group sessions (n = 5; n = 12) transpired with EG participants utilizing a semi-structured interview schedule which achieved an adequate level of saturation (Berg, 2009). Questions centered on the gaming experiences, what they did or did not learn about cricket (i.e., regarding rules, terminology, field layout, umpire signals, and player positions), and their future intentions to watch or play cricket. The semi-standardized format allowed the researchers to delve deeper into the experiences of the participants (Berg, 2009). Qualitative data within the focus groups were collected using an Olympus digital voice recorder model VN-8100PC (Olympus Imaging America Inc., Center Valley, PA).

Data Analysis

Quantitative Analysis

Sample characteristics were computed using descriptive statistics analysis. Repeated measure of ANOVA statistics were used to compare pre/post scores for both the EG and CG. According to Keselman et al. (1998), this method is widely used by behavioral researchers when assessing treatment effects. Because of the nature of the current study which utilized 2 (EG vs. CG) X 2 (pre vs. post video gaming session), interaction effect was mainly examined. Objective cricket knowledge comparisons were based on the number of correct answers on the pre/post-tests. Significance was set at $p < .05$. Effect sizes were also examined and reported with Eta squared (η^2). Eta squared has been considered the most commonly reported effect size for ANOVA (Levine & Hullett, 2002); values of .01, .06, and .14 are considered small, medium, and large, respectively (Cohen, 1988). According to Fritz, Morris, and Richler (2012), examining and reporting effect sizes are useful as it determines practical and theoretical importance of an effect along with power of analysis. In addition, it provides more general interpretation of quantitative analysis results and moves away from simple identification of statistical significance (Fritz et al., 2012).

Qualitative Analysis

Using a grounded theory framework (Charmaz, 2011), a multi-step iterative coding process recommended by Harry, Sturges, and Klinger (2005) was utilized for this research. First, the transcribed focus group data were analyzed using ATLAS.ti (Scientific Software Development, Gmbh, Germany) computer software in order to organize and synthesize the data. Next, the coding process began through providing individual codes across the qualitative data. An open

coding process was then used, which resulted in the collaborative development of several common themes within the interviews. Next, internal member checks were employed where the remaining members of the research team randomly selected portions of the two transcripts and developed their own variation of the codes (Berg, 2009). The group then met to determine if the codes were an accurate representation of the information gathered. Once codes were universally agreed upon, further categorization processes were conducted. This led to the final step of the process where code families (i.e. categories) were created – connecting the data to the research questions in a more concise manner.

Results

Quantitative Results

RQ1

Table 2 shows the extent to which *Don Bradman Cricket 14* can assist someone in learning about the sport of cricket. Objective knowledge of cricket for the EG significantly increased ($F(1, 87) = 20.66$, $p < .05$, $\eta^2 = 0.19$) from pre-test ($M = 16.02$, $SD = 4.65$) to post-test ($M = 24.55$, $SD = 5.74$) while the CG did not significantly differ from pre-test to post-test. Overall, the EG scored a 32.0% on the pre-test and 49.1% on the post-test, while the CG scored a 32.7% on the pre-test and a 33.3% on the post-test. When sub-categories were analyzed, four of the five sub-categories showed significant difference between pre-test and post-test. The EG's knowledge significantly increased on cricket rules ($F(1, 87) = 25.48$, $p < .05$, $\eta^2 = 0.23$); terminology ($F(1, 87) = 6.98$, $p < .05$, $\eta^2 = 0.07$); player positions ($F(1, 87) = 7.40$, $p < .05$, $\eta^2 = 0.08$); and field layout ($F(1, 87) = 8.83$, $p < .05$, $\eta^2 = 0.08$). The EG's and CG's knowledge on cricket umpire signals did not significantly differ from pre-test to post-test. However, there was an increase amongst the EG scores from pre-test ($M = 4.45$, $SD = 1.35$) to post-test ($M = 5.76$, $SD = 1.62$) in this area.

Table 2: Effects of Video Gaming on Objective Knowledge, Subjective Knowledge, and Intention to Watch and Play Cricket

Experimental Conditions	**EG Pre-Test Mean**	**EG Post-Test Mean**	**CG Pre-Test Mean**	**CG Post-Test Mean**	**η^2**	**Sig.**
Objective Knowledge						
Rules	2.13	4.98	2.35	2.41	.23	.00*
Terminology	3.27	4.64	3.16	3.10	.07	.00*
Positions	3.76	5.24	3.65	3.47	.08	.01*
Field Layout	2.29	3.96	2.33	2.76	.08	.01*
Umpire Signals	4.41	5.63	4.77	4.62	.02	.19
Subjective Knowledge						
Understanding Rules	1.33	2.90	1.38	1.64	.15	.00*
Understanding Strategies	1.29	3.19	1.43	1.62	.21	.00*
Understanding Physical Skills	1.67	3.62	1.96	2.04	.10	.00*
Understand Watching Games	1.55	3.02	1.70	1.79	.09	.01*
Intention to Watch and/or Play Cricket						
Interest in Watching on TV	2.64	2.81	2.57	2.34	.02	.19

Interest in Watching live	2.93	2.95	2.68	2.60	.02	.17
Interest in Playing	3.05	3.10	2.47	2.38	.09	.01*
Often Play Cricket	1.38	1.31	1.30	1.38	.00	.97

*indicated $p < .05$.

Furthermore, the EG's subjective knowledge of cricket significantly increased ($F(1, 87) = 16.06$, $p < .05$, $\eta^2 = 0.16$) from pre-test ($M = 5.83$, $SD = 2.84$) to post-test ($M = 12.74$, $SD = 3.45$) while the CG did not significantly differ from pre-test to post-test in this area. Both objective and subjective knowledge results indicate large η^2. Amongst objective knowledge sub-categories, knowledge on cricket rules had the highest η^2.

RQ2

Intention to watch or play cricket were also analyzed during the pre- and post-test for both groups. Both the EG and CG did not significantly differ from pre-test to post-test. However, as seen in *Table 2*, when comparing the EG and CG, there was a significant difference found for the interest in physically playing cricket sub-category, while no significant difference was found pre to post regarding intention to watch cricket live or on television.

Qualitative Results

Qualitative analysis revealed 17 individual codes. *Figure 1* below represents how these codes and their corresponding families were organized as they related to a broader understanding of the information gathered in this study. The four main code families included: (a) barriers to learning cricket through gaming; (b) learning through gaming; (c) benefits gained from the cricket gaming experiences; and (d) cultural comparisons elicited from the cricket video gaming. The definitions of the codes, as well as their structure and hierarchy assisted with the analysis process and provided a clear connection to the overall themes of this study outline by the research questions. The primary codes related to the RQs will be examined in the discussion section below.

Discussion

RQ1

The first purpose of this study was to determine to what extent playing the sport video game *Don Bradman Cricket* can assist someone in learning about the sport who has little prior knowledge of cricket. Compared to the CG, the EG significantly increased their objective (i.e. pre/post test scores) and subjective knowledge of cricket as a result of the video gaming experience. More specifically, compared to the CG, the EG significantly increased their scores pre to post relating to cricket rules, terminology, player positions, and field layout. These findings correspond to the aforementioned non-experimental survey-based report where *Madden NFL* video game players reportedly scored significantly higher in game situations/strategy (19%) and general knowledge (12%) compared to football fans who did not play *Madden NFL* (EA Sports, 2009). Moreover, the present study's findings mirror Jenny and Schary's (2014) results where international college students ($n = 40$) with little prior knowledge of American football scored significantly higher pre to post on an American football knowledge test after performing eight 30 minute *Madden NFL* video gaming sessions compared to a CG of other international college students. EG scores increased the most in questions relating to field layout and player positions.

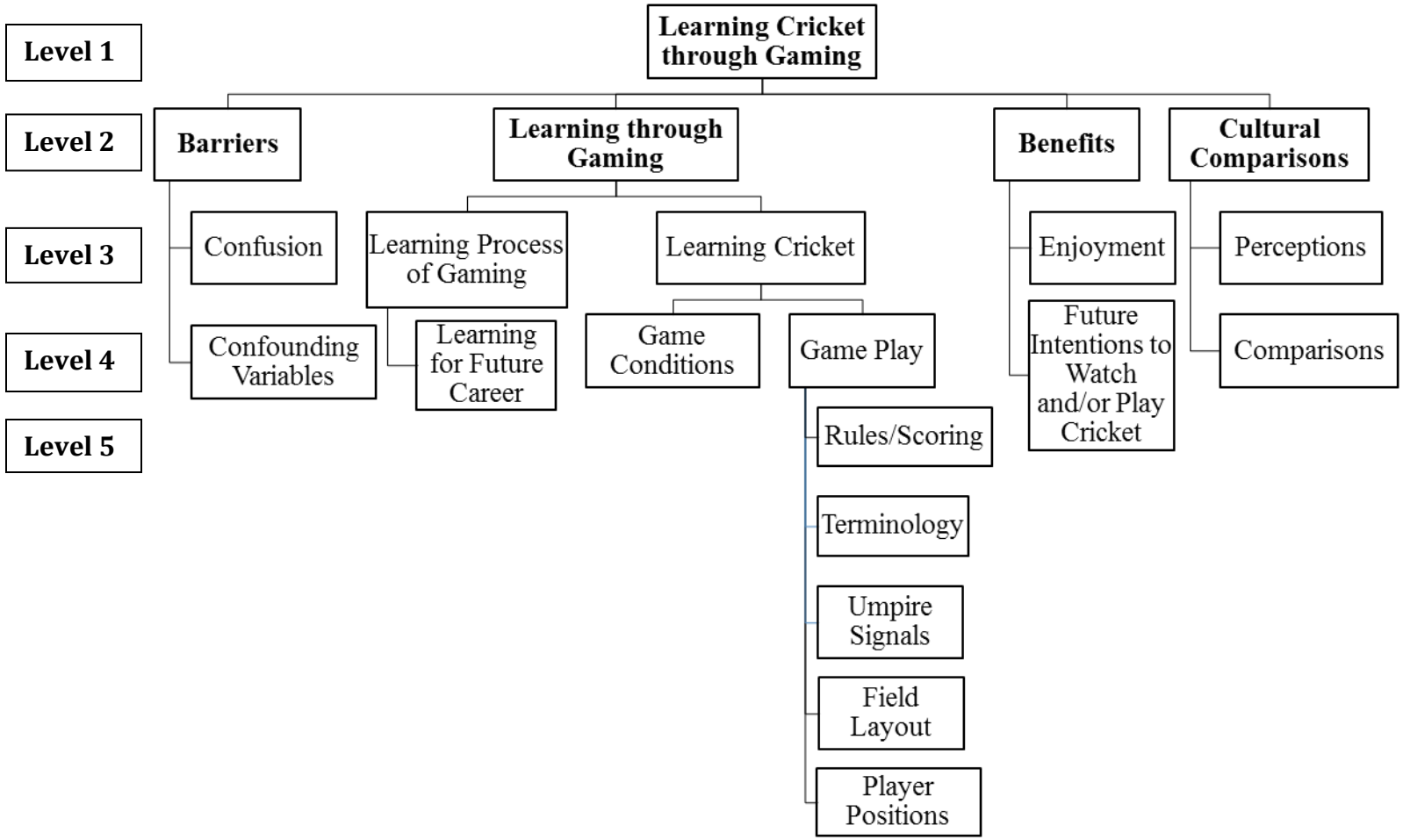

Figure 1: The above figure represents how the families at level two (and their associated codes, at levels three, four, and five) are linked to the overall concept presented in the study (level one).

Regarding the present study's focus group data, qualitative analysis revealed some confusion related to learning cricket throughout the study, however, many other comments were correlated with how much cricket knowledge was garnered through the gaming. Overall, based on the code count, participants discussed their learned knowledge of cricket more often than they discussed their confusion. The three families seen in the below *Figure 1* (level 2) which associated most to RQ1 included "learning through gaming," "cultural comparisons," and "barriers."

Learning Through Gaming

Many participants mentioned that they had fun playing the video game and learned about cricket through the gaming process. For example, one participant noted:

> I think it was really fun. I honestly had no clue what was going on the first few times I played. And it didn't help that I wasn't good at video games either. So that was kind of stressful in a way. But I did find out a lot more when I did the post-test. I could tell that I had learned a lot from the video game. So I do think it did help.

Other sample participant quotes which related to the participants' gained cricket knowledge from the gaming experience relating to the five categories of questions included:

- "I didn't know they carried the bat…when they ran the bases [i.e., wickets]." (rules)
- "I found out that there's such a thing as a super over. That's like their version of overtime." (terminology)
- "I used to think the cricket field was square. When I saw it was circular or oval, I was like wow." (field layout)
- "The wicket keeper, batter, and bowler… Those were the only three that [the video game commentators] really talked about." (player positions)
- "I learned the boundary four, six, and wide because those are things that constantly happened to me during the game either for me or against me." (umpire signals)

While more research is needed in this area, coaches and physical educators who employ the Teaching Games for Understanding (TGfU,) approach (i.e. Tactical Games Approach, Game Sense) might consider utilizing SVGs within instruction. The TGfU curricular model was created after Bunker and Thorpe (1982) observed that teaching sport skills in isolation (i.e. drill practice) often demotivated learners and many students could not make correct strategic decisions during game play. In this model, the cognitive learning domain is stressed through an emphasis on tactical transfer of strategies used across similar sports as tactical problems are solved by the learners (i.e. on-the-ball skills, off-the-ball movements, etc.) (Mitchell, Oslin & Griffin, 2013). For example, in striking and fielding games like cricket or baseball, offensive game concepts (e.g. strategic ball placement) and defensive strategies (e.g. adjusting positions as plays unfold) might be easier to view and understand via video gaming. Because the "player" is not forced to physically perform the skills while gaming, the SVGs might assist in greater learning of sport tactics and strategic decision-making. Memmert et al. (2015) have called for more research relating to the TGfU model and how state-of-the-art technology such as SVGs might be used to foster game understanding, tactical decision-making, and game-playing ability. More research is warranted in this area.

In Jenny and Schary's (2014) study which utilized the American football video game *Madden NFL*, statistically significant improvements pre to post-test for the EG were limited to the field layout and player positions sub-categories. In the present study, all sub-categories except umpire signals were statistically significant pre to post-test, but the EG did improve their scores pre to post in this category. The participants noted that "wide" and "dead ball" appeared to be the most common umpire calls within the game as they seemed to occur most often. As 10 different umpire signals questions were asked, it is possible that more gaming time was needed for the participants to be exposed to this many of different umpire signals. For example, while "wide" was a commonly seen umpire call in the game, a "leg-bye" was not. Thus, more time playing the video game may have provided the participants an opportunity to come across this play (and its corresponding umpire signal). More research is needed in this area.

Barriers to Learning

Throughout the focus group sessions, several barriers were mentioned which appeared to cause confusion and impact the ability of the participants in learning cricket through video game play. First, past research has noted that getting to know the video game and corresponding handheld controller buttons may act as an initial barrier to learning (Jenny & Schary, 2014). This may be particularly impactful for individuals with little past video gaming experience (particularly with the utilized gaming system) as the cognitive load of focussing on where the controller buttons are located initially take precedence over learning the intricacies of the game being played.

In Jenny and Schary's (2014) study involving playing the American football video game *Madden NFL*, the majority of participants felt they knew the controller buttons within one to two hours of game play. However, the participants were not shown the game's tutorial prior to starting unlike the current study. A participant in the current study stated: "honestly, after the tutorial, it really helped me, and then I understood at least most of the controls." However, the focus group data revealed consistency with Jenny and Schary's (2014) study that most participants felt comfortable with the controller button functions within the game after one to two hours of game play. The tutorial may have expedited this process, but this variable was not quantified. It is suspected that individuals with prior video gaming experience utilizing the same controller learn the controller buttons quicker than those who do not, but more evidence is needed to validate this claim. Future studies may attempt to quantify differences in video game learning between participants who do and do not receive the game's tutorial at the beginning of game play.

Another common barrier cited to learning cricket through gaming was the inability to always hear the in-game commentator feedback audio. The experimental environment of this study involved the participants gaming with a television and gaming system set up in each of the four corners of a large university classroom. It is standard practice for gaming labs to have gaming stations in close proximity to each other in order to increase the number of participants able to play at one time (Wilson, Darden & Meyler, 2010). However, one participant stated: "Since there were four TV screens at the same time it was difficult to hear the narrating of the game." This mirrors Jenny & Schary's (2014) findings where participants had trouble hearing in-game voice commentary of *Madden NFL* while playing in a university student union. To counteract this barrier, another participant suggested: "Make it so they have to wear a headset so they can only hear their TV so they could hear the terminology and rules better." However, for example, the Xbox One Chat Headset (Microsoft, Redmond, WA), which comes with the Xbox One gaming

system, primarily supports online gaming and only transfers audio spoken by the gamers to each other. In other words, the audio from the game itself is not broadcasted to the headset – the speakers on the television are utilized for game audio. Thus, practitioners working in similar environments might use "stereo" headsets with microphones which broadcasts player-to-player discussion as well as game audio. However, interaction with individuals watching (i.e. not playing) without headsets would be limited.

Some of the game's characteristics appeared to cause confusion which was another barrier to cricket learning: "I kind of got confused when they caught the ball, and they just threw it up in the air. I mean, I understand they got [an out] for that, but I don't understand why they threw it up every time." This sample participant quote was directed at the video game players displaying joy after catching a fly ball and getting an out. Frequently in cricket, fielding players throw the ball in the air after catching it because they are happy to get an out. However, this is not required and caused confusion for participants who were unfamiliar with this common cricket tradition.

Additionally, regarding learning cricket rules, a participant commented: "I think I learned everything, except for I didn't know how many players per side because it didn't ever show all the players at one time." Because a cricket field is very large, the default view of game action is zoomed in on the area surrounding the ball. This narrow view of game action did not easily permit participants in determining how many players play at one time. Conversely, Jenny and Schary's (2016) study found that the default wide-angle view within *Kinect Sports Rival's Rock Climbing* assisted participants in being able to recognize climbing routes and view proper climbing body positioning as opposed to the constricted view of the wall during "real life" climbing. Practitioners utilizing SVGs may consider having players view various game angles during game play which may enhance learning of various sport characteristics.

Finally, one of the most commonly cited areas of confusion during the focus group sessions was still a lack of understanding of cricket scoring. For example, one participant summarized her overall gaming experience by stating: "I learned a lot but I still don't understand the point system." This lack of scoring understanding was most likely due to the game not labelling "overs" or "runs" with the on-screen text. Within the game, these numbers are merely displayed with a slash separating them. Thus, clearly instructing the scoring system of cricket must be a priority for those teaching the sport to beginners as it appears to be a more difficult concept to grasp.

Cultural Comparisons

Participants appeared to glean knowledge of cultural similarities through the game. For example, one participant mentioned:

> They have their fan bases just like we have our fan bases here. And I never really thought about it. I was like yeah, cricket is a sport, but it's actually huge. I already knew it was huge in India and whatnot. But Australia has an insanely good team, and pretty much any of the Indian teams are good and stuff like that. Even looking in the crowd during the game, you could see how big the crowd was depending on what home team you were.

Other research has found participants may develop feelings of connectedness to a foreign culture through learning more about a sport ingrained within that country's society (i.e. American football within the U.S.; Jenny & Schary, 2014). However, in the current study, no evidence surfaced that these American participants felt additional connectedness to cultures where cricket is most popular.

Regarding cultural comparisons, many participants discussed the learning of cricket through comparing it to "America's pastime" – baseball. Representative participant quotes included:

- "I just thought [cricket] was like baseball. So I went into it imagining the rules were similar, and they were nothing alike."
- "I thought [cricket] was like baseball as well. There are a lot of differences, of course. But there were some similarities like with the ball going out of bounds and then getting the four points [in cricket]. And that reminded me of the four bases in baseball."
- "I thought there was an actual base that you ran to instead of the line that you had to cross over [to score runs in cricket]."
- "That's one area that baseball and cricket could really be applied to each other…The pitching match ups… where you have the righty/lefty match ups and whether or not you want to bring in the specialty pitcher to come in and get that [batter] out. And then also…the open field. In baseball, you always want to hit into the open spaces. And there are [defensive] shifts you can put on…because you've done your scouting, and you see that they hit it this way, so [the defense shifts] that way. But you want to hit it to the open field [in both sports]."

Baseball, also a striking and fielding sport, is probably the closest sport to cricket common within American culture. Even after the gaming experience, participants often related their cricket learning in baseball terms. Learning through comparisons was cited by several participants as being important to their understanding. One participant recommended this as a teaching strategy: "Relating [cricket] to sports that people in the U.S. are familiar with like baseball [assists in learning]. And like…the [term] 'turkey' in bowling [is] like…'duck' [in cricket]."

Overall, participants seemed to gather an understanding of cricket as the sessions progressed. Although participants did have some questions throughout the focus groups in terms of fact checking what they knew with the researchers, the analysis of the transcripts suggested that knowledge about the terms, rules, and game play of cricket were salient, as those codes appeared 12 times throughout the discussions. Although cricket was a new game for many of the participants, playing the video game did add to their collective comprehension of the game.

It is important to note that learning one sport via video gaming does not necessarily mean learning all other sports through video gaming is possible. Sport-specific cognitive and motor pattern schemas which are mirrored in the video game may facilitate learning the sport, but if different may detract from learning. In addition, if the main movement patterns in a sport are identified, and are deemed similar to other sports (i.e., cricket to baseball), video games might aim to develop these sport-specific fundamental movement skills which may lead to positive learning transfer across similar sports.

RQ2

The second purpose of this study was to investigate whether playing *Don Bradman Cricket* motivated someone to want to watch or play cricket. Both the EG and CG did not significantly differ from pre-test to post-test regarding intentions of watching cricket on television or live, or interest in physically playing cricket. However, a significant difference was found regarding interest in physically playing cricket when comparing the EG and CG (p = .01, η^2 = .09). Correspondingly, an experiment determining the effects of playing *Madden NFL* by international students with little prior American football knowledge found that "the EG scored significantly higher than the CG regarding their interest in watching American football on television and interest in playing American football, attributable to playing *Madden NFL*" (Jenny & Schary, 2014, p. 82).

Nonetheless, regarding the current study, there is not enough evidence to confidently say the video gaming caused a practically significant increase in interest in physically playing cricket. Although the comparison is statistically significant and the CG's interest went down, the effect size was small (η^2 = 0.09). The study's sample size (n = 89) and/or the amount of video game play (four hours) may be preventing an adequate analysis of the video game's true ability to motivate someone to want to play or watch cricket. Thus, future research with a larger sample size or extended amount of video gaming is warranted.

In addition, however, some of the qualitative findings contradicted the quantitative results. As seen in Figure 1, the primary code which related to RQ2 concerned future intentions to watch and/or play cricket. When asked by the researcher: "Did playing the video game version of cricket encourage you to want to watch authentic cricket in the future?", all but one focus group participant across both focus group sessions indicated they would watch at least some portion of a cricket match live or on television. Several participants expressed concern over the length of watching an entire cricket match, however. For example, one participant said: "I probably wouldn't watch the whole game because it would probably get boring after a while. But since I know and played [the video game version of] it, I probably would watch some of it." Another participant was motivated to want to experience another culture while watching a live cricket match. She commented: "I'd be more prone to watch it live rather than on TV. If I had the opportunity in a different country to go watch it, I'd be like yeah, just because it's part of their culture." Similarly, in the previously mentioned Jenny and Schary (2014) study, evidence emerged that international students felt a greater connectedness to American culture as a result of playing *Madden NFL*. Future research might investigate this phenomenon more thoroughly with other SVGs (i.e. Aussie rules football and Australia).

The majority of participants noted that they would prefer playing cricket over watching it; many noting they simply prefer playing sports over watching them. For example, one participant stated: "I like playing sports rather than watching [them]…I probably wouldn't watch [cricket] because I'd probably get bored. But I could definitely play it." Several participants noted they would not actively seek out opportunities to watch or play cricket, but would if given the chance due to the gaming experience:

> I'm not going to say that I would go out of my way to play it or watch it, but if it's on, I would watch it because I'm familiar with it now. Or if somebody was hitting or playing, I

> may or may not say yes depending on what I have going on. But I did gain interest in the sport just by playing [the video game].

On the other hand, Jenny and Schary (2015) conducted a mixed-methods experiment researching whether playing the MBVG *Kinect Sports Rivals Rock Climbing* (Microsoft Studios, Redmond, WA) could motivate future authentic rock climbing behavior with college students with no previous rock climbing experience. Results revealed that playing the MBVG did not motivate future authentic rock climbing. However, the potential danger and amount of energy necessary to perform authentic rock climbing may have impacted these results. Future research may explore physically playing a sport (e.g. cricket) versus playing the video game version of the sport (or the combination of the two) to determine whether it would motivate increased physical activity through future increased participation of that sport.

Of note, one participant who had previously watched cricket on television commented that playing the cricket video game engaged him into learning more than when he was passively watching cricket:

> I definitely learned a lot more playing the game than when I tried to watch it on TV. I didn't understand anything at all. And I had someone who knew about it and who had played sitting right beside me trying to tell me. And I was watching it, and I still had no idea what was going on. So I definitely feel like interacting and me being the one that was bowling and batting, it helped a lot. And I was able to figure out what I was doing.

A future study might measure potential differences in the learning of a sport through video gaming compared to watching television. Obviously, the quality of the commentating may be a major variable with both mediums.

Moreover, when one participant was probed as to why he would not seek out more cricket, the participant stated:

> I guess I haven't played it enough or haven't seen it enough for me to get into it yet. But I bet if I watched a little bit more and saw more things like that and found a team and got connected to a team like I'm connected to teams here, then I would actually start paying more attention to the sport and paying attention to that team.

Additionally, one participant noted she would not want to play cricket because she felt she did not know the game well enough yet:

> I would definitely not want to play because I feel like I would let my team down. I feel like any sport is very competitive. And you don't want the person that doesn't know what they're doing on your team…I've been on a team where people didn't know what they were doing and it's quite frustrating having to baby them through a game.

Thus, more exposure to cricket (and possibly the video game version) may have motivated these participants to want to watch and/or play cricket more. Future studies might investigate the impact of more time spent playing the SVG than were included in this study.

Limitations

While these findings are valuable, this study is not without its limitations. This study could have benefitted from a larger sample size, participant characteristics (e.g. video gaming experience), an increased amount of time playing the cricket SVG, and the use of headphones in an effort to amplify in-game voice commentary. Generalizations of this study's findings should be viewed through the lens of these possible limitations and may be limited to the sample utilized.

Conclusion

This study explored to what extent playing a cricket video game can impact someone learning about cricket and/or influence someone to want to watch or play cricket in the future. EG participants significantly increased their cricket knowledge as a result of the gaming, particularly relating to cricket rules, terminology, player positions and field layout. While more research is necessary, these findings have important repercussions in that playing SVGs may then assist participants in achieving SHAPE America's (2014) national physical education standard two which relates to physically literate individuals applying cognitive knowledge of sport. As *Don Bradman Cricket* is a sedentary video game, the majority of learning transpired within the cognitive learning domain. Future research might explore how MBVGs may have a significant impact on how fundamental movement skills can be learned within the psychomotor learning domain.

Furthermore, qualitative evidence also emerged that playing the cricket SVG may have motivated participants to want to watch or physically play cricket in the future. Again, while more replication studies are warranted, this finding supports that SVGs may aid individuals in increasing physical activity and attaining SHAPE America's (2014) national physical education standard five of valuing physical activity for enjoyment, challenge, self-expression, and/or social interaction. As one participant said: "[Playing the cricket video game] was fun. I feel like I know enough to play a game for fun, but I don't know it inside and out."

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